1.1.3: Course Syllabus of Employability/ Entrepreneurship/ Skill development

Academic Year

2021-22

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Computer Organization and Architecture**		Course Code:**20ECSC201**
L-T-P:**3-0-1**	Credits: **4**	Contact Hrs: **5hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**	Exam Duration: **3 hrs**	

Unit –I		
1	Basic Concepts and Computer Evolution, Performance Issues, A Top-Level View of Computer Function and Interconnection	**05 hrs**
2	Memory, Input/Output, Computer Arithmetic, Digital Logic	**08 hrs**
3	Instruction Sets: Characteristics and Functions, Addressing Modes and Formats	**07 hrs**
Unit –II		
4	Processor Structure and Function, Reduced Instruction Set Computers	**10 hrs**
5	Instruction-Level Parallelism and Superscalar Processors, Parallel Processing	**10 hrs**
Unit –III		
6	Multicore Computers, General-Purpose Graphic Processing Units	**05 hrs**
7	Control Unit Operation, Microprogrammed Control, Case studies and Projects	**05 hrs**

Text Books:

1. William Stallings, Computer Organization and ArchitectureDesigning for Performance, 10th Ed, Pearson Education, 2016.

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach 5th Edition, Elsevier publication, 2017.
2. Kai Hwang, Advanced Computer Architecture Parallelism Scalability Programmability, Tata McGraw Hill 2008

Program: Bachelor of Engineering		
Course Title: **Computer Organization and Architecture Lab**		Course Code:**20ECSP202**
L-T-P:**0-0-1.5**	Credits: **1.5**	Contact Hrs: **3hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **36**	Exam Duration: **3 hrs**	

List of experiments

Week No	Lab Assignments
1	Logisim Tool Demo
2	Combinational Circuits (Half Adder, Full Adder, Decoder, Multiplexer)
3	
4	Building ALU
5	1-bit RAM Cell and building bigger RAM
6	Cache Memory
7	[Cache Simulator + Time Analysis]
8	Instruction Format & Decoding, Control Signal Generation
9	Data Path Design for Given Set of Instructions
10	
11	MIPS 5-Stage Pipeline: Simulates the pipeline.
12	Loop unrolling: A software technique for exploiting instruction-level parallelism.
13	
14	Technical Paper reading, summarizing / Paper Presenting

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

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Data Structures and Algorithms**		Course Code: **20ECSC205**
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50hrs**	Exam Duration: **3hrs**	

Unit –I		
1	**Fundamentals of Algorithms and Problem Solving** Space and Time Complexities, Order of an algorithm, Efficiency Analysis of Stacks and Queues Revisited, Recursive Definitions, Recursive Functions, Towers of Hanoi, Backtracking, Recursion Vs. Iteration	**8 hrs**
2	**Hashing and Hash tables** Direct Address Table, Hash Table, Hash Functions, Collision Resolution Techniques.	**4 hrs**
3	**Graphs and Trees** Graphs, Computer Representation of Graphs, Trees, Tree Traversals, AVL Trees, 2-3 Trees, Application of Binary Trees, Tries, DFS, BFS	**8 hrs**
Unit –II		
4	**Sorting Techniques** Sorting, Bubble sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort.	**8 hrs**
5	**Substring Search Algorithms** Brute-force method, Boyer-Moore Algorithm, Knuth-Morris-Pratt Algorithm, Rabin-Karp Algorithm	**4 hrs**
6	**Graph Algorithms** Union-Find Data Structure, Shortest Path algorithms, Minimum Spanning Tree Algorithms	**8 hrs**
Unit –III		
7	**Problem Case Studies** Travelling Sales Person Problem, Knapsack Problem, Fake Coin Problem, Strassen's Matrix Multiplication, Huffman Coding	**5hrs**
8	**Limitation of Algorithm Power** Undecidability, P and NP Classes, P vs NP, NP-Hard, NP-Complete	**5 hrs**

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Third Edition, The MIT Press, 2009.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

Reference Books:

1. Hemant Jain, Problem Solving Using Data and Algorithms Using C, Taran Technologies Private Limited, 2016.
2. HackerRank / CodeChef / SPOJ

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

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Database Management System**		Course Code:**15ECSC208**
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction and ER Model** Introduction to DBMS; Data Models, Schemas and Instances; Three-Schema Architecture; Database Languages; Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets. Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues.	**06hrs**
2	**Relational Data Model and Relational Algebra** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Binary Relational Operations: CARTESIAN PRODUCT, JOIN: Additional Relational Operations; Relational Database Design Using ER- to-Relational Mapping.	**08hrs**
3	**SQL** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; JOIN operations, Complex SQL Queries.	**06hrs**
Unit –II		
4	**Database Design** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form.	**07 hrs**
5	**Introduction to Transaction Processing** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializibilty.	**07 hrs**
6	**Concurrency Control Techniques** Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering.	**06 hrs**
Unit –III		
7	**Database Security** Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks;	**05 hrs**
8	**Introduction to NOSQL and Columnar database:** Introduction; Difference between SQL and NoSQL; Scaling of Databases; Applications; Columnar Database: Introduction; Row-oriented Systems; Column-oriented systems; Benefits; An Example of Columnar Database;	**05 hrs**

Text Books:

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 6th Ed, Pearson Education, 2011.
2. ShashankTiwari , Professional NOSQL, 1st Ed,Wrox, 2011.

References:

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd Ed, McGraw Hill, 2007.
2. Silberschatz A., Korth H.F. and Sudharshan S., Database System Concepts, 5th Ed, Mc- GrawHill, 2006.

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

Course Title: **Data Structure and Algorithms Lab**		Course Code: **19ECSP201**
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 Stacks, Queues, Lists, Files
2	
3	
4	01 Assignment on Fundamentals of Algorithms
5	01 Assignment on Trees
6	02 Assignments on Graphs
7	
8	01 Assignment on Sorting
9	01 Assignment on Searching
10	01 Assignment on Sorting and Searching Applications
11	03 Assignments on Graph algorithms
12	
13	
14	Open Ended Experiment

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Third Edition, The MIT Press, 2009.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

Reference Books:

1. Hemant Jain, Problem Solving Using Data and Algorithms Using C, Taran Technologies Private Limited, 2016.
2. HackerRank / CodeChef / SPOJ

Course Title: **Computer Organization and Architecture Lab**		Course Code: **20ECSP202**
L-T-P: **0-0-1.5**	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	Logisim Tool Demo
2	Combinational Circuits (Half Adder, Full Adder, Decoder, Multiplexer)
3	
4	Building ALU
5	1-bit RAM Cell and building bigger RAM
6	Cache Memory [Cache Simulator + Time Analysis]
7	
8	Instruction Format & Decoding, Control Signal Generation
9	Data Path Design for Given Set of Instructions
10	
11	MIPS 5-Stage Pipeline: Simulates the pipeline.
12	Loop unrolling: A software technique for exploiting instruction-level parallelism.
13	
14	Technical Paper reading, summarizing / Paper Presenting

Text Books:

1. William Stallings, Computer Organization and Architecture Designing for Performance, 10th Ed, Pearson Education, 2016.

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach 5th Edition, Elsevier publication, 2017.
2. Kai Hwang, Advanced Computer Architecture Parallelism Scalability Programmability, Tata McGraw Hill 2008

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Program: Bachelor of Engineering		
Course Title: **Database Applications Lab**		Course Code: **15ECSP204**
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: **36**	Exam Duration: **3 hrs**	

List of experiments/jobs planned to meet the requirements of the course.

4- Demonstration	• Introduction to RDBMS/Case study/ basic SQL commands. • Set theory, logical operators and aggregate functions. • Group by , Having clause, Views and index • Basics of PL/SQL.
5-Exercises	• SQL queries on set theory, logical operators and join operations. • SQL queries queries on aggregate functions, group by and having clause. • SQL queries on Views and nested query operations. • PL/SQL queries using triggers and cursors. • PL/SQL queries using procedures and functions.
3-Structured Enquiry	• Database Design
1-Open Ended Experiment	• Database design & implementation
Text Book: i) Elmasri R. and Navathe S., Fundamentals Database Systems, 7th edition, Pearson Education, 2012. ii) Steven Feuerstein, Bill Pribyl Oracle PL/SQL Programming, 6th Edition , O'Reilly Media,2014.	
References: 1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd edition, McGraw Hill, 2007. 2. PL/SQL User's Guide and Reference 10g Release 1 (10.1) December 2003.	

Evaluation:

Students Assessment through ISA (80%) + ESA (20%)

Internal Semester Assessment (80%)	**Assessment**	**Weightage in Marks**
	Exercises	50
	Structured Enquiry	20
	Open Ended Experiment	10
End Semester Assessment (20%)	ESA	**20**
	Total	**100**

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Course Title: **Applied Statistics with R**		Course Code: **20EMAB209**
L-T-P: **3-1-0**	Credits: **4**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs:**40 hrs**	Exam Duration: **3 hrs**	

Unit I

Chapter 1: Description of data **8 hours**

Introduction: Data, Type of Variables, mean, weighted mean, median, mode, Quartiles, Variance, Coefficient of variation, skewness, Histogram, Box plots, Normal Quantitle Qunatile plots.

Chapter 2:Probability **6 hours**

Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Baye's rule,

Applications: Data Classification Methods - Decision Tree Induction, Bayesian Classification.

R-tutorial: Introduction to Data handling ,Description of data graphically, Histogram, Skewness, Boxplot, QQ-norm, Decision tree **8 hours**

Unit II

Chapter 3: Random variables and Probability Distribution **8 hours**

Random variables,simple Examples, Discrete and continuous random variables; Introduction to bivariate distribution, joint probability distribution, marginal distribution, covariance. Theoretical distributions: Binomial, Poisson, Normal.

Chapter 4: Statistical Inference I **8 hours**

Introduction: Sampling, SRSWR, SRSWOR, Cluster Sampling, Stratified Sampling, Basic terminologies of testing hypothesis, Confidence interval, Sample size determination, Hypothesis test for proportions, means(single and differences), using P-value approach

R-tutorial: Probability distribution, Testing of Hypothesis for proportions, means(single and differences)
8 hours

Unit III

Chapter 5: Correlation and Regression5 hours

Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression, Logistic Regression.

Chapter6: : Statistical Inference II **5 hours**

Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure(Goodness of fit)

R-tutorial: Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach
4 hours

Text Books

1. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Ed, TATA McGraw-Hill Edition 2007.
2. Kishor S Trivedi, probability and statistics with reliability queuing and computer science applications, 1ed, PHI, 2000.

Reference Books:

1. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 1ed, Sultan Chand & Sons, New Delhi, 2000.
2. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2005
3. Sheldon M.Ross ,Introduction to Probability and Statistics for Engineers and Scientists

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, 2,3	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	7	

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

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List of Experiments

Program: Bachelor of Engineering		
Course Title: **Microcontroller Programming and Interfacing**		Course Code: **21ECSC206**
L-T-P:**1-0-3**	Credits: **4**	Contact Hrs: **7hrs/week**
ISA Marks: **100**	ESA Marks: **0**	Total Marks: **100**
Teaching Hrs: **15 + 60**	Exam Duration:	

	Module I	
Lecture /Reading	**Introduction to Microcontroller and Embedded System** Microcontrollers and General Purpose Microprocessors, Embedded System Features, Choosing a microcontroller, Criteria for choosing a microcontroller, Harvard and Von Neumann Architecture, Introduction to AVR Microcontroller and Arduino Family.	01-hrs
Hands on	• Introduction to the hardware, setup, familiarizations with the working of the hardware	03-hrs
Lecture /Reading	**AVR Architecture and Assembly Language Programming on AVR Microcontrollers** Simplified View of an AVR Microcontroller, Internal Architecture (Harvard) of AVR, Registers and Data Memory in AVR, Instruction format and size in AVR, Using Instructions with Registers and Data Memory, Watch Dog Timer, Flags and Special Function Registers, Data Formats and Assembler directive. Introduction to AVR Assembly Programming, Instruction Types and Instruction Set of AVR (Data Transfer Instructions, Branch Instructions, Bit and Bit test Instructions, Arithmetic and Logic Instructions, MCU Control Instructions, Jump and RET Instruction), Structure of Assembly Program in AVR, asm, lst, map and object files, Executing a program instruction by instruction, RISC Architecture features of AVR Microcontrollers, Viewing registers and memory with AVR Studio IDE.	02-hrs
Hand on	• Assembly programming on the hardware using appropriate SDK Set of programs to be given on various instruction types/ instruction set • HLL Python programming on the hardware	09-hrs
Review	Review I	03-hrs
	Module –II	
Lecture /Reading	**AVR Time Delay and Instruction Pipeline** Delay Calculation of AVR, AVR Multistage execution Pipeline, Timers/Counters, C Data Types.	01 hrs
Hands on	AVR Timer/Counter Programming	06 hrs
Lecture /Reading	**AVR I/O Port Programming** I/O Port Pins and their functions, Role of DDR/DDRx Registers in Input and output operations, Programming for I/O Ports,I/O Bit Manipulations,	01 hrs
Hands on	I/O Port programming	06 hrs
Review	Review II	03 hrs
	Module –III	
Lecture /Reading	**Interrupts in AVR and Interrupt Programming** AVR Interrupts, Interrupts vs Polling, Interrupt Service Routine, Steps in executing an interrupt, Sources of Interrupts, Interrupt Priority, Concept of Context Saving in task switching, Enabling and Disabling Interrupts, Programming Timer Interrupts, Programming external interrupts	01 hrs
Hands on	Interrupt Programming	06 hrs
Lecture /Reading	**AVR Serial Port Programming**	01 hrs

	Basics of Serial Communication, RS232 standards, RS232 Pins, RS232 Handshaking Signals, ATMEGA32 connections to RS232, Baud Rate and UBRR Register, UDR register and USART, UCSR Registers and USART Configuration, Programming AVR for Serial Communication. Links:	
Hands on	Serial Communication programming	06 hrs
Review	Review III	03 hrs
Module –IV		
Lecture /Reading	**LCD and Keyboard Interfacing** LCD Interfacing, Sending Commands and Data to LCD (4 Bits and/or 8 Bits at a time).	01 hrs
Hands on	Keyboard Interfacing, Matrix Keyboard connection to AVR Ports, Key Identification,	06 hrs
Lecture /Reading	**Chapter No. 8. ADC, DAC and Sensor Interfacing** Need for ADC and DAC in Interfacing, ADC Characteristics, ADC devices, and ATmega32 ADC features, Programming A/D Converter	01 hrs
Hands on	DAC Interfacing, Sensor Interfacing	06 hrs
Review	Review IV	
Module –V		
Hands on	**Integration of the work done in various modules according to the problem statement**	09 hrs
Final Evaluation	**Presentation + Project exhibition**	03 hrs

Text Books:

1. Mazidi M. A, Naimi Sarmad, Naimi Sepehr, “”The AVR Microcontroller and Embedded System using Assembly and C”, Prentice Hall.

Reference Books:

1. J. M. Hughes, “Arduino A Technical Reference”, O’Reilly

Program:Bachelor of Engineering		
Course Title: **Exploratory Data Analysis**		Course Code: 21ECSC210
L-T-P: 2-0-2	Credits: 4	Contact Hrs: 6 hrs/week
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: **60**	Exam Duration: 3 hrs	Lab slots:15

Unit –I		
1	**Introduction and scientific python:** Ecosystem for data science, basic python, numerical and vectorized computation, data manipulation, data visualization.	**10 hrs**
2	**Exploratory Data Analysis:** Types of data: categorical, numerical, probability distributions , Descriptive statistics, univariate and multivariate statistics, advanced data visualization, Case study	**10 hrs**
Unit –II		
3	**Data Pre-Preprocessing**	**10 hrs**

	Data cleaning, data integration, dimensionality reduction: feature selection and feature extraction, data transformation	
4	**Supervised Learning** Linear and logistic regression, naïve Bayes classifier, K-nearest neighbours	**10 hrs**
5	**Clustering** Partitioning-based, hierarchical clustering, density-based clustering	**10 hrs**
	Unit –III	
6	**Time-series analysis**: Autocorrelation, time-series forecasting, auto regressive moving average models.	**10 hrs**

Reference Books:

1. Wes McKinney ,Python for Data Analysis, Published by O'Reilly Media, 2nd Edition ,October 2017.
2. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd edition, Morgan Kaufmann, 2012
3. 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.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Lab Exam on Course Project	1, 2	Demonstration of Course Project
II		3,4,5	
III		6	

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Program: Bachelor of Engineering		
Course Title: Object Oriented Programming		CourseCode: **20ECSC204**
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: **3hrs**	

Unit –I		
1	**Introduction:** Introduction to object oriented programming. Characteristics of object oriented languages, Programming Basics, arrays, Functions in C++ (parameter passing techniques.)	**4 hrs**
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	**Inheritance:** Introduction, types of Inheritance, constructors, Abstract class,Aggregation: classes within classes	**6 hrs**
Unit –II		
4	**Virtual Functions and Polymorphism:** Virtual functions, Friend functions, static functions, The 'this' pointer	**6 hrs**
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	**Design Patterns:** Creational, Structural and Behavioural design patterns.	**4 hrs**
Unit –III		
7	**Streams and Files:** Stream classes, File I/O with streams.	**4 hrs**
8	**Standard Template Library:** container classes**:** Sequence and Associative Containers	**4 hrs**
Textbooks 1. Robert Lafore, Object oriented programming in C++, 4th Ed, Pearson education, 2001		
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 Ed, Tata McGraw Hill, 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& 3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	45&6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

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Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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, Applications Of 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

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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)

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	7	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering
Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development	

Program: **Bachelor of Engineering**		
Course Title: **Operating Systems Principles and Programming**		Course Code:**18ECSC202**
L-T-P: **4-0-1**	Credits: **5**	Contact Hrs: **6**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50 + 26**	Exam Duration: **3 Hrs**	

	Unit –I	
1	**Introduction** Introduction to Operating System, Operations, System components, Overview of UNIX Operating System, UNIX utility commands, UNIX APIs and characteristics.	04 hrs + 04 hrs (Tut)
2	**Process Management** Process Concept, Process scheduling, Process Control, Process Accounting, Inter-process communication, Multithreading models and Thread API, Thread library, Process scheduling: Basic concepts; Scheduling criteria, Scheduling algorithms	10 hrs + 12 hrs (Tut)
3	**Process Synchronization** Synchronization, Producer Consumer problem, The critical section problem, Peterson's solution, Synchronization mechanism, Mutex, Semaphores, Classical problems of synchronization.	06 hrs + 04 hrs (Tut)
	Unit –II	
4	**Deadlocks** Deadlock System Model and Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	06 hrs + 02 hrs (Tut)
5	**File management** UNIX File Types, File systems and File Attributes, I-nodes in UNIX, UNIX Kernel Support for Files, Directory Files, Hard and symbolic filenames, General File APIs. File and Record Locking.	07 hrs + 04 hrs (Tut)
6	**Memory Management** Memory management strategies, Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.	07 hrs
	Unit –III	
7	**Virtual Memory Management** Virtual Memory Management, Background, Demand paging, Page replacement.	5 hrs
8	**Case study** RT Linux: Features, architecture, components, application program interface, scheduling and threads.	5 hrs

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 9 ed., Wiley-India, 2019.
2. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX Environment", 3 ed. Addison Wesley Professional, 2018

Reference Books:

1. William Stallings,"Operating System Internals and Design Principles", 1 ed., Pearson Education, Asia, 2015
2. Gary Nutt," Operating System", 3 ed., Pearson Education,2009
3. Terrence Chan, "Unix System Programming Using C++", 1 ed., Prentice Hall India, 2014
4. Marc J. Rochkind, "Advanced Unix Programming", 2 ed., Pearson Education, 2005.

List of Experiments

Expt. No.	Experiments	No. of Slots
1	Process control (Using fork, wait, exec, exit API's)	2
2	Inter Process Communication using Pipes, FIFO's	2
3	Concurrent operations using Threads	2
4	File/ record locking and unlocking using *fcntl*	1
5	Simulation of CPU scheduling algorithms	1
6	Deadlock avoidance(Banker's algorithm), Deadlock detection	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	1,2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2**
III	Q.No.-7	7	Solve Any **1**
	Q.No.-8	8	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering
Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development	

Program: Bachelor of Engineering		
Course Title: **Object Oriented Programming Lab**		Course Code: **20ECSP203**
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 Number	**Lab assignments/experiment**	**Number of Slots**
1	Demonstration: Introduction to Code Blocks IDE (Integrated Development Environment), C++ programming basics.	4
2	Exercise : Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling	4
3	Structured Enquiry : Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling	2
4	Open Ended : Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns	2

Text Book:

1. Robert Lafore, "Object oriented programming in C++", 4thEd, Pearson education, 2001

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 Ed, Tata McGraw Hill, 2017

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	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Software Engineering**		Course Code: **15ECSC301**
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	**Software Engineering Process** Professional software development Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, The rational unified process, Continuous Integration and Continuous Deployment and Tools.	**6 hrs**
2	**Agile Software Development** Agile methods, Plan-driven an d agile development, Extreme programming, Agile project management.	**4 hrs**
3	**Requirement Engineering** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirements elicitation and analysis; Requirements validation; Requirements management	**6 hrs**
Unit –II		
4	**System Modeling** Context models, Interaction Models, Structural models, Behavioral models.	**6 hrs**
5	**Architectural Design** Architectural Design Decision, Architectural Views, Architectural Patterns, Application Architectures	**5 hrs**
6	**Object-Oriented Design And Implementation** Object oriented design using UML, design patterns, Implementation Issues, Open Source Development.	**5 hrs**
Unit –III		
7	**Software Testing** Development Testing, Test Driven Development, Release Testing, User Testing	**4 hrs**
8	**Configuration Management** Change management, Version management, System building, Release management	**4 hrs**

Text Books:

1. Ian Somerville, Software Engineering, 10th, Pearson Ed, 2015

Reference Books:

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

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

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Computer Networks – I**		Course Code: **19ECSC302**
L-T-P: **3-1-0**	Credits: **4**	Contact Hrs: **66**
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	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **System Software**		Course Code: **17ECSC302**
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 to a Machine Architecture** Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC and SIC/XE Programming Examples.	**6hrs**
2	**Assembler** Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.	**9hrs**
Unit –II		
3	**Assembler M/c Independent Features and Design options** Machine Independent Assembler Features: Literals, Symbol Defined Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Options: One Pass Assembler, Multi Pass Assembler, Implementation Examples: Assembler(8086): MASM	**7 hrs**
4	**Loaders and Linkers** Basic Loader Functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Machine Dependent Loader Features: Relocation, Program Linking, Algorithm and Data Structures for a Linking. Loader M/c Independent Features: Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples: 8086 Linker.	**8 hrs**
Unit –III		
5	**Macro Processor** Basic Macro Processor Functions: Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, **Machine Independent Macro Processor Features:** Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters Implementation Examples: 8086 Macro Processor.	**5 hrs**
6	**Back end of Compiler: Code generation and Machine dependent features.** Review of phases of compilers, code generation routines, machine dependent features.	**5 hrs**

Text Books:

1. Leland.L.Beck and D. Manjula, System Software, 3rd edition, Pearson Education, 2011.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, 2nd edition, Addison-Wesley, 2011.

Reference Books:

1. Muhammad Ali Mazidi et al,The 8051 Microcontroller and Embedded systems, 2nd Edition, Pearson education, 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**
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	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Java Programming**		Course Code:**19ECSP301**
L-T-P:**1-0-1.5**	Credits: **2.5**	Contact Hrs: **4hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **52**	Exam Duration: **3 hrs**	

Unit –I		
1	**JAVA Language Fundamentals**: Java Features, Programming basics, Arrays and Strings, classes and objects	**8hrs**
2	**Inheritance:** Introduction, types of inheritance, static and dynamic polymorphism.	**8hrs**
3	**Interfaces and Exception Handling:** Introduction, Create and implement interfaces, Exception handling	
Unit –II		
4	**Collections Frame work**: Introduction to generic programming, Collections: Interfaces: List, Set, Queue Classes: ArrayList, LinkedList and HashSet, Map	**8 hrs**
5	**Lambda Expressions:** Functional programming, Functional interface, Bulk operations on collections	**8 hrs**
6	**Streams API:** Basics of Streams, Reduction operations, Iterators and Streams	
Unit –III		
7	**GUI Programming:** Introduction toswings, User interface design and event handling.	**4hrs**
8	**Java Database Connectivity (JDBC):** Introduction, Drivers, Interfaces and classes to develop data base applications, case study	**4 hrs**

Text Books:

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

Reference Books:

i. Kathy Sierra and Bert Bates, Head First Java: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media

ii. Introduction to Java Programming, Liang Y D, Pearson, 11th Edition

Scheme for Semester End Examination (ESA)

***Note: This course is a lab course and the ESA is Course Project**

Unit	Course Project for 20 Marks	Chapter Numbers	Instructions
I, II, III	Design and Implementation is evaluated	1,2,3,4,5, 6 and 7	Implement all the concepts studied in java Programming

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Machine Learning**		Course Code: **17ECSC306**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**	Exam Duration: **3 hrs**	

Unit – 1		
1.	**Introduction to machine learning** Introduction to Machine Learning, Applications of Machine Learning, Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning, Dataset formats, Features and observations.	**5 hrs**
2.	**Supervised Learning: Linear Regression, Logistic Regression** Linear Regression: Single and Multiple variables, Sum of squares error function, The Gradient descent algorithm, Application, Logistic Regression, The cost function, Classification using logistic regression, one-vs.-all classification using logistic regression, Regularization.	**7 hrs**
Unit – 2		
3.	**Supervised Learning: Neural Network** Introduction to perceptron learning, Model representation, Gradient checking, Back propagation algorithm, Multi-class classification, and Application- classifying digits. Support vector machines,	**6 hrs**
4.	**Unsupervised Learning : Dimensionality reduction and Learning Theory** Expectation Maximization (EM), Factor Analysis, The dimensionality reduction, PCA : PCA for compression, Incremental PCA, Randomized PCA, Kernel PCA , ICA (Independent Component Analysis). Bias/variance tradeoff, Union and Chernoff / Hoeffding bounds VC dimension.	**6 hrs**
Unit – 3		
5.	**Reinforcement Learning** Reinforcement Learning: Introduction, Applications, Model of the environment, Policy search, Learning to optimize rewards and value functions, Evaluating actions: The credit assignment problem, Policy gradients, Markov decision processes, Q-learning.	**6 hrs**

Text Books:

1. Tom Mitchell., Machine Learning, McGraw Hill, McGraw-Hill Science, 3rd edition.
2. Christopher Bishop., Pattern Recognition and Machine Learning, Springer, 2006.

References Books:

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Concepts, Tools, and Techniques to Build Intelligent Systems, AurelianGerona, Publisher: O'Reilly Media , July 2016.
2. Advanced Machine Learning with Python Paperback, 28 Jul 2016 by John Hearty.

List of experiments:

Experiment No.	Brief description about the experiment	Number of slots
1.	Introduction to Scikit and TensorFlow Simple programs with TensorFlow	1
2.	Linear Regression Nonlinear Regression Logistic Regression Activation Functions	1
3.	Training a multi-layer perceptron using API's	1
4.	Training a neural network – construction, execution and use of neural network.	1
5.	Training Neural Networks - a sequence classifier and to predict time series.	1
6.	Classification of Human Facial Expressions using Neural Networks	1
7.	Principal Component Analysis on ● simple matrix ● on iris dataset	1
8.	Course Project : Students in a group of four shall implement machine learning solution to a real world problem using Scikit Ex: ● Sentiment Classification using LSTM , encoder-decoder, Natural Language Processing ● Playing Solitaire using CNN and Deep Reinforcement Learning	4

Scheme for End Semester Examination (ESA)

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

List of Experiments

Expt. No.	Experiments	No. of Slots
1	Introduction to Data Science , Basics of Python libraries	2
2	Pre-processing: Assessing and analyzing data, cleaning, transforming and adding new features	2
3	Learning model: Constructing and testing learning model	1
4	Post-processing: Creating final predictions	1

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

FORM
ISO 9001: 2008
School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **System Software Lab**		Course Code: 19ECSP302
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: **36**	Exam Duration: **3hrs**	

Sl No	Experiments	Slots/Hrs
1.	Practice programs on user defined functions , structures and programs on file handling	3 hrs
2.	Introduction to basics of given assembly language Programs	3 hrs
3.	Evaluation on given assembly language Program	3 hrs
4.	Implementation of Pass 1 Assembler	3 hrs
5.	Implementation of Pass 2 Assembler	6 hrs
6.	Implementation of Pass 1 Linking loader	3 hrs
7.	Implementation of Pass 2 linking loader	6 hrs
8.	Course Project on identifying machine to implement assembler , learning its architectural features and design Pass 1 Assembler or Pass2 Assembler	6 hrs

Reference Books:

1. Leland.L.Beck and D. Manjula, System Software, 3rd edition, Pearson Education, 2011.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers- Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2011.

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Mini Project**		Course Code: **15ECSW301**
L-T-P: **0-0-3**	Credits: **3**	Contact Hrs: **3 hrs/week**
CIE Marks: **50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **39**	Exam Duration: **3 Hrs**	

Student Evaluation Matrix

Sl. No	**Continuous Internal Evaluation**	**Assessment**	**Weightage in Marks**
1	Review 1 :	Problem identification and Software Requirement Specification (SRS)	10
2.	Review 2 :	Software Design	10
3.	Review 3 :	Construction (testing and final demo)	15
4.		Individual contribution to team	10
5.		Project report	05
		Total	**50**

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;		**08hrs**
4	**Cluster Analysis** Cluster Analysis- Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.		**08hrs**
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, MichelineKamber 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, 2016.
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.

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering
Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development	

Program: **Bachelor of Engineering**		
Course Title: **Computer Networks-II**		Course Code: **20ECSC303**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **70**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

	Unit –I	
1	**Network Layer- Routing Algorithms** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet ,intra-AS Routing in the Internet: RIP , Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP.	**08hrs**
2	**Network Layer** Broadcast and Multicast Routing, Broadcast Routing Algorithms, Error Reporting, **Multicasting:** IGMP Group Management, IGMP Messages, Message Format, and IGMP Operation.	**08hrs**
	Unit –II	
3	**Data Link Layer** Introduction to the Link Layer, Error-Detection and -Correction Techniques : Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC),Hamming Code, Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols: Aloha, Slotted Aloha, CSMA, CSMA/CD, CSMA/CA, Taking-Turns Protocols, The Link-Layer Protocol for Cable Internet Access.	**08hrs**
4	**Switched Local Area Networks** Link-Layer Addressing and ARP, Ethernet and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANs),Multiprotocol Label Switching (MPLS), Data Center Networking, Retrospective: A Day in the Life of a Web Page Request.	**08hrs**
	Unit –III	
5	**Wireless and Mobile Networks** Wireless Links and Network Characteristics, 802.11 Wireless LANs, Architecture, MAC Protocol, Frame, Mobility, Personal Area Networks: Bluetooth and Zigbee.Cellular Networks and Internet Access, Mobility, Mobile IP, Managing Mobility in Cellular Network.	**04hrs**
6	**Multimedia Networking:** Multimedia Networking Applications, Streaming Stored Video, Voice-over-IP, Protocols for Real-Time Conversational Applications.	**04hrs**

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:

4. Peterson, Larry L, Computer networks : a systems approach, 5th Edition, The Morgan Kaufmann series in networking, 2012
5. Dimitri P. Bertsekas and Robert G. Gallager, Data Networks (2nd Edition),PHI,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**
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: **Computer Network Lab**		Course Code:**20ECSP305**
L-T-P:**0-0-1.5**	Credits: **1.5**	Contact Hrs: **3hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Teaching Hrs:**42**	Exam Duration: **3 hrs**	

List of Experiments

S.No	Experiments	Number of lab Slots (3 hrs)
1.	Demonstration of Mininet.	1
2.	Traffic measurement and traffic volume control using the POX controller.	1
3.	Implementation of load balancing/routing technique.	2
4.	Error Detection and Correction using Socket programming.	1
5.	Demonstration of Junos.	1
6.	Configuration and analysis of VLAN.	1
7.	Configuration and analysis of STP/MPLS.	1
8.	Configuration and analysis of OSPF and BGP routing protocols.	2
9.	Experimental analysis of the Handover Procedure in a WiFi Network.	1
10.	Performance analysis of IEEE 802.11 MAC protocols.	1

Course Content

Course Code: **21ECSC307**	Course Title: **Blockchainand Distributed Ledgers**	
L-T-P : **2-0-1**	Credits: **3**	Contact Hrs:**30**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**		Exam Duration: **3 hrs**

Content	Hrs
Unit – 1	
Introduction Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy, Types of blockchain, blockchain platforms, Blockchain Architecture and use cases, Introduction to Bitcoin	**06 hrs**
Introduction to cryptography, Symmetric key crypto, Public key crypto: Introduction, RSA, Diffie-Hellman, PKI, Hash Functions: Introduction, SHA, Digital signature Schemes: RSA,Digital Signature Standard, Merkle trees.	**06 hrs**
Unit – 2	
Consensus Mechanisms and Mining Basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Proof of Activity, Practical Byzantine Fault Tolerance (PBFT), Federated PBFT, RAFT, Consensus protocols in Blockchain platforms, Scalability issues of consensus protocols.	**06 hrs**
Ethereum Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling	**06 hrs**
Unit – 3	
Blockchain Applications Blockchain in Financial Software and Systems: Settlements, KYC, Insurance Government: Digital identity, land records, public distribution system, social welfare systems, Blockchain for cyber security: Cloud forensics, Identity management, Intrusion detection	**06 hrs**

References Books

1. Melanie Swan, “Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014.
2. ArshdeepBhaga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", 1st Edition, VPT, January 31, 2017.

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Web Technologies Lab**		Course Code: **21ECSP304**
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 HTML basics, JavaScript Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics	4 hrs
2	RESTful API using NodeJS and Express Introduction to Node.js .Building servers using the http and net modules, Node modules and events, Express, REST API client, Postman, Accessing Data, Data Security using Bcrypt. API security using JWT tokens.	12 hrs
3	Angular Building blocks of Angular Apps, Components, Templates, Directives. Services, Dependency injection, Bindings, observables, pipes, component communications, Forms, Interacting with servers using HTTP. RouteGuard, Interceptors, Bundling and deploying applications, Hosting	12 hrs
4	React JSX, React Components, Interaction of Components, Lifecycle methods, Form.	8 hrs

Reference Books:

1. Robert W. Sebesta."Programming the World Wide Web", Pearson Publications 8th Edition, 2014.
2. Nathan Murray, Felipe Coury, et al, "ng-book: The Complete Guide to Angular", FullStack.io Publications, 2019
3. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
4. Den Ward, "React Native Cookbook: Recipes for solving common React Native development problems", 2nd Edition.2019

Program: Bachelor of Engineering		
Course Title: **Distributed and Cloud Computing**		Course Code:**20ECSC305**
L-T-P:**2-0-1**	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	**Distributed System Models and Enabling Technologies** Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	**4 hrs**
2	**Virtual Machines and Virtualization of Clusters** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management.	**4 hrs**
3	**Cloud Platform Architecture over Virtualized Data Centers** Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	**4 hrs**
Unit –II		
4	**Cloud Programming and Software Environments** Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine.	**4 hrs**
5	**Cloud Resource Management** Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time.	**4 hrs**
6	**Cloud Security** Cloud security risks, Privacy; privacy impact assessment, Trust, Security of virtualization. Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	**4 hrs**
Unit –III		
7	**Docker Containers** Introduction, Docker swarm, Kubernetes.	**3 hrs**
8	**Building containerized applications** Microservice architecture, building micro services and containerized applications.	**3 hrs**

Text Books:

6. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, Elsevier, 2013.
7. Dan C. Marinescu , Cloud Computing Theory and Practice, Elsevier, 2013.
8. Nigel Poulton, The Kubernetes Book, Packt Publishing, 2019.

Reference Books:

9. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, Mastering Cloud Computing, McGraw Hil, 2013.
10. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010.

List of Experiments:

Expt./Job No.	Brief description about the experiment/job
1.	Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization
2.	Implementation of cloud service models(IaaS, PaaS, SaaS)
3.	OS-level virtualization
4.	Building containerized application
5.	Cloud resource scheduling and security mechanisms

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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** 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	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Internet of Things**		Course Code: **17ECSE303**
L-T-P: **2-0-1**	Credits: 3	Contact Hrs: **4 hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30 **hrs**	Exam Duration: 3 **hrs**	

Unit –I		
1	**Introduction to Internet of Things (IoT)** Definition & Characteristics of IoT, Things in IoT, IoT protocols, IoT functional blocks, communication models and APIs.	**4 hrs**
2	**IoT Architecture** Enabling technologies: Sensors, Zigbee, Bluetooth/BLE, IoT ecosystem, Data Link protocols: IEEE 802.15.4e, IEEE 802.11.ah, DASH7, Low Power Wide Area Network (LPWAN), NB-IoT, LoRa	**4 hrs**
3	Network protocols Routing Protocol for Low-Power and Lossy Networks (RPL), cognitive RPL (CORPL), Channel-Aware Routing Protocol (CARP), Low power Wireless Personal Area Networks (LoWPAN), IPV6, 6LoWPAN, Route-Over & Mesh-Under techniques	**4 hrs**
Unit –II		
4	**Application and Security protocols** Message Queue Telemetry Transport (MQTT), MQTT for Sensor Networks, Secure MQTT, Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), OPC UA, TLS/DTLS, LWM2M, oneM2M	**4 hrs**
5	**IoT Platforms Design Methodology** IoT Design Methodology, Case Study on IoT System for Weather Monitoring etc., Basic building blocks of an IoT device, Raspberry Pi, interface (serial, SPI, I2C), IoT Operating Systems: Contiki, RIOT; IETF Device Classes, Microcontrollers & RF; Power Management in IoT.	**4 hrs**
6	**Programming with Raspberry Pi &WiFi controllers (CC3220/ESP8266) & 6LoWPAN Controller (CC2650)** XML, JSON, SOAP and REST-based approach, WebSocket protocol.	**4 hrs**
Unit –III		
7	**IoT prototyping** Business models, example applications: Case studies on Home automation, Cities, Environment, Energy, Agriculture, Health with emphasis on data analytics and security. Industrial IoT (IIoT), Role of AI/ML in IoT.	**6 hrs**

Text Books:

1. ArshdeepBahga, Vijay Madiset , Internet of Things (A Hands-on-Approach) Universities Press- 2014
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, John Wiley & Sons – 2012.

Reference Books:

1. Subhas Chandra Mukhopadhyay ,Internet of Things Challenges and Opportunities Springer- 2014.
2. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", Wiley - 2009.

List of Experiments

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Expt./Job No.	Brief description about the experiments	No. of Lab slots per batch (estimate)
1.	Programming with Raspberry Pi	3
2.	Cloud service interface for data storage and retrieval	2
3.	Performance analysis of Data link protocols, routing and application protocols	3
4.	Open Ended Experiment with focus on data analytics and security	2

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**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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

Unit –I		
1	**Building Blocks, Strategies and Performance** Understanding Coding Platforms and Tools, Data Structures and Algorithms Revisited, Warm up Problems, Parsing and Formatting Text, Code Performance Analysis and Tools	**12 hrs**
2	**Advanced Data Structures** Matrix, Grids, Trees and variants, Lists, Skip lists, Hash, Trie and variants	**10 hrs**
3	**Dynamic Programming** Memory Functions, Optimization Problems	**8 hrs**
Unit –II		
4	**Graph algorithms** Traversal Algorithms, Shortest Path Algorithms, Spanning Tree Algorithms and Variants	**25 hrs**
5	**Introduction to Computational Geometry** Points, Line Segments, Polygons and Basics of Geometric Problems	**5 hrs**
Unit –III		
6	**Chapter 6: Problem Solving** Assortment of Problems and Techniques	**14 hrs**

Text Books:

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.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third Edition, MIT Press, 2010.
2. HackerRank / CodeChef Platforms

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Computer Vision**		Course Code**:18ECSE301**
L-T-P: 2-0-1	Credits: 3	Contact Hrs: **3hrs/week**
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 30	Lab Slots:10	Exam Duration: 3 hrs

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Unit – 1		
1	**Introduction** Computer Vision Overview, Pixels and image representation, Filters: Linear systems, Convolutions and cross-correlations; Lab: Basics, Filters	**4hrs**
2	**Features and filtering** Edge detection: Gaussian, Sobel filters, Canny edge detector, Features and fitting: RANSAC Local features, Harris corner detection, Feature descriptors: Difference of gaussians, Scale invariant feature transform; Lab: Filters, Edges, Features	**8hrs**
Unit – 2		
3	**Semantic segmentation** Perceptual grouping, Agglomerative clustering, Super pixels and over segmentation; Clustering: K-means, Mean shift; Visual Bag of Words: Texture features, Visual bag of words; Lab: Resizing, clustering, recognition	**6 hrs**
4	**Motion** Optical Flow, Lucas-Kanade method, Horn-Schunk Method, Pyramids for large motion, Tracking: Feature Tracking, Lucas KanadeTomasi (KLT) tracker; Lab: Object detection, optical flow	**6hrs**
Unit – 3		
5	**Advanced Techniques** Image stitching, Image pyramids, Object recognition, Dimensionality reduction, Face identification, Detecting objects by parts	**6hrs**

Reference Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Pearson Education India, 2nd Ed, 2015.
3. R. I. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2nd Edition, 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 3 out of 4
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any 3 out of 4
III	Lab exam	5	Lab exam evaluation

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Embedded Intelligent Systems**		Coursecode: **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	**12hrs**
3	**ML Frameworks lab with the target device** Caffe, tensorflow, TF Lite machine learning frameworks & architecture ,Modelparsing, 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	**16hrs**
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	**8hrs**
5	**Android Anatomy** Android Architecture ,Linux Kernel , Binder , HAL Native Libraries , Android Runtime, Dalvik Application framework , Applications, IPC	**8hrs**

Text Books

1. Linux System Programming , by Robert Love , Copyright © 2007 O'Reilly Media
2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster , Publisher: Morgan Kaufmann

Reference Books:

1. Deep Learning , MIT Press book ,Goodfellow, Bengio, and Courville's

2.Beginning Android , by Wei-Meng Lee , Publisher: Wrox , O'Reilly Media

Scheme for End Semester Assessment (ESA)

UNIT	Experiments to be set of 10 Marks Each	Chapter Numbers	Instructions
I	Project Examination	1,2,3,4,5	Project implementation and demonstration 20 marks

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering
Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development	

Program: Bachelor of Engineering		
Course Title: **Parallel Computing**		Course Code: **17ECSE307**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **43**	Exam Duration: **03hrs**	

Unit –I		
1	**Introduction to Parallel Computing & Parallel Programming Platforms** Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines.	8 hrs
2	**Principles of Parallel Algorithm Design** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.	8 hrs
Unit –II		
3	**Analytical Modeling of Parallel Programs** Sources of Overhead in Parallel Programs, Performance metrics for parallel systems, The effect of Granularity on performance, Scalability of Parallel Systems, Minimum execution time and minimum cost optimal execution time, Asymptotic analysis of Parallel programs, Other Scalability Metrics.	8 hrs
4	**Programming Using the Message Passing Paradigm** Principles of Message – Passing Programming, The Building Blocks, and MPI: The Message passing Interface, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups & Communicators.	8 hrs
Unit –III		
5	**Pthreads and Synchronization** Thread Basics, POSIX Thread API, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs.	4 hrs
6	**OpenMP** Open MP programming model, Specifying tasks in openMP, Synchronization constructs in opn MP, Data handling in OpenMP, Open MP library functions, Environment variables in OpenMP, Explicit Thread versus OpenMP based programming.	4 hrs

Text Books:

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, Introduction to Parallel Computing, Second Edition, Pearson India, 2013

Reference Books:

1. Michael Quinn, Parallel Computing Theory and Practice, Tata McGraw Hill, 2003

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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	5	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Quantum Computing**		Course Code: **17ECSE306**
L-T-P: 3-0-0	Credits: 3	Contact Hrs: **3hrs**
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40	Exam Duration: 3hrs	

Unit –I		
1	**Introduction and Background:** Overview, Computers and the Strong Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation	**6 hrs**
2	**Linear Algebra and the Dirac Notation:** The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators, The Spectral Theorem, Functions of Operators, Tensor Products, The Schmidt Decomposition Theorem, Some Comments on the Dirac Notation	**6 hrs**
3	**Introduction to Quantum Toolbox in Python:** Installation, Basics and Quantum mechanics	**4 hrs**
Unit –II		
4	**Qubits and the Framework of Quantum Mechanics:** The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations, Mixed States, Partial Trace, General Quantum Operations	**6 hrs**
5	**A Quantum Model of Computation:** The Quantum Circuit Model, Quantum Gates, 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits	**6 hrs**
6	Exploring Python for Solving Problems / Projects using Quantum Computing.	**4 hrs**
Unit –III		
7	**Introductory Quantum Algorithms:** Probabilistic Versus Quantum Algorithms, Phase Kick-back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm	**4 hrs**
8	**Case Studies and Projects done during the course**: Image processing, Data Sciences, Machine Learning, Networking	**4 hrs**

Text Books

1. Phillip Kaye, Raymond Laflamme and Michele Mosca "An Introduction to Quantum Computing ", Oxford University, Press, 2007
2. User Guide - Quantum Toolbox in Python, Release 4.2.0 – Qutip.org

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

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Web Technologies Lab**		Course Code: **18ECSP304**
L-T-P: 0-0-2	Credits: 2	Contact Hrs: **4hrs/week**
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 32	Exam Duration: 3 hrs	

1	**Javascript Frameworks** Introduction to HTML, CSS, and JavaScript Basics Angular 4: Introduction, Navigation: Angular router, Dependency injection, Bindings, observables, and pipes, component communications, forms, Interacting with servers using HTTP and Web Sockets, Bundling and deploying applications. Node.js Introduction to Node.js Building servers using the http and net modules, Node modules and events, Express, Accessing Data..	**20hrs**
2	**Python Frameworks** Introduction to Python Frameworks, components of frameworks, building RESTful web services.	**6 hrs**
3	**Using Python full stack frameworks** Django: Introduction to Django, Django's take on MVC: Model, View and Template, Django Forms: Form classes, Validation, Authentication, Advanced Forms processing techniques, working with databases, Integrate with RESTful web services.	**6 hrs**

Reference Books:

1. Robert W. Sebesta."Programming the World Wide Web", Pearson Publications 8th Edition, 2014.
2. Felipe Coury, Ari Lerner et.al, "ng-book: The Complete Guide to Angular4", FullStack.io Publications, 2017.
3. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
4. Daniel Rubio,"BeginningDjango: Web Application Development and Deployment with Python" 1st edition, ApressPublication , 2017.

Tentative Lab Plan

Expt./ Job No.	**Lab assignments/experiment**	**No. of Lab. Slots per batch (estimate)**
1	Demonstration on HTML ,CSS, Javascript	02
2	Demonstration on Angular.js	02
2	Exercise on Angular.js	01
3	Demonstration on Node.js	02
4	Exercise on Node.js	01
5	Demonstration on Django	02
6	Exercise on Django	01
9	Structured enquiry 1 – JavaScript Framework	02
10	Structured enquiry 2 – Django	02

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Course Code: **21ECSC307**	Course Title: **Blockchainand Distributed Ledgers**	
L-T-P : **2-0-1**	Credits: **3**	Contact Hrs:**30**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**		Exam Duration: **3 hrs**

Content	Hrs
Unit – 1	
Introduction Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy, Types of blockchain, blockchain platforms, Blockchain Architecture and use cases, Introduction to Bitcoin	**06 hrs**
Introduction to cryptography, Symmetric key crypto, Public key crypto: Introduction, RSA, Diffie-Hellman, PKI, Hash Functions: Introduction, SHA, Digital signature Schemes: RSA,Digital Signature Standard, Merkle trees.	**06 hrs**
Unit – 2	
Consensus Mechanisms and Mining Basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Proof of Activity, Practical Byzantine Fault Tolerance (PBFT), Federated PBFT, RAFT, Consensus protocols in Blockchain platforms, Scalability issues of consensus protocols.	**06 hrs**
Ethereum Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling	**06 hrs**
Unit – 3	
Blockchain Applications Blockchain in Financial Software and Systems: Settlements, KYC, Insurance Government: Digital identity, land records, public distribution system, social welfare systems, Blockchain for cyber security: Cloud forensics, Identity management, Intrusion detection	**06 hrs**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Semantic Web**		Course Code:**19ECSE303**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **40**
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	

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: Data Integration and Cloud Services (0-0-3)		Coursecode: **21ECSE332**
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	**Data Integration for Developers:** Introduction to PowerCenter, Folders, Sources, and Targets, Design Objects, File Lookups, Relational Lookups, Database Joins in PowerCenter,Workflow Logic, Merging, Routing, and Sorting Data, Command Tasks,Debugging,Parameterization,Updating Database Tables,Mapplets,Mapping Design Workshop, Addendum.	**20 hrs**
2	**PowerCenter Architecture and Transformations:** PowerCenter 10 Architecture, Parameter Files, User-Defined and Advanced Functions, Pivoting Data, Dynamic Lookups, Stored Procedure and SQL Transformations, Troubleshooting Methodology and Error Handling, Transaction Processing, Transaction Control Transformation, Recovery, Command Line Programs, Performance Tuning Methodology, Performance Tuning Mapping Design, Memory Optimization, Performance Tuning: Pipeline Partitioning.	**20 hrs**
3	**Cloud Application Integration Services:**Overview of Cloud Application Integration, Understand the Basics: Process Designer, Working with Assets,Adding Web Services to a Process, Fault Handling, Introduction to Guides Designer, API Management, CAI and CDI Integration, Troubleshooting, Tips & Tricks, Best Practices.	**10 hrs**
4	**Cloud Data Integration Services:** Informatica Cloud Overview, Runtime Environments and Connections, Synchronization Task, Cloud Mapping Designer, Cloud Mapping Designer – Transformations, Mapping Parameters, Expression Macro and Dynamic Linking,Replication Task, Masking Task, Mass Ingestion Task, Task flows, Hierarchical Connectivity, Intelligent Structure Model.	**10 hrs**

Text book:

1. Learning InformaticaPowerCenter 10.X,Second Edition, Rahul Malewar, Publisher: Packt, 2017.

Reference book:

1. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Publisher: Elsevier, 2012.

Course Title: **The ARM Architecture**		Coursecode:**19ECSE302**
L-T-P: **2-1-0**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Minor Project**		Course Code: **15ECSW302**
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**	

Sixth semester minor project themes:

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	Problem Definition and Synopsis
Review-2	Requirements, Algorithms, Design
Review-3	Implementation

Scheme for End Semester Assessment (ESA)

Sl.No	Expectation	Marks
1	Write up 1. Problem Statement. 2. Existing and Proposed system. 3. System Model with brief description. 4. Functional and Non Functional Requirements.	05
2	Presentation: Prepare minimum of 15-18 slides of presentation with consultation of your respective guides.	08
3	Demo (Complete execution of the project with results) and Viva voce.	25
4.	Project Report.	12

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: Bachelor of Engineering		
Course Title: **Big Data and Analytics**		Course Code:**17ECSC401**
L-T-P:**2-1-0**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs:54		Exam Duration: **3 hrs**

	Unit –I	
1	**Introduction :** What is Big Data?, Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	4 hrs
2	**Big Data Storage :** Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, Combining Sharding and Replication.On Disk Storage Devices, In-memory Storage Devices. Sharding, Replication, Combining Sharding and Replication.	6 hrs
3	**Big Data Processing :**Parallel Data Processing, Distributed Data Processing, Hadoop, Map Reduce	3 hrs
	Unit –II	
4	**Big Data Modeling:**Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.	6 hrs
5	**Big Data Technologies :** MongoDB - What is MongoDB? WhyMongoDB? Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.	6 hrs
	Unit –III	
6	**Big Data Visualization :** Hive - What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).	5 hrs

Text Books:

2. Thomas Erl, WajidKhattak,and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques, Prentice Hall, 2015.
3. SeemaAcharya, SubhashiniChellappan, Big Data and Analytics, Wiley India Pvt Ltd 2014.

Reference Books:

2. Frank J Ohlhorst, Big Data and Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012.
3. Colleen Mccue, Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis, Elsevier, 2007.

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	1,2,3	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	

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Information Security**		Course Code: **20ECSC402**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **45**	Exam Duration: **3 hrs**	

Unit –I		
1	Cryptography Basics: Introduction, Classic Crypto: Modern Crypto, Taxonomy of Cryptography and Cryptanalysis. Symmetric Key Crypto: Stream Ciphers, Block Ciphers-AES, DES, IDEA, Block cipher modes, Message Integrity	**06 hrs**
2	Public Key Crypto and Hash Functions: Introduction, Knapsack, RSA, Diffie-Hellman, Elliptic Curve Cryptography, Uses for Public Key Crypto, Public Key Infrastructure, X.509 Certificates.	**06 hrs**
Unit –II		
3	Data Integrity Algorithms: Cryptographic Hash Functions: applications and requirements, Hash functions based on cipher block chaining, Secure Hash algorithm, Message authentication codes: requirements and functions, HMAC, Digital Signatures, and Digital Signature Standard.	**06hrs**
4	Authentication and Authorization: Introduction, Authentication Methods: Passwords, Biometrics, Two-Factor Authentication, Single Sign-On, Protocols. Introduction to authorization , Access Control Matrix, Multilevel Security Models, Multilateral Security, Firewalls, Intrusion Detection	**06hrs**
Unit –III		
5	Application and Transport Security Protocols: Introduction, Authentication protocols, Secure Socket Layer, IPsec, Kerberos, GSM, Pretty Good Privacy and S/MIME, Transport Layer Security, HTTPs, Kerberos	**03 hrs**
6	Network and Wireless Security Protocols:IPSec overview, Encapsulating security payload, combining security associations, Internet key exchange, GSM Security, IEEE 802.11 Wireless LAN Security.	**03 hrs**

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

1. William Stallings, Cryptography and Network Security Principles And Practices, 7th Edition, Pearson, 2017.
2. Mark Stamp, “Information Security: Principles and Practices”, 2nd Edition, John Wiley and Sons, 2011.

References

1. Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, 2nd Edition, Thompson, 2005.
2. ChristofPaar Jan Pelzl, “Understanding Cryptography”, Springer-Verlag Berlin Heidelberg 2010
3. Nigel Poulton, TheKubernetes Book, Packt Publishing, 2019.

List of lab Experiments:

Expt./Job No.	Brief description about the experiment/job	No. of Lab. Slots
9.	Implementation of substitution cipher	1
10.	Demo and practice on Crypto Library	1
11.	Performance analysis of symmetric key algorithm algorithms	2
12.	Performance analysis of asymmetric key algorithm algorithms	2
13.	Performance analysis of Hash algorithms	2
14.	Course project	7

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, Q.No.-8	5, 6	Solve Any **1**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

	Program: Bachelor of Engineering		
	Course Title: **Cyber Security**		Course Code:**19ECSE401**
	L-T-P:**2-0-1**	Credits: **3**	Contact Hrs: **2hrs/week**
	ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
	Teaching Hrs: **30**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction to Cybercrime**: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, A global Perspective on cybercrimes. Cyber attack plans, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets, Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era.	**6 hrs**
2	**Methods used in Cybercrime**: Phishing, password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Identity theft.	**6 hrs**
Unit –II		
3	**Cybercrimes and Cyber security**: The Legal Perspectives Why do we need Cyber law: The Indian Context, The Indian IT Act, Digital Signature and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.	**6 hrs**
4	**Cybercrime- Real-Life Examples**: Illustrations, Examples and Case studies Introduction, Real-Life Examples, Case Studies: Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Online Scams.	**6 hrs**
Unit –III		
5	**Digital Forensics**: Historical background of cyber forensic, Forensic analysis of email, Digital forensic life cycle, Network forensic, Setting up a computer forensic Laboratory, Forensic analysis of digital media	**6 hrs**

Text Books:

1. Nina Godbole & Sunit Belapure, Cyber Security, Wiley India, 2012
2. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005

Reference Books:

1. Kevin Mandia, Chris Prosise, Matt Pepe, Incident Response and Computer Forensics, Tata McGraw -Hill, New Delhi,, 2006

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.-7,8	5	Solve Any **1**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Software Testing**		Course Code:**18ECSE407**
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration**: 3 hrs**	

Unit – 1		
1	**Software Testing Principles:** Need for testing ,The Psychology and Economics of Program Testing Program ,Inspections, Walkthroughs, and Reviews.	**04hrs**
2	**Test-Case Design:**Overview, White box testing, Error Guessing, strategies , Module (Unit) Testing-Incremental Testing, Top-down versus Bottom-up Testing, Performing the Test.	**06hrs**
3	**Higher-Order Testing**: Function testing, System testing, Acceptance testing, Installation testing, Test planning and Control, Test completion criteria, Extreme testing.	**06hrs**
Unit – 2		
4	**Testing Tools and Standards:**Automated Tools for Testing - Static code analyzers - Test case generators - GUI Capture/Playback – Stress Testing - Testing Client – server applications – Testing compilers and language processors - Testing web-enabled applications.	**10hrs**
5	**CMM Model and its stages** – Introduction to PCMM, CMMI and Six Sigma concept – ISO 9000.	**06hrs**
Unit – 3		
6	**Software Quality and Testing:**Introduction to software quality and quality control – Benefits of quality control - Quality assurance - quality circles and quality improvement.	**04hrs**
7	**Introduction to quality cost** – Measuring quality cost – Total Quality Management (TQM).Architecture, Process, memory and file management in Mobile OS, Network OS.	**04hrs**

Text Books:

1. Glenford J. Myers, Tom Badgett, Corey Sandler, and Todd M. Thomas, "The Art ofSoftware Testing", John Wiley & Sons, Second edition, 2004.
2. Roger S. Pressman, "Software Engineering. A Practitioners Approach", McGraw-HillInternational Edition, Seventh edition, 2009.

References:

1. William E. Perry, "Effective Methods for Software Testing", John Wiley & Sons, Secondedition, 2000.
2. Boris Beizer, "Techniques for Functional Testing of Software and Systems", John Wiley & Sons, 1995.
3. P.C. Jorgensen, "Software Testing - A Craftman's Approach", CRC Press, 1995.
4. Boris Beizer, "Software Testing Techniques", Van Nostrand Reinhold, Second edition,1990.

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, Q.No.-8	6, 7	Solve Any **1**

KLE TECH	**FORM** **ISO 9001: 2008** School of Computer Science & Engineering

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

Program: **Bachelor of Engineering**		
Course Title: **Social Network Analysis**		Course Code: **18ECSE402**
L-T-P: **3-0-0**	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** Introduction : Motivation, different sources of network data, types of networks, tools for visualizing network data.	**06 hrs**
2	**Structural properties of networks** Structural properties of networks : Notions of centrality, cohesiveness of subgroups, roles and positions, structural equivalence, equitable partitions, stochastic block models.	**10 hrs**
Unit –II		
3	**Cascading properties of networks** Cascading properties of networks : Information/influence diffusion on networks, maximizing influence spread, power law and heavy tail distributions, preferential attachment models.	**10 hrs**
4	**Small world phenomenon** Small world phenomenon : Six Degrees of Separation, Structure and Randomness, Decentralized Search, Empirical Analysis and Generalized Models, Core-Periphery Structures and Difficulties in Decentralized Search, Advanced Material: Analysis of Decentralized Search.	**06 hrs**
Unit –III		
5	**Mining Graphs- I** Mining Graphs- I : Community and cluster detection: random walks.	**04 hrs**
6	**Mining Graphs- II** Mining Graphs- II : Spectral methods; link analysis for web mining.	**04 hrs**

Text Books

1. Stanley Wasserman, Katherine Faust, Social network analysis: methods and applications, Cambridge University Press, 1994.
2. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World., Cambridge University Press, 2010.

Reference Books:

1. Peter R. Monge, Noshir S, Contractor, Theories of communication networks, Oxford University Press, 2003.
2. Duncan Watts, Six degrees: the science of a connected age. Norton, 2004.

Scheme for Semester End Examination (ESA)

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

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: **C# Programming and .NET**		Course Code: **18ECSE409**
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: 3 hrs	

	Unit –I	
1	**The Philosophy of .NET** Understand the motivation behind the .NET platform, Common Language Infrastructure (CLI). Know the role of the Common Type System (CTS), the Common Language Specification (CLS) and the Common Language Runtime (CLR), Understand the assembly, metadata, namespace, type distinction, Contrast single-file and multi-file assemblies, Know the role of the Common Intermediate Language (CIL), Platform independent .NET(Mono / Portable .NET distributions).	**5hrs**
2	**C# Language Fundamentals** Language Fundamentals, Reference and value Types, primitive types the Nullable and enum types, Classes and objects, Defining classes Creating objects, Using static members, Overloading Methods, Various Constructors. Encapsulating data, access modifiers, properties, indexers arrays and readonly fields. Structures. String and DateTime classes, three pillars of OOPs	**7 hrs**
3	**Exceptions and Object Life Time** Ode to Errors, Bugs and Exceptions, The Role of .NET Exception handling, the System. Exception base class, Throwing a generic Exception, Catching Exceptions, CLR System-Level Exceptions (System.SystemException), Custom Application-Level Exceptions (System.ApplicationException). Handling Multiple Exception, The Finally Block, The Last Chance Exception, Understanding Object Life time. The CIL of "new", The Basics of Garbage Collection	**4 hrs**
	Unit –II	
4	**Event handling paradigm Interfaces and Collections** Understanding the .NET Delegate type, Multicast Delegate and events. Interfaces, overriding interface implementation. Explicit interface implementation, Collection, IEnumerable, IEnumerator, IList, IComparer and their Generic equivalent. Working with generic List, Stack, Dictionary and Queue	**6 hrs**
5	**Programming Window Forms Applications** Anatomy of a Form, Component Class, Control Class, Control Events, Responding to Keyboard Events, Form Class, Building Menus with Windows Forms, Building your Menu System, Creating Pop-Up Menu, Adding Controls to Forms (IDE-Free), Adding Controls to Forms (via VS.NET), Working with Basic Controls like Buttons, Configuring Tab Order.	**5 hrs**
6	**Working with Database** Introduction to ADO.NET , Connecting to a database, Understanding DataTables, Creating a DataAdapter, Referencing fields in a DataRow, Navigating records ,Adding, editing, and deleting records, Building an ADO.NET example.	**5 hrs**
	Unit –III	
7	**Understanding the .NET Assemblies** Problems with Classic.COM Binaries, An overview of .NET Assembly, Building a single file test assembly, A C# Client Application, A Visual Basic .NET Client Application, Cross-Language Inheritance, Exploring the Car Library's Manifest, Exploring the Car Library's Types.	**4 hrs**
8	**Using .NET Assemblies** Building a multi file assembly, Using the Multifile Assembly , Understanding the private Assemblies, Probing for private Assemblies (The Basics), Private Assemblies and XML Configuration Files, Probing for Private Assemblies(The details), Understanding Shared Assemblies, Understanding Shared Names, Building a Shared	**4 hrs**

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

	Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly.	

Text Books:

1. Herbert Schildt, "The Complete Reference C# 4.0", Tata McGraw –Hill, 2010
2. Andrew Troelsen, "Pro C# with .NET 3.0", Special Edition, Dream tech Press, India, 2007.

Reference Books:

1. Stephen C. Perry, AtulKahate, Stephen Walther, Joseph Mayo, "Essential of .net and Related Technologies with a focus on C#, XML, ASP.net and ADO.net", 2nd Edition, Pearson, 2009.
2. Paul J. Deitel, Harvey Deitel, "Visual C# 2010 for Programmers", 4th Edition, Pearson, 2010.
3. Joseph Albahari and Ben Albhari, "C# 3.0/4.0 in Nutshell", 3rd Edition, O'Rilley, 2007.

Course Content

Course Code: **20ECSE405**	Course Title: **Software Defined Networks**	
L-T-P : **3-0-0**	Credits: **3**	Contact Hrs: **40**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**		Exam Duration: **3 hrs**

Content	Hrs
Unit – 1	
Chapter No. 1.Introduction Evolving network requirements, Types of Network and Internet Traffic, The SDN approach, Data Center Networking: Big Data over SDN, Cloud Networking over SDN.	08 hrs
Chapter No. 2. SDN Data Plane and OpenFlow Data plane functions and protocols, OpenFlow logical network device, OpenFlow protocol, OpenFlow messages, OpenFlow events: Responding to switches.	08 hrs
Unit – 2	
Chapter No. 3.Control Plane SDN Control plane architecture, POX architecture, OpenDaylight architecture, REST, Mininet based examples,	08 hrs
Chapter No. 4.Programming SDNs Components in POX, POX APIs, Registering Components, The Event System: Handling Events, Creating Your Own Event Types**,** Raising Events**,** Binding to Components' Events, Working with packets, Working with sockets: ioworker, OpenFlow in POX**.**	08 hrs
Unit – 3	
Chapter No. 5.Software Application plane SDN Application Plane Architecture , Traffic Engineering, Measurement and Monitoring. Security Requirements, SDN Security.	04hrs
Chapter No. 6.Network Functions Virtualization (NFV) OpenFlow VLAN Support, Virtual Private Networks, Network Virtualization: A Simplified Example, Network Virtualization Architecture, Benefits of Network Virtualization.	04 hrs

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

1. William Stallings, "Foundations of modern networking: SDN, NFV, QoE, IoT and Cloud", Addison Wesley; 1 edition, 2015.
2. Thomas D. Nadeau & Ken Gray, "SDN - Software Defined Networks", O'Reilly, 2013.

References

3. Sreenivas Voruganti, Sriram Subramanian,"Software-Defined Networking (SDN) with OpenStack", Packt Publishing, 2016.
4. 2. POX manual current documentation, https://openflow.stanford.edu/display/ONL/POX+Wiki.html

Program: Bachelor of Engineering		
Course Title: **Software Architecture and Design Thinking**		Course Code:**18ECSE410**
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: **3 hrs**	

Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development

	Unit –I	
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	**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	**6 Hrs**
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	**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	**Quality Attributes** Tactics for Availability, Tactics for Interoperability, Tactics for Modifiability, Tactics for Performance, Tactics for Security, Tactics for Testability, Tactics for Usability,	**6 Hrs**
6	**Architectural Tactics and Patterns** Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics and Patterns, Using Tactics Together	**5 Hrs**
	Unit –III	
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**
8	**Designing an Architecture, Implementation, Testing and Evaluation** **Designing:** 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	**4 hrs**

Textbooks:

1. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice (3rd Edition), Addison-Wesley Professional; 3 edition
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern- Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2012 (chapter 2)

Reference Books:

1. Richard N. Taylor, Nenad Medvidovic and Eric M. Dashofy: Software Architecture: Foundations, Theory, and Practice, Wiley- India 2012
2. Mary Shawand David Garlan: Software Architecture-Perspectives on an Emerging Discipline, Prentice Hall of India, 2007

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	

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 5. Problem Statement and Objectives. 6. System design with brief description. 7. 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

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8thSem Elective List

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	**5 hrs**
2	**Dependency Parsing, Recurrent Neural Networks** Dependency Grammar , Neural dependency parsing, Recurrent Neural Networks and Language Models, Vanishing Gradients, Fancy RNNs	**7 hrs**
Unit –II		
3	**Machine Translation, Seq2Seq and Attention** Machine Translation, Seq2Seq and Attention, Advanced Attention	**6 hrs**
4	**Transformer Networks , Coreference Resolution, Memory Networks** Transformer Networks and CNNs, Tree Recursive Neural Networks and Constituency Parsing , Advanced Architectures and Memory Networks	**6 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	**6 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 3Ed. Draft. Ian Goodfellow, YoshuaBengio, and Aaron Courville. *Deep Learning*. MIT Press.		

List of experiments

Expt./Job No.	**Brief description about the experiments**	**No. of Lab slots per batch (2 hrs)**
1.	Installation of nltk tool kit in python and practicing of word tokenization, spellchecker programs.	1
2.	Compute softmax points (probabilities) for numerical stability.	1
3.	Implement the word2vec model for word vector representation.	1
4.	Implement the dependency parsing for the following sentence “I parsed this sentence correctly” and show at least three steps for parsing with stack and buffer status.	2
5.	Write a program to build seq2seq sentence from word corpora(Tensorflow).	1
6.	Implement the neural image caption generator.	2
7.	Implement question answering (QA) system, to answer the questions posed in natural language.	1

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

Program: **Bachelor of Engineering**		
Course Title: Big Data Analytics		Course Code: 18ECSO401
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: 3 hrs	

	Unit –I	
1	Introduction: Data Analytics, Data Analytics Life Cycle, Big Data Characteristics, Different Types of Data.	**4hrs**
2	Big Data Technologies: Parallel Data Processing, Distributed Data Processing, Hadoop , Spark	**8hrs**
3	Nosql: NoSQL Databases, Document databases, Key-value databases, Wide-column stores, Graph databases	**4 hrs**
	Unit –II	
4	Big Data Modeling: Data Model Structures, Data Model Operations, Processing Workloads, Processing in Batch Mode, Processing in Real-time Mode.	**8 hrs**
5	MongoDB – Introduction to MongoDB, RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.	**8 hrs**
	Unit –III	
6	Big Data Visualization: Hive - Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL).	**4 hrs**
7	Big data applications and case study : Stock market analysis, weather data analysis	**4 hrs**

Text Books:

3. Thomas Erl, WajidKhattak,and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques, Prentice Hall, 2015.
4. SeemaAcharya, SubhashiniChellappan, Big Data and Analytics, Wiley India Pvt Ltd 2014

Reference Books:

4. Frank J Ohlhorst, Big Data and Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012.
5. Colleen Mccue, Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis, Elsevier, 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, 2,3	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	7	

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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:

1. 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**
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	

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Program: **Bachelor of Engineering**		
Course Title: **Model Thinking**		Course Code: **18ECSE411**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **40 hrs**
ISA Marks: **50**	ESA Marks:**50**	Total Marks: **100**
Teaching Hrs: **40 hrs**	Exam Duration: **03 hrs**	

Unit –I		
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 –II		
4	**Randomness and Learning Models** Luck as Randomness, Random Walks & Colonel Blotto, Replicator Dynamics, Fisher's Fundamental Theorem, Prediction and the Many Model Thinker, Social Models	**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 –III		
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.

Reference Books:

1. Model Thinking Coursera online course from Michigan University.

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	7	

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Program: Bachelor of Engineering			
Course Title: **Essential of IT**			Course Code: **15ECSO405**
L-T-P: **3-0-0**		Credits: **3**	Contact Hrs: **40 hrs**
ISA Marks: **50**		ESA Marks:**50**	Total Marks: **100**
Teaching Hrs: **40 hrs**		Exam Duration: **03 hrs**	
Unit –I			
1	**Introduction to computer systems:** Components of computer systems, program execution cycle, computer networks, software and its classification, Operating System: introduction, memory management, process management, file management.		**06 hrs**
2	**Programming basics:** Introduction to problem solving, SDLC overview and need for object oriented approach, object oriented concepts, introduction to java, control structures, arrays, strings.		**06 hrs**
3	**Classes and Objects:** Class fundamentals, access specifiers, constructors and its types, method overloading, static members.		**04 hrs**
Unit –II			
4	**Data structures:** Introduction, Linear data structures: stack, queue, linked lists, Non-Linear data structures: trees, binary search tree, illustration using java collection framework.		**05 hrs**
5	**Inheritance and Polymorphism:** Inheritance: basics, types of inheritance, method overloading and overriding, dynamic method dispatch.		**05 hrs**
6	**Packages, Interfaces and Exceptions:** Introduction to packages, access protection, interfaces, exception handling mechanism, and user defined exceptions.		**06 hrs**
Unit –III			
7	**Database Design Process:** Characteristics of DBMS, ER model, mapping ER model to relational schema, normalization.		**04 hrs**
8	**Structured Query Language:** SQL data types, database languages, operators, aggregate functions, order by and group by clause, joins and sub queries.		**04 hrs**

Text Books:

1. Infosys Campus Connect Foundation Program Volume:1–3, Education and Research Department, Infosys Technologies Ltd, 2013.
2. Herbert Schildt, “Java The Complete Reference”, 8th Edition, McGraw-Hill, 2012.

Reference Books:

1. Elmasri. and Navathe, “Fundamentals of Database Systems”, 6th Edition, Pearson Education, 2011.
2. Silberschatz, Galvin, and Gagne, "Operating System Concepts", 8th Edition, Wiley, 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	7	

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Program: **Bachelor of Engineering**		
Course Title: Software Engineering		Course Code: 15ECSO403
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: 3 hrs	

	Unit –I	
1	**Software Engineering process** Professional software development, Software engineering ethics, Case studies, Software processes: Software process models, Process activities, Coping with change, The rational unified process, Continuous Integration and Continuous Deployment and Tools.	**6hrs**
2	**Agile Software Development** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management.	**4 hrs**
3	**Requirement Engineering** Functional and Non-functional requirements; The software requirements Document, Requirement specification, Requirements Engineering Processes, Requirement's elicitation and analysis; Requirements validation; Requirements management.	**6 hrs**
	Unit –II	
4	**System Modeling** Context models, Interaction Models, Structural models, Behavioral models.	**6 hrs**
5	**Architectural Design** Architectural Design Decision, Architectural views, Architectural patterns, Application Architectures.	**5 hrs**
6	**Object-Oriented design and implementation** Object oriented design using UML, design patterns, Implementation Issues, Open source development.	**5 hrs**
	Unit –III	
7	**Software Testing** Development Testing, Test Driven Development, Release Testing, User Testing.	**4 hrs**
8	**Configuration management** Change management, Version management, System building, Release management.	**4 hrs**

Text Books:

1. Ian Somerville, Software Engineering, 9th, Pearson Ed, 2015

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

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 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	

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Program: **Bachelor of Engineering**		
Course Title: **Industry Project**		Course Code: 20ECSW494
Credits: 11	ISA Marks: 50	ESA Marks: 50
Total Marks: 100	Exam Duration: 3 hrs	L-T-P: 0-0-11

Overview of the Course

The purpose of providing the Industry Project is to give you the opportunity for students, to apply the knowledge, skills and competencies they have acquired, in real life practice. An Industry Project involves a stay in a relevant company or organization.

The students who got placed in campus interviews may be offered Industry Project depending upon the need of the company. Other students who wish to do Industry Project are responsible to find a company on their own.

Scheme for In Semester Assessment (ISA) and End Semester Assessment (ESA)

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Project	18ECSW494	50	50	Students must secure minimum of 40% marks in both ISA and ESA.

Parameter	Marks
Write Up	10
Presentation	10
Project demo	25
Report	05
Total Marks	**50**

ESA Evaluation Parameters

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KLE TECH.	**FORM** **ISO 9001: 2008** Department of Computer Science& Engineering	**Document #: FMCD2005**	**Rev: 1.0**
Curriculum Content- Course wise			**Year: 2017-21**

Program: **Bachelor of Engineering**		
Course Title: **Industry Training**		Course Code: 18ECSI493
Credits: 6	ISA Marks: 50	ESA Marks: 50
Total Marks: 100	Exam Duration: 3 hrs	L-T-P: 0-0-6

Overview of the Course:

Industry Training is a supervised, practical training periods for which Undergraduate, final year students earn academic credits. Industry Training provide excellent opportunities for students to put into practice much of the knowledge and skills acquired during their studies and to gain firsthand knowledge of the software industry. It is also an opportunity for employers to observe the student in the work environment and evaluate their potential for possible future employment.

The companies selected for the Industry Training can range from start-ups to large scale industries. The students who got placed in campus interviews may be offered Industry Training depending upon the need of the company. Other students who wish to do internship are responsible to find a company on their own for the Training.

Scheme for In Semester Assessment(ISA) and End Semester Assessment (ESA)

Course	Course Code	Max ISA marks	Max ESA marks	Minimum Passing Marks
Industry Training	18ECSI493	50	50	Students must secure minimum of 40% marks in both ISA and ESA.

ESA Evaluation Parameters

Parameter	Marks
Write Up	10
Presentation	10
Skills learned (Development, Testing)	25
Report	05

Course Content

Program: **Bachelor of Engineering**		
Course Title: **Capstone Project**		Course Code: 20ECSW401
L-T-P: **0-0-11**	Credits: **11**	Contact Hrs: **3 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **45**	Exam Duration: **3hrs**	

Eight semester Capstone project theme: Usage of Design Principles in building the solution.

CP 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	Project demonstration	10
2	Results and Discussions	05

3	Relevance of project to ethical/ social/ legal/ economic concerns	05

Program: **Bachelor of Engineering**		
Course Title: **Blockchain and Distributed Ledgers**		Course Code:21ECSC307
L-T-P: 2-0-1	Credits: 3	Contact Hrs: **4 hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Exam Duration: 3 hrs	

	Unit –I	
1	**Introduction** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy, Types of blockchain, blockchain platforms, Blockchain Architecture and use cases, Introduction to Bitcoin, Bitcoin transactions and scripts	**6 hrs**
2	**Cryptography Basics** Introduction to cryptography, Public key crypto: Introduction, RSA, Digital certificate, PKI, Hash Functions: Introduction, SHA, Digital signature Schemes: RSA, Digital Signature Standard, Merkle trees.	**6 hrs**
	Unit –II	
3	**Consensus Mechanisms** Basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Proof of Activity, Practical Byzantine Fault Tolerance (PBFT), Federated PBFT, Consensus protocols in Blockchain platforms, Scalability issues of consensus protocols.	**6 hrs**
4	**Blockchain Platforms** Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling, architecture and components of Hyperledger, Fabric membership and identity management, chaincode as a smart contract	**6 hrs**
	Unit –III	
5	**Blockchain Applications** Blockchain in Financial Software and Systems: Settlements, KYC, Insurance Government: Digital identity, land records, public distribution system, social welfare systems, Blockchain for cyber security: Cloud forensics, Identity management, Intrusion detection.	**6 hrs**

Reference Books:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. Rogen Wattenhofer, "Blockchain Science : Distributed Ledger Technologies", 1st Edition, Inverted Forest Publishing, 2019

3. Andreas A, Gavin Wood, "Mastering Etherium: Building smart contracts and DApp", 1st Edition, O'Reilly Media, 2018.
4. Matt Zand, Xun Wu, Mark Anthony Morris, “Hands-On Smart Contract Development with Hyperledger Fabric V2”, 1st Edition, O'Reilly Media, 2018.

Program: **Bachelor of Engineering**		
Course Title: **Web Technologies Lab**		Course Code: **21ECSP304**
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 HTML basics, JavaScript Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics	4 hrs
2	RESTful API using NodeJS and Express Introduction to Node.js .Building servers using the http and net modules, Node modules and events, Express, REST API client, Postman, Accessing Data, Data Security using Bcrypt. API security using JWT tokens.	12 hrs
3	Angular Building blocks of Angular Apps, Components, Templates, Directives. Services, Dependency injection, Bindings, observables, pipes, component communications, Forms, Interacting with servers using HTTP. RouteGuard, Interceptors, Bundling and deploying applications, Hosting	12 hrs
4	React JSX, React Components, Interaction of Components, Lifecycle methods, Form.	8 hrs

Reference Books:

5. Robert W. Sebesta.”Programming the World Wide Web”, Pearson Publications 8th Edition, 2014.
6. Nathan Murray, Felipe Coury, et al, "ng-book: The Complete Guide to Angular", FullStack.io Publications, 2019
7. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
8. Den Ward, “React Native Cookbook: Recipes for solving common React Native development problems”, 2nd Edition.2019

Lab Plan

Expt./ Job No.	Lab assignments/experiment	Slots
1	Demonstration on HTML, JavaScript	02
2	Exercise on JavaScript	01

3	Demonstration on Node	03
4	Exercise on Node	01
5	Demonstration on Angular	02
6	Exercise on Angular	01
7	Demonstration on React	02
8	Exercise on React	01
9	Structured enquiry 1 – MEAN	02
10	Structured enquiry 2 – React	02