ANNEXURE A

COMPUTER ENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duratiion (Hrs)	Marks					Credits
						Th	IA	TW*	O	Total	
CE710	Compiler Design	3	0	0	**3**	100	25	0	0	125	3
CE721	Embedded Systems & Design	3	0	0	**3**	100	25	0	0	125	3
CE722	Machine Learning										
CE723	Data Analytics										
CE724	Mobile Computing & Android Programming										
CE730	Compiler Design Lab	0	0	2	--	0	0	25	50	75	2
**	Open Elective	3	0	0	3	100	25	0	0	125	3
CE740	Internship	0	0	3	--	0	0	50	50	100	3
CE750	Project Work - Phase I	0	0	3	--	0	0	50	75	125	3
	TOTAL	9	0	8	--	300	75	125	175	675	17

*Term Work marks are to be awarded through continuous evaluation

** Students may enter the subject code of the open elective selected from the courses of other branch of Engineering.

LEGEND

Abbreviation	Description
L	Lecture
T	Tutorial
P	Practical
O	Oral
Th	Theory
TW	Term Work
IA	Internal Assessment

COMPUTER ENGINEERING COURSE

SCHEME OF INSTRUCTION AND EXAMINATION REVISED COURSE 2019-2020

SEMESTER – VIII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination					
		L	T	P	Duratiion (Hrs)	Marks				Credits
						Th	IA	TW*	O	Total	
CE810	Cryptography Techniques for Network Security	3	0	0	**3**	100	25	0	0	125	3
CE821	Internet of Things										
CE822	Pattern Recognition										
CE823	Multimedia Systems & Applications						25	0	0	125	3
CE824	Software Development Framework	3	0	0	**3**	100					
CE830	Elective - NPTEL / MOOC / SWAYAM	3	0	0	--	0	0	50	50	100	3
CE840	Project Work - Phase II	0	0	10	--	0	0	100	150	250	9
	TOTAL	9	0	10	**29**	200	50	150	200	600	18

*Term Work marks are to be awarded through continuous evaluation

LEGEND

Abbreviation	Description
L	Lecture
T	Tutorial
P	Practical
O	Oral
Th	Theory
TW	Term Work
IA	Internal Assessment

COMPILER DESIGN					
Course Code	**CE710**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**40 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives

The subject aims to provide the student with:

1	To understand the basic principles of compiler design
2	To know the major steps involved in translating a high-level programming language down to a low-level target machine language
3	To understand the relationship between machine and assembly language, compilers, interpreters, linkers, loaders, assemblers and macro preprocessors
4	To construct efficient algorithms for compilers

Course Outcomes

The Student will be able to:

CE710.1	Understanding the basic structure and working principles of various components and phases of compiler.
CE710.2	Illustrate automation compiler construction process using tools
CE710.3	Justify the role of parser in compiler design.
CE710.4	Demonstrate the code generation and code optimization techniques.

UNIT-1	
Evolution of Programming Languages: The move to higher level languages, Impacts on Compilers, Applications of compiler Technology. **Assemblers**: Design of a Two Pass Assembler. **Introduction to Compiler**, Phases of compilation, Bootstrapping and Porting, Compiler writing tools, Input Buffering. **Lexical Analysis**: The role of a lexical analyzer, Specification and Recognition of Tokens, Role of Finite Automata in lexical analysis, Study of the features and applications of LEX/FLEX tool. Implementation of lexical analysis using	10hrs

Lex/Flex tool.	
UNIT-2	
Syntax Analysis: Overview of Context free grammars, Defining Context Free Grammar for If, Nested IF, For, While, Switch, Nested For, Nested While. Derivations and Parse trees, Ambiguity, Elimination of Left recursion, Left factoring. **Top down parsing**: Recursive descent parsing and Predictive parsers. **Parser Generator YACC**: Syntax Phase implementation for If, Nested If, For, While, Switch, and Assignment Statement using YACC tool.	10hrs
UNIT-3	
Bottom up parsing: Shift-reduce parser, Operator precedence parser, LR parsers. **Intermediate Code Generation**: Intermediate Language, Declarations, Assignment statements, Boolean expressions, Case statement, Backpatching , Procedure call. **Error detection and recovery**: Lexical phase errors, Syntactic phase errors, Semantic errors.	10hrs
UNIT-4	
Code generation: Issues in the design of a code Generator, Basic blocks and flow graphs, Next-use information, A simple Code generator, DAG representation of Basic blocks, Peephole Optimization, Generating code from DAGS. **Code optimization**: The principle sources of optimization, Optimization of basic blocks, Implementation for Common Sub expression technique using DAG. **Symbol table**: The contents of a symbol table, Data structures for Symbol Table, Representing scope information.	10hrs

TEXTBOOKS	
1	Compilers – Principles, Techniques, and Tools; Alfred Aho, Monica Lam, Ravi Sethi and Jeffrey Ullman ; 2009; 2nd Edition, Pearson, ISBN: 978-81-317-2101-8,

2	Compiler design with FLEX and YACC; Vinu V. Das ; 2007; PHI publication, ISBN:978- 81-203-3251-5
3	Systems Programming; D M Dhamdere, 2011 Tata McGraw Hill Education Private Limited
REFERENCES	
1	Louden; Compiler Construction, Principles and Practice; 2006, Galgotia Publication, ISBN:0-534-93972-4
2	Compiler design in C; Holub A I , 1992, Prentice-Hall, ISBN:0-87692-778-9
3	System Programming and Compiler Construction; R.K. Maurya, Anand A. Godbole; 2014; Dreamtech Press,ISBN 13:9789351197195
4	Compiler Design; A.A.Putambekar; First Edition 2009,Technical Publications Pune

EMBEDDED SYSTEMS AND DESIGN					
Course Code	**CE721**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**40 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives

The subject aims to provide the student with:

1	To understand the basics of Embedded Systems
2	To understand the basics of organization and architectural issues of a microcontroller
3	To learn programming techniques used in a microcontroller
4	To understand fundamentals of Real Time Operating Systems

Course Outcomes

The Student will be able to:

CE721.1	Describe the differences between the general computing system and the embedded system; also recognize the classification of embedded systems and Embedded system development tools.
CE721.2	Explain the concept of real time embedded systems using the concepts of RTOS.
CE721.3	Develop the programs for a microcontroller and its interfacing.
CE721.4	Describe the role of embedded systems in industry.

UNIT-1	
Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC (System on Chip). **Real Time Operating Systems:** Real Time Tasks, Real Time Systems, Types of Real Time Tasks, Real Time Operating Systems, Real Time Scheduling Algorithms. **The Embedded System Development Environment:** The Integrated Development Ebnvironment (IDE), Simulators, Emulators and Debugging.	10hrs

UNIT-2	
Introduction to 8051: Architecture and Pin Diagram. 8051 Assembly Language Programming. Jump, Loop and Call Instructions. I/O Port Programming. 8051 Addressing Modes. Arithmetic, Logic Instructions and Programs.	10hrs
UNIT-3	
8051 Timer Programming in Assembly and C. **8051** **Serial Port** Programming in Assembly and C. **Interrupts** Programming in Assembly and C. **8051 Interfacing** To External RAM / ROM.	10hrs
UNIT-4	
8051 LCD and Keyboard Interfacing **Hardware Software Co-Design and Program Modeling:** Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design. **Embedded System Case Studies**: Battery operated smart card reader, Washing Machine, Microwave Owen, Automotive Embedded Systems.	10hrs

TEXTBOOKS	
1	The 8051 microcontroller & Embedded systems; M. A. Mazidi, J. G. Mazidi, R. D. McKinlay; 2nd Edition; Pearson
2	The 8051 microcontroller; Kenneth J. Ayala, 3rd Edition; CengageLearning.
3	Embedded / real – time systems: concepts, design & programming, Black Book; Dr. K. V. K. K. Prasad; Reprint edition2013/2018; Dreamtech press,
REFERENCES	
1	Introduction to Embedded Systems; Shibu K.V, 2nd Edition; McGrawHill
2	Embedded systems an integratedapproach;Lyla B. Das, Reprint Edition 2016, Pearson;
3	Embedded system design A Unified hardware/softwareIntroduction; Frank Vahid&Tony Givargis;Wiley Student Edition Reprint 2014, Wiley

MACHINE LEARNING					
Course Code	**CE722**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**40 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives

The subject aims to provide the student with:

1	To introduce basic concepts and techniques of Machine Learning
2	To understand the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
3	To study the design and implementation of various machine learning algorithms in a range of real-world applications.

Course Outcomes

The Student will be able to:

CE722.1	Identify the characteristics of machine learning that make it useful to real-world problems; characterize machine learning algorithms as supervised, semi- supervised, and unsupervised.
CE722.2	Explain fundamental issues and challenges of machine learning: data model selection, generalization and model complexity.
CE722.3	Demonstrate the concept of support vector machines, regression algorithms
CE722.4	Illustrate and apply algorithms for dimensionality reduction and clustering;

UNIT-1	
Introduction to Machine Learning: Machine Learning; Examples of Machine Learning Applications **Supervised Learning:** Learning a Class from Examples, Vapnik- Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm. **Bayesian Decision Theory:** Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules	10hrs

UNIT-2	
Parametric Methods AND Non-Parametric Methods: **Parametric Methods:** Introduction Maximum Likelihood Estimation, evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures, Over fitting and Under fitting. **Multivariate Methods:** Multivariate Data, Multivariate Normal Distribution, Multivariate Classification, Discrete Features, Multivariate Regression **Nonparametric Methods:** Introduction, Nonparametric Density Estimation, Generalization to Multivariate Data, Nonparametric Classification.	10hrs
UNIT-3	
Dimensionality Reduction and Clustering **Dimensionality Reduction:** Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Isomap. **Clustering:** Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the number of clusters. **Kernel Machines:** Introduction, Optimal Separating Hyperplane, The Non-Separable Case: Soft Margin Hyperplane, vSVM, Kernel Trick, Vectorial Kernels, Defining Kernels, Multiple Kernel Learning, Multiclass Kernel Machines.	10hrs
UNIT-4	
Fundamentals of Deep Learning: **The Neural Network:** Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptron as Neurons, Feed-forward Neural Networks, Linear Neurons and their Limitations, Sigmoid Tanh and ReLU Networks, Softmax Output Layers. **Training Feed-Forward Neural Networks**: The Cafeteria Problem, Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons.	10hrs

TEXTBOOKS	
1	Introduction to Machine Learning; EthemAlpaydın, Third Edition, PHI ISBN No. 978-81-203- 5078-6.
2	Fundamentals of Deep Learning, Nikhil Buduma, First Edition, O'Reilly, ISBN No. 978-14-919- 2561-4.

REFERENCES	
1	Understanding Machine Learning(From Theory to Algorithms), Shaishalev-Shwartz and Shai Ben-David, First Edition, Cambridge University Press, , ISBN No. 978-1-107-51282-5.
2	Pattern Recognition and Machine Learning, Christopher M. Bishop, Mcgraw-Hill, ISBN No. 0- 07-115467-1. Paperback – 23 August 2016
3	Machine Learning,Tom Mitchell, First Edition,Mcgraw-Hill, ISBN No. 0-07-115467-1.
4	Deep Learning (Adaptive Computation and machine Learning Series), Ian Goodfellow and YoshuaBengio, Illustrated, 3 January 2017, MIT Press, Massachusetts London, England, ISBN No. 9780262035613.

DATA ANALYTICS					
Course Code	**CE723**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**40 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives

The subject aims to provide the student with:

1	To learn, understand and practice Big Data Analytics
2	To introduce and learn about the tools required to manage and analyze Big Data like Hadoop, NoSQL, MapReduce
3	To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability
4	To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes

The Student will be able to:

CE723.1	Explain the fundamental concepts of database management and to demonstrate basic data analysis techniques.
CE723.2	Demonstrate the Data Analytics Lifecycle to address big data analytics projects
CE723.3	Apply appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results
CE723.4	Illustrate the appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences

UNIT-1	
Basic Data Analysis Techniques: **Introduction** to Data Analytics, Data pre-processing, concepts of supervised and unsupervised learning. Sampling, sampling methods and re-sampling **Basic statistics**: Mean median, standard deviation, variance, correlation and covariance. **Linear regression:** Simple linear regression, introduction to multiple linear regressions.	10hrs

UNIT-2	
Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance and covariance **Classification:** logistic regression, decision trees, SVM., Naïve Bayesian	10hrs
classifiers, text analysis. **Ensemble methods**: bagging, random forests, boosting. **Clustering:** K-means, K-medoids, Hierarchical clustering. **Association Rules**, Apriori algorithm.	
UNIT-3	
DBMS, NoSQL and Basic Data Analytics Lifecycle : **DBMS:** Introduction to Database Management Systems, Purpose of Database Systems, Database System Applications, View of Data, Database Languages, Database System Structure. **Introduction to NoSQL Database:** Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Comparative study of SQL and NoSQL **Basic Data Analytics:** Need of Data analytic lifecycle, Key roles for successful analytic projects. **Phases of Data analytic lifecycle:** Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.	10hrs
UNIT-4	
Data Analytics using R - Theory, Methods & Case Studies: **Introduction to R:** GUI of R, R nuts and Bolts, Getting data into & out of R, Data types in R, Basic operations, Basic statistics, Generic functions, Data visualization using R, Data exploration & presentation, Statistics for model building & evaluation. **Case study using R:** Call Data Record analytics, Medical Data Analysis	10hrs

TEXTBOOKS	
1	“Data Science & Big Data Analytics”, David Dietrich, Barry Hiller, EMC education services, Wiley publications, 2012
2	"The Elements of Statistical Learning", Trevor Hastie, Robert Tibshirani, Jerome Friedman,Second Edition, 2011, Springer,
3	"Database System Concepts", Silberschatz A., Korth H., Sudarshan S., 6th edition, McGraw Hill Publishers, ISBN 0-07-120413-X,
4	Mark gardner, “Beginning R: The Statistical Programming Language”, Wrox Press (WILEY), 2012

REFERENCES	
1	C J Date, “An Introduction to Database Systems”, 8th Edition, Addison-Wesley, ISBN: 0201144719,Addison-Wesley Pub.Co.
2	Adam Fowler, “NoSQL For Dummies”, 2015, John Wiley & Sons, ISBN-1118905628.

MOBILE COMPUTING AND ANDROID PROGRAMMING					
Course Code	**CE724**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**40 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives

The subject aims to provide the student with:

1	To understand the basic concepts of mobile computing.
2	To be familiar with the MAC, IP and Transport layer protocols and Ad-Hoc networks.
3	To learn the basics of GSM.
4	To understand the basics of android programming.

Course Outcomes

The Student will be able to:

CE724.1	Explain the basics of mobile telecommunication system
CE724.2	Identify issues and the solution for at each layer of the mobile network protocol stack
CE724.3	Discuss/Study GSM and services
CE724.4	Explain and apply/Study the basics of Android Programming.

UNIT-1	
Introduction: Mobile computing characteristics Mobile Computing vs wireless Networking Simplified Reference model **Wireless Transmission:** Frequencies for Radio Transmission Signals **Medium Access Control:** Motivation for a specialized MAC – Hidden and exposed terminals, near and far terminals SDMA FDMA TDMA – fixed TDM, classical aloha, slotted aloha, CSMA, Multiple access with collision avoidance (MACA) CDMA Comparison of S/T/F/CDMA	10hrs

UNIT-2	
Mobile Internet Protocol: Mobile IP Packet Delivery Overview of mobile IP Desirable features of Mobile IP Key mechanism used in Mobile IP **Mobile Transport Layer:** Traditional TCP - Congestion control, Slow start, fast retransmit/fast recovery, Implications on mobility Classical TCP improvements – Indirect TCP, Snooping TCP, Mobile TCP	10hrs
UNIT-3	
GSM: Services System Architecture **Mobile AD-HOC Networks :** Ad-Hoc Basic Concepts – setup without infrastructure support, routing in MANET complex task Characteristics of MANETs Applications of MANETs Popular MANET routing protocols – DSDV, DSR Security Issues in MANETs	10hrs
UNIT-4	
An Overview of the Android Architecture: Android Software Stack ,Linux Kernel, Android Runtime – ART, Android Libraries - C/C++ Libraries, Application Framework, Applications. **The Anatomy of an Android Application:** Android Activities, Android Intents, Broadcast Intents, Broadcast Receivers, Android Services, Content Providers, The Application Manifest, Application Resources, Application Context. **Understanding Android Application and Activity Lifecycles:** Android Applications and Resource Management, Android Process States, Foreground Process, Visible Process, Service Process, Background Process, Empty Process , Inter-Process Dependencies, The Activity Lifecycle , The Activity Stack, Activity States.	10hrs

TEXTBOOKS	
1	Mobile Communications; Jochen H. Schiller; Second Edition; Pearson Education, New Delhi; 2007.
2	Fundamentals of Mobile Computing; Prasant Kumar Pattnaik, Rajib Mall; Second Edition; PHI Learning Pvt. Ltd, New Delhi; 2012.
3	Android Studio 2 Development Essentials;Neil Smyth; CreateSpace Independent Publishing Platform; 2016
REFERENCES	
1	UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober; Principles of Mobile Computing; Springer; 2003
2	John Horton; Android Programming for Beginners; Second Edition; Packt Publishing; 2015

COMPILER DESIGN LAB					
Course Code	**CE730**		**Credits**	**2**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**0**	**0**	**2**		
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 75 marks	**0**	**25**	**0**	**0**	**50**

Course Objectives

The subject aims to provide the student with:

1	To understand the basic principles of compiler design
2	To know the major steps involved in translating a high-level programming language down to a low-level target machine language
3	To understand the relationship between machine and assembly language, compilers, interpreters, linkers, loaders, assemblers and macro preprocessors
4	To construct efficient algorithms for compilers

Course Outcomes

The Student will be able to:

CE730.1	Understanding different phases of compilation process.
CE730.2	Demonstrate modern tools and techniques used in compilers.

List of Experiments

(Experiments are not limited to the list but a minimum of 8 experiments is to be completed)

Sr No	Title
1	To eliminate left recursion from grammar
2	A program to detect tokens from user defined expression.
3	A LEX program to find if the input is integer, real number or word
4	A LEX program to convert decimal numbers to hexadecimal numbers.
5	A Lex program to include line numbers in a given source program
6	A LEX program to compute average of given set of numbers.
7	A YACC program to parse an expression for a given grammar.
8	A program to compute First and Follow for a user specified grammar.
9	A program to compute Leading and Trailing for a user specified grammar.
10	To implement code generation algorithm.
11	Intermediate code for simple assignment statement using YACC tool.
12	Implementation of Common Sub expression technique using DAG
13	A program to simulate a Predictive Parser.
14	Syntax Phase implementation for If , Nested If using YACC

TEXTBOOKS	
1	Compilers – Principles, Techniques, and Tools, Alfred Aho, Monica Lam, Ravi Sethi and Jeffrey Ullman, 2nd Edition, Pearson, ISBN: 978-81-317-2101-8, 2009.
2	Compiler design with FLEX and YACC; Vinu V. Das, 2007, PHI publication, ISBN:978- 81-203-3251-5
3	Systems Programming by D M Dhamdere, 2011, Tata McGraw Hill Education Private Limited

REFERENCES	
1	Louden; Compiler Construction, Principles and Practice; 2006, Galgotia Publication, ISBN:0-534-93972-4
2	Compiler design in C; Holub A I , 1992, Prentice-Hall, ISBN:0-87692-778-9
3	System Programming and Compiler Construction; R.K. Maurya, Anand A. Godbole; 2014; Dreamtech Press,ISBN 13:9789351197195
4	Compiler Design; A.A.Putambekar; First Edition 2009,Technical Publications Pune

CRYPTOGRAPHY TECHNIQUES FOR NETWORK SECURITY					
Course Code	**CE810**		**Credits**	**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**40 Hrs/sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with

1	Familiarize with Cryptography and very essential algorithms.
2	Understand Symmetric-key cryptosystem and Asymmetric-key cryptosystem.
3	Understand Authentication and Key management.
4	Understand concepts of Network security.

Course Outcomes:

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

CE810.1	Demonstrate the concepts of Symmetric-key cryptography.
CE810.2	Illustrate the concepts of Asymmetric-key cryptography.
CE810.3	Discuss the Hash functions, Digital signatures and Key management.
CE810.4	Identify the security aspects at application layer, transport layer and network layer.

UNIT -1	
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. **Block Ciphers and The Data Encryption Standard**: Traditional Block Cipher Structure, Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design principles. **Advanced Encryption Standard**: AES Structure.	10 hours
UNIT -2	
Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. **Stream Cipher,** RC4.	10 hours

Public Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm. **Other Public key CryptoSystems:** Diffie-Hellman Key Exchange, Elgamal Cryptographic System.	
UNIT -3	
Cryptographic Hash Functions: Applications of CHF, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA-512). **Message Authentication Code**s: Message Authentication Requirements, Message Authentication Functions, Requirements for MACs, Security of MACs, MACs based on Hash Functions (HMAC). **Digital Signatures**: Digital Signatures, Elgamal Digital Signature Scheme, NIST Digital Signature Algorithm.	10 hours
UNIT -4	
Key Management and Distribution: Symmetric Key Distribution using Symmetric Encryption, Symmetric Key Distribution using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public key infrastructure, Kerberos. **Transport Level Security**: Web Security Considerations, Secure Socket layer, HTTPS, Secure Shell (SSH). **Electronic Mail Security**: Pretty Good Privacy, S/MIME. **Wireless Network Security**: Wireless Security, IEEE 802.11 wireless LAN overview, IEEE 802.11i Wireless LAN Security.	10 hours

TEXTBOOKS	
1	**Cryptography and Network - Security Principles and Practice**, William Stallings, Pearson, 6th Edition, 2014.
2	**Cryptography and Network Security**, Behrouz A. Forouzan, DebdeepMukhopadyay, McGraw Hill Education, 2nd Edition, 2010.
REFERENCES	
1	**Cryptography and Network Security**,Atul Kahate,McGraw Hill Education, 3rd Edition, 2011

INTERNET OF THINGS					
Course Code	**CE821**		**Credits**	**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**40 Hrs/sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with

1	Assess the genesis and impact of IoT applications, architectures in the real world.
2	Illustrate diverse methods of deploying smart objects and connect them to the network.
3	Compare different Application protocols for IoT.
4	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Course Outcomes:

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

CE821.1	List the impact and challenges posed by IoT networks leading to new architectural models.
CE821.2	Compare and contrast the deployment of smart objects and the IoT protocols used technologies to connect them to the network efficiently.
CE821.3	Identity the management models in IoT.
CE821.4	Formulate the different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT -1	
Introduction to IoT: Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges. **IoT Network Architecture and Design:** Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	10 hours

UNIT -2	
Smart Objects The "Things" in IoT: Sensors, Actuators, and Smart Objects, Sensor Networks. **Connecting Smart Objects**: Communications Criteria, IoT Access Technologies. **IP as the IoT Network Layer**: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	10 hours
UNIT -3	
Identity Management Models: Different Identity Management Models,User Centric, Device Centric and Hybrid Trust management Life Cycle. **Identity and Trus**t: Web of Trust Model. **Access control:** Access control in IoT context, Different access control schemes, Capability-based access control, Concept of capability, Identity-based capability structure, Identity-driven capability-based access control.	10 hours
UNIT -4	
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. **IoT Physical Devices and Endpoints - RaspberryPi**: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Demonstration of Wireless Temperature Monitoring System Using Pi & DS18B20 Temperature Sensor, Demonstration on Connecting Raspberry Pi via SSH for Remoteaccess. **Smart and Connected Cities**: An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.	10 hours

TEXTBOOKS	
1.	**"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry**,** 1st Edition, Pearson Education (Cisco Press Indian Reprint), 2017. (ISBN: 978- 9386873743),
2.	**"Internet of Things",** Srinivasa K G, 1st Edition, CENGAGE Learning India, 2018.
3.	"**Identity management for internet of things"**, Parikshit N. Mahalle and Poonam N. Railkar. Vol. 39. River Publishers, 2015.
REFERENCES	
1	**"Internet of Things (A Hands-on-Approach)",** Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014. (**ISBN:** 978-8173719547).
2	**"Internet of Things: Architecture and Design Principles",** Raj Kamal, 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224).

PATTERN RECOGNITION					
Course Code	**CE822**		**Credits**	**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**40 Hrs/sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with

1	To equip students with basic mathematical and statistical techniques commonly used in pattern recognition.
2	To introduce students to a variety of pattern recognition algorithms.
3	To be able to identify applications of pattern recognition.
4	To develop a foundation that can used as the basis for further study and research in pattern recognition

Course Outcomes:

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

CE822.1	Explain the pattern recognition concepts and representative structures.
CE822.2	Understand the concepts of kNN and Bayes classifiers and their variants.
CE822.3	Asses the concepts of HMM, SVM and Neural Networks.
CE822.4	Justify the use of PCA in applications of pattern recognition.

UNIT -1	
ntroduction- Introduction to Pattern Recognition, Different paradigms for Pattern Recognition. **Representation**- Data Structures for Pattern Representation: Patterns as Vectors, Patterns as Strings, Logical Descriptions, Fuzzy and Rough Pattern Sets, Patterns as Trees and Graphs. Representation of Clusters. Proximity Measures: Distance Measure, Weighted Distance measure, Non-Metric Similarity function, Edit Distance, Mutual Neighbourhood Distance, Conceptual Cohesiveness, Kernel Functions. Size of Patterns: Normalization of Data, Use of appropriate similarity measures. Abstraction of Data Set. Feature Extraction: Fisher's Linear Discriminant, Principal Component Analysis. Feature Selection: Exhaustive Search, Branch and Bound Search, Selection of Best Individual Features, Sequential Selection, Sequential floating search, Max-Min approach	10 hours
to feature selection, Stochastic Search Techniques, Artificial NeuralNetworks. Evaluation of Classifiers. Evaluation ofClustering.	
UNIT -2	
Nearest Neighbour Based Classifiers- Nearest Neighbour Algorithm. Variants of Nearest Neighbour Algorithm: k-Nearest Neighbour (kNN)algorithm, Modified k-Nearest neighbour(MkNN) algorithm, Fuzzy kNN algorithm, r Near Neighbours. Use of Nearest Neighbour Algorithm for Transaction Databases. Efficient Algorithms: The Branch & Bound algorithm, The Cube algorithm, Searching for Nearest Neighbour by Projection, Ordered Partitions, Incremental Nearest Neighbour Search. Data Reduction. Prototype Selection: Minimal Distance Classifier, Condensation Algorithms, Editing Algorithms, Clustering Methods, Other Methods. **Bayes Classifier**- Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with Nearest Neighbour Classifier. Naïve Bayes Classifier: Classification using Naïve Bayes Classifier, The Naïve Bayes Probabilistic Model, Parameter Estimation, Constructing a classifier from the Probability Model. Bayesian Belief Network.	10 hours

UNIT -3	
Hidden Markov Models- Markov Models for Classification. Hidden Markov Models: HMM parameters, Learning HMMs. Classification using HMMs: Classification of Test Patterns. **Support Vector Machines**- Introduction: Linear Discriminant Functions. Learning the Linear Discriminant Function: Learning the weight vector, Multi-class problems, Generality of Linear Discriminants. Neural Networks: Artificial Neuron, Feed-forward Network, Multilayer perceptron. SVM for Classification: Linearly Separable Case, Non-linearly separable case.	10 hours
UNIT -4	
Continuous Latent Variables- Principal Component Analysis: Maximum variance formulation, Minimum-error formulation, Applications of PCA, PCA for high dimensional data. Probabilistic PCA: Maximum likelihood PCA, EM algorithm for PCA, Bayesian PCA, Factor Analysis. Kernel PCA.	10 hours

TEXTBOOKS	
1.	**Pattern Recognition An Algorithmic Approach,**M. Narasimha Murty, Dr. V SusheelaDevi ,Springer - ISBN 978-0-85729-494-4 (2011)
2.	**Pattern Recognition and Machine Learning,**Christopher M. Bishop,Springer -ISBN-10: 0-387-31073-8 (2006)
REFERENCES	
1.	**Pattern recognition From Classical to Modern Approaches**, Sankar K. Pal, Amita Pal, World Scientific Publishing Company - ISBN 981-02-4684-6 (2002)
2.	**Pattern Recognition and Image Preprocessing**,Sing-Tze Bow, Marcel Dekker - 2nd Edition - 2002

MULTIMEDIA SYSTEMS AND APPLICATIONS					
Course Code	**CE823**		**Credits**	**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**40 Hrs/sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with

1	Students will acquire an understanding of the fundamental principles of multimedia systems.
2	Students will gain an intuitive understanding of multimedia applications.
3	Tounderstand thestandards availablefor different audio,video and text applications.
4	Students will be introduced to principles and current technologies of multimedia systems

Course Outcomes:

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

CE823.1	Define the fundamental principles of multimedia system.
CE823.2	Categorize the different ways of representing multimedia data.
CE823.3	Discuss the core multimedia processes and technologies.
CE823.4	Illustrate the use of multimedia for the web and mobile platform.

UNIT -1	
Multimedia: Definitions, Where to Use Multimedia, Multimedia in Business, Multimedia in Schools, Multimedia at Home, Multimedia in Public Places, Virtual Reality, Delivering Multimedia, CD-ROM, DVD, Flash Drives, Broadband Internet. **Making Multimedia:**Stages of a Multimedia Project, The Intangibles, Hardware, Software, Authoring Systems. **Images:** Making Still Images, Bitmaps, Vector Drawing, Vector Drawn Objects vs. Bitmaps,3-D Drawing and Rendering, Color, File Formats.	10 hours

UNIT -2	
Sound: Digital Audio, MIDI Audio, MIDI vs. Digital Audio, Multimedia System Sounds, Audio File Formats, Vaughan's Law of Multimedia Minimums, Adding Sound to Project. **Animation**: The Power of Motion, Principles of Animation, Animation by Computer, Making Animations that Work. **Video:** Analog Video, Digital Video, Displays, Digital Video Containers, Obtaining Video Clips, Shooting and Editing Video.	10 hours
UNIT -3	
Planning and Costing: The Process of Making Multimedia, Scheduling, Estimating, RFPs and Bid Proposals. **Designing and Producing:** Designing, Producing. **Content and Talent**: Acquiring Content, Acquiring Talent.	10 hours
UNIT -4	
The Internet and Multimedia: Internet History, Internetworking, Multimedia on the Web, Developing for the Web, Text for the Web, Images for the Web, Sound for the Web, Animation for the Web, Video for the Web. **Mobile Multimedia:** Digital Revolution Worldwide, Mobile Hardware, Connection, Mobile Operating Systems.	10 hours

TEXTBOOKS	
1.	**Multimedia: Making it Work**, Tay Vaughan, Ninth Edition, McGraw Hill Education ISBN-13:978-93-5260-157-8, ISBN-10:93-5260-157-2.
REFERENCES	
1	**A - Multimedia Technologies and Application**, Walterworth John, Ellis Horwood Ltd.- London - 1991.
2	**Multimedia Systems**, John F Koegel Buford - Addison Wesley - First Indian Reprint- 2000.

SOFTWARE DEVELOPMENT FRAMEWORK					
Course Code	**CE824**		**Credits**	**3**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	3	**0**	**0**	**40 hrs/sem**	
Scheme of Examination TOTAL = 125 marks	**IA**	**TW**	**TM**	**P**	**O**
	25	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with

1	Describe their unique features relative to traditional software practices.
2	Study the functionality and behaviors of a software component into a reusable and self-deployable binary unit.
3	Study Agile Software Development, Extreme Programming and Software Development Rhythms.
4	Examine the applications in the real world and addresses their impacts on developing software.

Course Outcomes:

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

CE824.1	Design and construct the software systems using reusable software components based on domain engineering and component-based development.
CE824.2	Assess the conventional principles, concepts and methods in software engineering with the elements of object oriented and CBSE to create client/server systems.
CE824.3	Apply Agile approaches within an overall Project Management Lifecycle framework.
CE824.4	Propose the extreme programming to small applications / projects.

UNIT -1	

Introduction to Software Process: Process models, Generic process models, prescriptive process models and spiral model. **Pattern-based Software design**: Design patterns – kind of patterns, frameworks, describing a pattern, Pattern languages and repositories, Pattern based design in context, Thinking in pattern, Design tasks, Pattern-organizing tables, Common design mistakes. **Cleanroom Software Engineering**: Approach, functional specification, design and testing. **Component-Based Software Engineering**: CBSE process, domain engineering, component-based development, classifying and retrieving components and economics of CBSE.	10 hours
UNIT -2	
Client-Server Software Engineering: Structure of client-server systems, software engineering for Client-Server systems, analysis modelling issues, design and testing issues. **Web Engineering**: Attributes of web-based applications, the WebE process, a framework for WebE, formulating, analyzing web-based systems, design and testing for web-based applications, Management issues. **Reengineering**: Business process reengineering, software reengineering, reverse reengineering, restructuring, forward reengineering, Economics of reengineering.	10 hours
UNIT -3	
Computer-Aided Software Engineering: Building blocks and taxonomy for CASE, integrated CASE environments, integration architecture, CASE repository, case study of tools like TCS Robot. **Agile Programming**: Introduction, Flavors of Agile Development, Agile Manifesto, Refactoring Techniques, Limitations of The Agile Process.	10 hours
UNIT -4	
Extreme Programming (XP): Introduction, XP Equation, XP Values, Assuming Sufficiency-Sufficient time and resources, Constant change of cost, Developer effectiveness, Freedom to experiment. **Extreme Programming Practices & Events:** Introduction, Coding Practices, Developer Practices, Business Practices. **Events**: Introduction - Iteration Planning- Stories and tasks, Estimates and schedules, first iteration, Iteration, Releasing.	10 hours

TEXTBOOKS	
1.	"**Software Engineering a Practitioners Approach**", Roger S. Pressman, 8th Edition – 2014, McGraw-Hill,
2.	"**Software Engineering**", Ian Sommerville, 9th Edition, 2010, Addison-Wesley.
REFERENCES	
1.	"**Software Engineering**",Stephen R. Schach, TMH, Seventh Edition.
2.	"**Design Patterns**", Erich Gamma, Ralph Johnson, Richard Helm, John Vlissides, Pearson Education, 2015.
3.	"**Software Engineering for Embedded Systems: Methods, Practical Techniques, and Applications**", Robert Oshana, Mark Kraeling, Newnes, Publisher (2013*).*