School of Engineering and Technology

Department of Electronics and Communication Engineering

Syllabus

BTech- Electronics and Computer Engineering [with Specialization in Artificial Intelligence and Machine Learning] – Lateral Entry

2022 Batch

January 2021

Christ University, Bengaluru
Karnataka, India
www.christuniversity.in

Syllabus for BTech- Electronics and Computer Engineering [with Specialization in Artificial Intelligence and Machine Learning]-Lateral Entry for batch 2022-25 prepared by the Department of Electronics and Communication Engineering, School of Engineering and Technology and approved by the Academic Council, Christ University, Bengaluru, India.

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1. INTRODUCTION

CHRIST- Deemed to be University blossomed out of the educational vision of the Carmelites of Mary Immaculate (CMI) congregation founded by St Kuriakose Elias Chavara. He was a visionary, an educationist and a social reformer of the nineteenth century who founded the Congregation in 1831 in South India.

CHRIST- Deemed to be University was established in July 1969 as Christ College. It was the first institution in Karnataka to be accredited by the National Assessment and Accreditation Council (NAAC). University Grants Commission (UGC) conferred Autonomy to the institution in 2004. It became the first College in South India to be reaccredited with A+ by NAAC in 2005. UGC identified it as an Institution with Potential for Excellence in 2006.Under Section 3 of the UGC Act, 1956, Ministry of Human Resources Development of the Union Government of India, vide Notification No. F. 9-34/2007-U.3 (A), declared Christ College as a Deemed to be University, in the name and style of CHRIST- Deemed to be University in July 2008. The University was accredited with 'A' Grade by NAAC in 2016.

CHRIST- Deemed to be University offers 46 Bachelor, 47 Master, 16 MPhil and 17 PhD Programs in Humanities, Social Sciences, Sciences, Commerce and Management, Education, Law and Engineering. The University which celebrates diversity has students from all the states of India and 58 countries across the globe.

CHRIST- Deemed to be University rooted in Gospel values, is committed to provide holistic education through the development of intellectual competence, personal skills, inter-personal skills and societal skills. The University welcomes to its fold students from all over the country and the world in an environment of religious harmony and secularism.

VISION
"EXCELLENCE AND SERVICE"

- CHRIST- Deemed to be University, a premier educational institution, is an academic fraternity of individuals dedicated to the motto of excellence and service. We strive to reach out to the star of perfection through an earnest academic pursuit for excellence and our efforts blossom into 'service' through our creative and empathetic involvement in the society to transform it.
- Education prepares one to face the challenges of life by bringing out the best in him/her. If this is well accepted, education should be relevant to the needs of the time and address the problems of the day. Being inspired by Blessed Kuriakose Elias Chavara, the founder of Carmelites of Mary Immaculate and the pioneer in innovative education, CHRIST- Deemed to be University was proactive to define and redefine its mission and strategies reading the signs of the time.

MISSION STATEMENT

"CHRIST- Deemed to be University is a nurturing ground for an individual's holistic development to make effective contribution to the society in a dynamic environment."

CORE VALUES

The values which guide us at CHRIST- Deemed to be University are:

Faith in God
Moral Uprightness
Love of Fellow Beings
Social Responsibility
Pursuit of Excellence

DEPARTMENT VISION

To emerge as a centre of academic excellence in the field of Electronics & Communication Engineering to address the dynamic needs of the industry upholding moral values

DEPARTMENT MISSION

- Impart in-depth knowledge in Electronics & Communication Engineering to achieve academic excellence.
- Develop an environment of research to meet the demands of evolving technology.
- Inculcate ethical values to promote team work and leadership qualities befitting societal requirements.
- Provide adaptability skills for sustaining in the dynamic environment.

PROGRAM EDUCATIONAL OBJECTIVES OF B.TECH IN ECE

PEO1 : Domain Knowledge
Apply the knowledge of Electronics & Communication Engineering to analyse, design and develop solutions for real time engineering problems
PEO2 : Research Oriented
Be competent to pursue higher learning and research
PEO3: Ethics & Teamwork
Assimilate technical skills with professional ethics
PEO4 : Life Long Learning
Be passionate to attain professional excellence through lifelong learning

2. PROGRAM OFFERED

- **Undergraduate Programmes** (B.Tech, 8 Semester Program)
  - Bachelor of Technology in Automobile Engineering (AE)
  - Bachelor of Technology in Civil Engineering(CIVIL)
  - Bachelor of Technology in Computer Science and Engineering (CSE)
  - Bachelor of Technology in Electronics and Communication Engineering (ECE)
  - Bachelor of Technology in Electrical and Electronics Engineering (EEE)
  - Bachelor of Technology in Information Technology (IT)
  - Bachelor of Technology in Mechanical Engineering (ME)
- Postgraduate Programmes (M. Tech, 4 Semester Program)
  - Master of Technology in Computer Science and Engineering (CSE)
  - Master of Technology in Communication Systems(ECE)
  - Master of Technology in Information Technology(IT)
  - Master of Technology in Machine Design(MD)
  - Master of Technology in Power Systems(PS)
  - Master of Technology in Structural Engineering(SE)
- Doctoral Programmes (Ph.D.) (Doctor of Philosophy)
  - Doctor of Philosophy (Ph.D.) in Computer Science and Engineering
  - Doctor of Philosophy (Ph.D.) in Electronics and Communication Engineering
  - Doctor of Philosophy (Ph.D.) in Civil Engineering
  - Doctor of Philosophy (Ph.D.) in Electrical and Electronics Engineering
  - Doctor of Philosophy (Ph.D.) in Mechanical Engineering
  - Doctor of Philosophy (Ph.D.) in Information Technology

3. ELIGIBLITY CRITERIA

❖ **For Undergraduate Programmes**

A pass in PUC (10+2) or equivalent with 50% marks in aggregate with Mathematics, Physics and Chemistry is the minimum eligibility for admission.

Lateral Entry:

Candidates who have successfully completed 3 year diploma in Engineering are eligible to apply for lateral entry into:

- Automobile Engineering (AE)
- B.Tech Civil Engineering (CE)
- B.Tech Mechanical Engineering (ME)
- B.Tech Computer Science and Engineering (CSE)
- B.Tech Electronics & Communication Engineering (ECE)
- B.Tech Electrical and Electronics Engineering (EEE)
- B.Tech Information Technology (IT)

Candidates will be admitted to second year of the programme only after appearing the Christ deemed to be University selection process for engineering programmes.

❖ **For Postgraduate Programmes**:

- For Master of Technology in Computer Science and Engineering
  - A Pass in B.Tech/B.E or M.Sc with 55% aggregate.

- For Master of Technology in Communication Systems
  - A Pass in B.Tech/B.E or M.Sc in Electronics and VLSI Design with 55% aggregate.

- For Master of Technology in Civil Engineering
  - A Pass in BE/B.Tech or M.Sc in Civil and VLSI Design with 55% aggregate.

- For Master of Technology in Mechanical Engineering
  - A Pass in BE/B.Tech with 55% aggregate.

❖ **For Doctoral Programmes (Ph.D.):**

- A pass with 55% marks in post graduation and equivalent in the relevant subject from any recognized university.
- A research proposal (Maximum 1500 words) has to be submitted along with the application.

4. SELECTION PROCESS

1) Candidates can process the admission based on the Undergraduate Entrance Test and Ranking by COMEDK.

OR

2) Christ Selection Process as given below:

Process	Particulars	Date	Venue/Centre
Entrance Test	Christ Entrance test for each candidate	As per the E-Admit Card	As per the E- Admit Card
Personal Interview	Personal interview for 15 minutes for each candidate by an expert panel	As per the E-Admit Card	As per the E- Admit Card
Academic Performance	Assessment of past performance in Class 10, Class 11/12 during the Personal Interview	As per the E-Admit Card	As per the E- Admit Card

5. ADMISSION PROCESS

Candidates will be intimated about the Selection status (Selected/Wait Listed/Not Selected) through the University Notice Board/on the "Application Status" link on University website. The Selection results will be declared within 24 hours of Personal Interview session.

The selected candidates must process admission at **Office of Admissions, Central Block, Christ deemed to be University within 3 working days of declaration of Selection Process results/as per the stipulated date and time mentioned by Office of Admissions.**

Selected candidates should collect the Fee Challan from the Office of Admissions and remit the Annual fee at the South Indian Bank, CHRIST- Deemed to be University Branch. The Offer of Admission will stand cancelled, if failing to remit the fee within the stipulated date and time.

Admission will not be processed without the presence of the candidate and the mandatory original documents mentioned below;

1. The Offer of Admission Card (E-Admission Card/Mail)
2. Class 10 Marks Statement
3. Class 11 Marks Statement, if Candidate is pursuing class 12 and appearing for final examination during March-April Month
4. Class 12 Marks Statement, if candidate has appeared and passed the Class 12 examination

The University ID card is a smart card, which is both an ID card as well as a South Indian Bank ATM card with a chip containing the student personal details. All transactions within the University campus after commencement of classes, including fees payment will be processed only through this card. It is also an access card for Library and other restricted places. Candidates are advised to collect the South Indian Bank account opening form along with fees challan and process it at the Bank branch within the University premises.

Candidates who fall under International student category (ISC), If selected, should register with the Foreigner Regional Registration Officer (FRRO/FRO) of the Local Police in Bangalore, India within 14 working days from the date of admission or arriving in Bangalore.

All International student category (ISC) candidates if studied in India should obtain an NOC from the previous qualifying institution.

6. GENERAL RULES

- There is a grading scheme for each paper and for all the courses.
- All marks will indicate the marks, percentage obtained, grade and grade point average.
- The grade point average will be calculated as follows: for each subject, multiply the grade point with the number of credits; divide the sum of product by the total number of credits.
- The CGPA [Cumulative GPA] is calculated by adding the total number of earned points [GP x Cr] for all semesters and dividing by the total number of credit hours for all semesters.

$$\mathbf{GPA} = \frac{\sum[\mathbf{GPA \times Cr}]}{\sum \mathbf{Cr}}$$

7. GRADING SCHEME FOR EACH PAPER: Undergraduate Courses

Percentage	Grade	Grade Point	Interpretation	Class
80 and above	A	4.0	Outstanding	First Class with Distinction
73-79	A-	3.67	Excellent	First Class
66-72	B+	3.33	Very Good	
60-65	B	3.0	Good	
55-59	B-	2.67	Average	Second Class
50-54	C+	2.33	Satisfactory	
45-49	C	2.00	Pass	Pass Class
40-44	D	1.0	Pass	
39 and below	F	0	Fails	Fail

8. GRADING SCHEME FOR EACH PAPER: Postgraduate Courses

Percentage	Grade	Grade Point	Interpretation	Class
80 and above	A+	4.0	Excellent	First Class with Distinction
70-79	A	3.5	Very Good	
65-69	B+	3.0	Good	First Class
60-64	B	2.5	Above Average	
55-59	C+	2.0	Average	Second Class
50-54	C	1.5	Satisfactory	
40-49	C-	1.0	Exempted if aggregate is more than 50%	Pass Class
39 and below	F	0	Fails	Fail

We believe that the student opportunities and experiences should lead to an appreciation of the holistic development of individual. We also try to pass to our students our passion for what we do, and to have the students comprehend that we also desire to continue to learn.

09. TEACHING PEDAGOGY

- Team/Class room teaching.
- PowerPoint presentations and handouts.
- Simulated situations and role-plays.
- Video films on actual situations.
- Assignments.
- Case Studies.
- Exercises are solved hands on.
- Seminars
- Industry / Field visits.
- Information and Communication Technology.
- Project work.
- Learning Management System- Moodle

10. ASSESSMENT PATTERN - BTECH COURSE 2018 BATCH

Following are the details of the modifications proposed for assessment pattern - BTech course AY 2017-18

	Category	Weightage for CIA	Weightage for ESE
1	Courses with theory and practical	70	30
2	Courses with only theory	50	50
3	Courses with only Practical	50	50

COURSES WITH THEORY AND PRACTICAL				
	Component	**Assessed for**	**Minimum marks to pass**	**Maximum marks**
1	Theory CIA	30	-	30
2	Theory ESE	30	12	30
3	Practical CIA	35	14	35
4	Attendance	05	-	05
4	Aggregate	100	40	100

DETAIL OF MARK FOR COURSES WITH THOERY AND PRACTICAL

	THEORY					**PRACTICAL**				
	Component	**Assessed for**	**Scaled down to**	**Minimum marks to pass**	**Maximum marks**	**Component**	**Assessed for**	**Scaled down to**	**Minimum marks to pass**	**Maximum marks**
1	CIA-1	20	**10**	-	**10**	Overall CIA	**50**	**35**	**14**	**35**
2	CIA-2	50	**10**	-	**10**					
3	CIA-3	20	**10**	-	**10**					
4	Attendance	05	**05**	-	**05**	Attendance	**NA**	**NA**	**-**	**-**
5	ESE	100	**30**	12	**30**	ESE	**NA**	**NA**	**-**	**-**
		TOTAL	**65**	-	**65**	TOTAL		**35**	**14**	**35**

- Minimum marks required to pass in practical component is 40%.
- Pass in practical component is eligibility criteria to attend Theory End semester examination for the same course.
- A minimum of 40 % required to pass in ESE -Theory component of a course.
- Overall 40 % aggregate marks in Theory & practical component, is required to pass a course.
- There is no minimum pass marks for the Theory - CIA component.
- Less than 40% in practical component is refereed as FAIL.
- Less than 40% in Theory ESE is declared as fail in the theory component.
- Students who failed in theory ESE have to attend only theory ESE to pass in the course

II. ASSESSMENT - ONLY FOR THEORY COURSE (without practical component)

- Continuous Internal Assessment (CIA) : 50% (50 marks out of 100 marks)

- End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

CIA I : Subject Assignments / Online Tests	: 10 marks
CIA II : Mid Semester Examination (Theory)	: 25 marks
CIAIII: Quiz/Seminar/Case Studies/Project/Innovative Assignments/presentations/publications	: 10 marks
Attendance	: 05 marks
Total	**: 50 marks**

Mid Semester Examination (MSE) : Theory Papers:

- The MSE is conducted for 50 marks of 2 hours duration.
- Question paper pattern; Five out of Six questions have to be answered. Each question carries 10 marks

End Semester Examination (ESE):

The ESE is conducted for 100 marks of 3 hours duration.

The syllabus for the theory papers are divided into FIVE units and each unit carries equal Weightage in terms of marks distribution.

Question paper pattern is as follows.

Two full questions with either or choice will be drawn from each unit. Each question carries 20 marks. There could be a maximum of three sub divisions in a question. The emphasis on the questions is to test the objectiveness, analytical skill and application skill of the concept, from a question bank which reviewed and updated every year

The criteria for drawing the questions from the Question Bank are as follows

50 % - Medium Level questions

25 % - Simple level questions

25 % - Complex level questions

11. COURSE STRUCTURE

III SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE331	Mathematics for Intelligent Systems	3	0	0	100	3	0	0	3
2	ECE332P	Data Structures and Algorithms	3	0	2	100	3	0	1	4
3	ECE333P	Electronic Devices and Circuits	3	0	2	100	3	0	1	4
4	ECE334	Digital System Design	3	0	0	100	3	0	0	3
5	ECE335	Computer Organization and Processors	3	0	0	100	3	0	0	3
6	HS322	Professional Ethics	2	0	0	100	2	0	0	2
7	CY321	Cyber Security	2	0	0	----	0	0	0	0
8	HOL311	Holistic Education-III	1	0	0		1	0	0	1
		Total				600				20

IV SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE431P	Object Oriented Programming	3	0	2	100	3	0	1	4
2	ECE432	Artificial Intelligence	3	0	0	100	3	0	0	3
3	ECE433	Signals and Systems	3	0	0	100	3	0	0	3
4	ECE434P	Microcontroller based System Design	3	0	2	100	3	0	1	4
5	BS451	Engineering Biology Laboratory	0	0	2	50	0	0	1	1
6	HS425	Project Management and Finance	3	0	0	100	3	0	0	3
7	EVS421	Environmental Science	2	0	0	50	0	0	0	0
8	HOL411	Holistic Education-IV	1	0	0	----	1	0	0	1
		Total				600				19

V SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE531P	Database Management System	3	0	2	100	3	0	1	4
2	ECE532P	Digital Signal Processing	3	0	2	100	3	0	1	4
3	ECE533	Programming Language Paradigm	3	0	0	100	3	0	0	3
4	ECE544	Program Elective-1	3	0	0	100	3	0	0	3
5	ECE545	Program Elective-2	3	0	0	100	3	0	0	3
6	ECOE56XX	Open Elective-1	3	0	0	100	3	0	0	3
7	IC521	Constitution of India	0	0	0	---	0	0	0	0
		Total				600				20

VI SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE631P	VLSI Design	3	0	2	100	3	0	1	4
2	ECE632P	Introduction to Machine Learning	3	0	2	100	3	0	1	4
3	ECE633	Computer Networks	3	0	0	100	3	0	0	3
4	ECE644EXX	Program Elective-3	3	0	0	100	3	0	0	3
5	ECE645EXX	Program Elective-4	3	0	0	100	3	0	0	3
7		Open Elective –2 (GE)	2	0	0	100	2	0	0	2
		Total				600				19

VII SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE731	Internet of Things	3	0	0	100	3	0	0	3
2	ECE732P	Digital Image Processing and Computer Vision	3	0	2	100	3	0	1	3
3	ECE733	Python for Machine Learning	3	0	0	100	3	0	0	3
4	ECE744EXX	Program Elective -5	3	0	0	100	3	0	0	3
5	ECE735	Service Learning	1	0	2	50	1	0	1	2
6	EC0E76XX	Open Elective - 3	3	0	0	100	3	0	0	3
7	ECE781I	Internship	0	0	4	50	0	0	2	2
8	ECE782	Project Work Phase-I	0	0	4	50	0	0	2	2
						650				21

VIII SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	ECE841EXX	Program Elective-6	3	0	0	100	3	0	0	3
2	ECE881	Project Work Phase-II	0	0	20	300	0	0	10	10
						400				13

Program Elective-1

SL No.	Course Code	Course Name
1	ECE534E1	Software Engineering
2	ECE534E2	Web Programming
3	ECE534E3	JAVA Programming
4	ECE5354E4	Operating systems

Program Elective-2

SL No.	Course Code	Course Name
1	ECE535E1	Sensors and Transducers
2	ECE535E2	Control Systems
3	ECE535E3	Industrial Instrumentation
4	ECE535E4	Mechatronics
5	ECE535E5	NEMS and MEMS for Engineers

Program Elective-3

SL No.	Course Code	Course Name
1	ECE634E1	ARM system architecture
2	ECE634E2	Automotive Electronics
3	ECE634E3	RTOS
4	ECE634E4	Electromagnetic Fields

Program Elective - 4

SL No.	Course Code	Course Name
1	ECE635E1	Cryptography and Network Security
2	ECE635E2	C# and .Net
3	ECE635E3	Big Data Analytics
4	ECE635E4	Cloud and Grid Computing
5	ECE635E5	Mobile Computing
6	ECE635E6	Soft Computing

Program Elective – 5

SL No.	Course Code	Course Name
1	ECE734E1	Bio Medical Signal Processing
2	ECE734E2	ADSP
3	ECE734E3	Statistical Signal Processing
4	ECE734E4	Speech Processing

5	ECE734E5	High Speed networks
6	ECE734E6	Natural Language Processing

Program Elective-6

SL No.	Course Code	Course Name
1	ECE831E1	Mobile Application Development
2	ECE831E2	Database Administration
3	ECE831E3	Software Testing
4	ECE831E4	Web Services and Service Oriented Architecture

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ECE

Sl No	Course Name
1	Sensors and Transducers
2	Industrial Instrumentation
3	Automotive Electronics
4	Telecommunication Infrastructure & Management
5	Consumer Electronics
6	Microwave for Engineers
7	Fundamentals of Signal Processing
8	Fundamentals of Image Processing
9	NEMS and MEMS for Engineers
10	Embedded Boards for IoT Applications
11	System Design & Measurement using LabVIEW
12	Basics of VLSI for Engineers
13	Computerized Control System

12. DETAILED SYLLABUS

COURSE NAME: Mathematics for Intelligent Systems						
Course Code : ECE331						
	L	**T**	**P**	**S**	Category	PCC
Contact Hrs./Week	3	0	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	0	ESE Marks	100
Total Contact Hrs.	45	0	0	0	Exam Hours	3
Credits.	3	0	0	0		
Course objectives: The course will lay down the basic concepts and techniques of linear algebra, differential equation, Analytical optimization and graph theory as applied to intelligent system design.						
Prerequisites: Mathematics-I and Mathematics-II						

Modules	**Teaching Hours**
Unit-1 Linear Algebra	
Introduction, Gaussian Elimination, Triangular Factors, Inverses and Transposes. Determinants, Properties & Applications of the Determinant. Vector Spaces, Linear Independence, Basis and Dimension, Linear Transformations, Eigenvalues and Eigenvectors, Diagonalization of a Matrix.	9
Unit-2 Multivariant Calculus	
Functions, Scalar derivative, rules of differentiation, partial derivatives, Gradient, directional derivative. Vector and matrix calculus: How to find derivative of {scalar-valued, vector- valued} function with respect to a {scalar, vector}	9
Unit-3 Optimization I	
Objective function, Constraints and Constraint surface; Formulation of design problems as mathematical programming problems. Classification of optimization problems Optimization using Calculus: Convexity and concavity of functions of one and two variables, local/global maxima and minima, saddle point, Gradient vectors, Lagrangian function, KKT method.	9
Unit-4 Optimization II	
Standard form of linear programming (LP) problem- Graphical method, Simplex method, Duality and primal. Methods of line search, Global convergence theorem, Steepest descent method. Quasi-Newton methods: DFP/ BFGS/ Broyden family. Quadratic Programming.	9
Unit-5 Graph Theory	
Graph Theory: Graph Terminology and Special Types of Graphs, Planar Graphs, Graph Coloring, Trees, Graph Minor. Vertex cover, matching, path cover, connectivity, edge coloring, vertex coloring, list coloring; Planarity, Perfect graphs; other special classes of Graphs Connectivity, Euler-Fleury's Algorithm, Hierholzer's algorithms and Hamilton Paths-Travelling salesman	9

problem . Shortest path algorithm-Dijkstra's algorithm	
List of Experiments - NIL -	
Self-study: NIL	
Site/Industrial Visits: NIL	
Course outcomes: At the end of the course, the student will be able to do: • Apply the understanding of working with data in matrix form for solving systems of linear algebraic equations, for finding the basic matrix decompositions with the general understanding of their applicability in intelligent systems. • Understand the notion of an abstract vector space and how coordinates, and matrices of linear transformations, arise from the underlying linearity structures imposed on the system • Apply multivariable and vector-valued functions and their derivatives, using gradient algorithms to determine local/global maxima and minima, saddle points. • Analyze the type of optimization problem and apply suitable algorithm to find the optimum value of the objective function • Understand the fundamental concepts in graph theory and Apply algorithms and theorems from graph theory on solving problems	
Text Books: T1. Gilbert Strang, Linear Algebra and its applications, 4th Ed, Cengage Learning, 2006 T2. MP Deisenroth, A A Faisal, C S Ong, Mathematics for Machine learning, Cambridge University, 2020 T3. Phil Dyke, Advanced Calculus, Macmillan International Higher Education, 1998 T4. Fletcher R., Practical Methods of Optimization, John Wiley, 2000 T5. Reinhard Diestel, "Graph Theory", Springer (2010)	
Reference Books: R1. Singiresu S Rao, Engineering Optimization, 4th ed, Wiley, 2009 R2. Jorge Nocedal and Stephen J. Wright: "Numerical Optimization", second ed,1999	
Online Resources: NIL	

Course Name: Data Structures and Algorithms					
Course Code : ECE332P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This course is designed to make the students familiar with basic techniques of algorithm analysis, to understand concepts of searching and sorting techniques and to assess how the choice of data structures impacts the performance of a program.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Definition and basics of: Data Structure, ADT, Algorithms, Time and Space Complexity, Asymptotic Notations (O, θ, Ω), Time complexity computation of non-recursive algorithms (like Matrix addition, Selection sort – using step count), Array – basic operations, concept of multi-dimensional array, Polynomial operations using Array, Sparse Matrix	**9**
Unit-2 STACK AND QUEUE	
Stack ADT: basic operations, Queue ADT: basic operations, Circular Queue, Evaluation of Expressions, Another application or Mazing Problem	**9**
Unit-3 LINKED LIST	
Singly Linked List: concept, representation and operations, Circular Linked List, Polynomial and Sparse Matrix operations using LL, Doubly Linked List: basic concept	**9**
Unit-4 INTRODUCTION TO ALGORITHMS	
Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Fundamentals of the Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithm, Mathematical Analysis of Recursive Algorithm and examples, Empirical Analysis of Algorithms and Algorithm Visualization	**9**
Unit-5 ALGORITHM DESIGN TECHNIQUES	
Brute Force and Exhaustive Search: Selection Sort, Bubble Sort, Sequential Search and Brute-force string matching, Travelling Salesman Problem, Knapsack Problem, Assignment Problem, DFS and BFS. Decrease and Conquer: Insertion Sort and Topological Sorting and Binary Search, Warshall's and Floyd's Algorithm. Greedy Techniques: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm and Huffman trees	**9**
List Of Experiments	**Practical Hours**
Program to Find the Number of Elements in an Array	**2**

Programs for Stack, Queues and Circular Queues using Arrays	**2**
Program to convert an Infix Expression into Postfix and Postfix Evaluation	**2**
Program to create add remove & display element from single linked list	**2**
Program to create add remove & display element from double linked list	**2**
Program to count number of nodes in linear linked list	**2**
Program to create add remove & display element from circular linked list	**2**
Program to reverse linked list	**2**
Program to add two polynomials using linked list	**2**
Program to implement bubble sort program using arrays	**2**
Program to implement selection sort program using arrays and Program to implement insertion sort program using arrays	**2**
Program to implement heap sort using arrays and Program to implement heap sort using pointers	**2**
Program to implement linear search using pointers and Program to implement binary search using pointers	**2**
Program to implement linear search using arrays and Program to implement binary search using arrays	**2**
Program to implement bubble sort program using pointers	**2**
Self-study: Nil	
Site/Industrial Visits : Nil	
Course outcomes: CO1: Explain linear and non-linear data structures like stack, queue, linked list, tree and graph{L2}{PO1, PO2} CO2: Explain data structures operations including insertion, deletion, traversal, searching, and sorting {L2}{PO1,PO2} CO3: Understand the concept and operations of singly linked list, circular linked list and double linked list. {L2}{PO1,PO2,PO3} CO4: Understand the functions of data warehousing including the components, architecture mapping, data extraction and data cleanup [L2]{PO1, PO2} CO5: Demonstrate online analytical processing (OLAP) as per the OLAP guidelines using OLAP tools. {L3}{PO1,PO2,PO3,PO4,PO5} CO6: Implement programs to summarize the operations of data structures {L4}{PO1,PO2,PO3,PO4}	
Text Books: T1. Sahni Horwitz,, Freed Anderson, Fundamentals of Data Structures in C, 2nd Edition (or latest) , University Press.\ T2. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", 3/e, Pearson Education Asia, 2008, (Reprint 2012).	

T3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Java", 6/e, Wiley, 2014.

Reference Books:

R1. TharejaReema, Data Structures Using C, 2nd Edition, Oxford University Press
R2Tanenbaum, Langsam, Augenstein, Data Structures using C, Pearson
R3. T. H Cormen, C E Leiserson, R L Rivest and C Stein: "Introduction to Algorithms", 3rd Edition, The MIT Press, 2014.
R4.Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms, Second Edition, Universities Press, 2007.

Online Resources : NIL

Course Name: Electronic Devices & Circuits					
Course Code : ECE333P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs
Course objectives: The aim of this course is to familiarize the student with the principle of operation, capabilities and limitation of various electron devices so that he or she will be able to use these devices effectively.					
Prerequisites: Basic Electronics					
Units					**Teaching Hours**
Unit-1 BJT – BIASING AND SMALL SIGNAL ANALYSIS					
1. DC Biasing - BJTs : Operating Point, Transistor Biasing circuits (Fixed Bias, Emitter Bias, Voltage Divider Bias, DC Bias with voltage feedback. Transistor as a switch. 2. BJT AC Analysis: BJT as amplifier. Small signal equivalent circuits (Low frequency re and h models only). Small signal analysis of CE, CB, CC (Voltage Divider Bias) configurations using re and hybrid model – with and without bypass capacitor.					9
Unit-2 FET – BIASING AND AMPLIFIERS					
1. JFET: Construction, Operation, Characteristic, Shockley's Equation, Transfer Characteristics and Applications, MOSFET :Enhancement type MOSFET and Depletion MOSFET – Construction, Operation and Characteristics, Handling precautions for MOSFET FET Biasing: Fixed Bias Configuration, Self – Bias Configuration, Voltage Divider Biasing. Depletion Type MOSFETs, Enhancement Type MOSFETs, FET Amplifiers: FET Small Signal Model					9
Unit-3 FREQUENCY RESPONSE AND HIGH FREQUENCY ANALYSIS					
1. General shape of frequency response of amplifiers. Definition of bel, decibel, cut off frequencies and bandwidth. Low frequency analysis of amplifiers to obtain lower cut off frequency. 2. Hybrid – pi equivalent circuit of BJTs. High frequency analysis of BJT amplifiers to obtain upper cut off frequency					9
Unit-4 FEEDBACK AMPLIFIERS					
1. Feedback Amplifiers: Negative and positive feedback. Properties of negative and positive feedback, negative feedback configurations, analysis of negative feedback amplifiers for gain, frequency response, input impedance, and output impedance of different configurations (voltage series, current series, voltage shunt, and current shunt)					9
Unit-5 CASCADE SYSTEMS AND POWER CONTROL DEVICES					
CASCADE SYSTEMS: Analysis of frequency response and gain for BJT and FET amplifiers **POWER CONTROL DEVICES**: Power control devices: PNPN diode (Shockley diode)					9

SCR characteristics – LASCR (Light Activated SCR) – TRIAC – DIAC – Structure & Characteristics. Characteristics and equivalent circuit of UJT - intrinsic stand-off ratio	
List of Experiments:	**Practical Hours**
1. Input and Output Characteristics of common Emitter Transistor Configuration	2
2. Input and output Characteristics of common base transistor Configuration	2
3. Characteristics of JFET	2
4. Characteristics of UJT	2
5. Determination of Stability factor (Fixed bias, Collector to Base bias & Self bias)	2
6. CE amplifier – Frequency Response	4
7. Common source FET amplifier – Frequency Response	4
8. Characteristics of SCR	4
9. Current series feedback amplifier: determination of frequency response with and without feedback	4
SIMULATION USING PSPICE/MULTISIM	
1. Voltage divider bias	2
2. Shunt feedback amplifiers –frequency response and gain	2
Self-study : Bias Stabilization, Thermal runaway. Transistor as a switch -Unit 3	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1**: Understand the biasing and small signal analysis of BJT. [L2] **CO2:** Understand the biasing and small signal analysis of FET. [L2] **CO3:** Construct the low frequency and high frequency BJT amplifiers. [L3] **CO4:** Examine the feedback amplifiers for different applications [L4] **CO5:** Perform analysis of the cascading stages of amplifiers and working principle of power devices. [L4] **CO6:**	
Text Books: T1. Robert L. Boylestead & Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th ed., Pearson Education, 2009. T2. Jacob Millman & Christos C. Halkias, "Electronic Devices and Circuits", Tata McGraw-Hill Education Pvt. Ltd., 2010.	
Reference Books: R1. Millman J. and Halkias C. " Integrated Electronics ", Tata McGraw-Hill Publishing, 2000 R2. Donald A Neamen, "Electronic Circuit Analysis and Design", 3/e, TMH. R3. Albert Paul Malvino, Electronic Principles, 8th Ed, McGraw-Hill Education, 2016. R4. Sedra and Smith." Microelectronic Circuits", 6/e, Oxford University Press, 2010. R5. David A. Bell, "Electronic Devices and Circuits", 4th Edition, Prentice Hall of India, 2007.	
Online Resources: NIL	

Course Name: Digital System Design					
Course Code : ECE334P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
This course is designed to make the students familiar with basic techniques of algorithm analysis, to understand concepts of searching and sorting techniques and to assess how the choice of data structures impacts the performance of a program.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Switching Theory: Laws of Boolean algebra, Theorems of Boolean algebra, Switching functions, Methods for specification of switching functions - Truth tables and Algebraic forms, Realization of functions using logic gates. Digital Logic Elements: Electronic logic gates, Positive and negative logic, Logic families - TTL, ECL and CMOS, Realization of logic gates.	**9**
Unit-2 BOOLEAN ALGEBRA	
Simplification of Boolean Expressions and Functions: Algebraic methods, Canonical forms of Boolean functions, Minimization of functions using Karnaugh maps, Minimization of functions using Quine-McClusky method.	**9**
Unit-3 COMBINATIONAL CIRCUITS-I	
Design of Combinational Logic Circuits: Gate level design of Small Scale Integration (SSI) circuits, Modular combinational logic elements - Decoders, Encoders, Priority encoders, Multiplexers and Demultiplexers. Design of Integer Arithmetic Circuits using Combinational Logic: Integer adders - Ripple carry adder and Carry look ahead adder, Integer subtractors using adders, Unsigned integer multipliers - Combinational array circuits, Signed integer multipliers - Booth coding, Bit-pair recoding, Carry save addition and Wallace tree multiplier,	**9**
Unit-4 COMBINATIONAL CIRCUITS-II	
Signed integer division circuits – Combinational array circuits, Complexity and propagation delay analysis of circuits. Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices, Design of multiple output circuits using PLDs.	**9**
Unit-5 SEQUENTIAL CIRCUITS	
Sequential Circuit Elements: Latches -RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops. Analysis and Design of Synchronous Sequential Circuits: Models of sequential circuits – Moore machine and Mealy machine, Flip-flops - Characteristic table, Characteristic equation and Excitation table, Analysis of sequential circuits- Flipflop input expressions, Next state equations, Next state maps, State table and State transition	**9**

diagram, Design of sequential circuits - State transition diagram, State table, Next state maps, Output maps, Expressions for flip-flop inputs and Expressions for circuit outputs, Modular sequential logic circuits- Shift registers, Registers, Counters and Random access memories, Design using programmable logic sequencers (PLSs). Design of Arithmetic Circuits using Sequential Logic : Serial adder for integers, Unsigned integer multiplier, Unsigned integer division circuits, Signed integer division, Floating-point adder/subtractor - Design of control circuit, Floating - point multiplier.	
List Of Experiments	**Practical Hours**
NIL	
Self-study: Nil	
Site/Industrial Visits : Nil	
Course outcomes: CO1: Describe the switching theory and realization of logic gates and logic families. [L2]{L2}{PO1, PO2} CO2: Illustrate the KMAP and Quine Mcluskey methods to minimize the logic functions{L2}{PO1,PO2,PO3,PO4} CO3: Explain the logic of various combinational circuits and obtain the logic diagram.. {L2}{PO1,PO2,PO3,PO4} CO4: Explain the logic of various sequential circuits and obtain the logic diagram.. {L2}{PO1,PO2,PO3,PO4} CO5: Explain the logic of VHDL programming to develop a digital logic circuits{L2}{PO1, PO2} CO6: Implement combinational and sequential circuits to solve real world problems{L4}{PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10}	
Text Books: T1. Donald P Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles and Applications" , Tata McGraw Hill 7 th Edition, 2010.	
Reference Books: R1. Stephen Brown. Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", Tata McGraw Hill, 2nd Edition 2005. R2 R D Sudhaker Samuel, "Illustrative Approach to Logic Design. Sanguine- Pearson", 2010. R3. Charles H. Roth, "Fundamentals of Logic Design", Cengage Learning, 5th Edition, 2004. R4. Ronald J. Tocci, Neal S. Widmer. Gregory L. Moss, "Digital Systems Principles and Applications, " 10th Edition. Pearson Education, 2007. R5. M Morris Mano, "Digital Logic and Computer Design", Pearson Education, 10th Edition, 2008.	
Online Resources: Nil	

Course Name: Computer Organization and Processors					
Course Code : ECE335					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: To discuss the basic structure of a digital computer and to study in detail the organization of the Control unit, the Arithmetic and Logical unit, Memory unit and Intel Processors.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 BASIC STRUCTURE OF COMPUTERS	
A Brief History of computers, Von Neumann Architecture, Harvard architecture, Computer Components, Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses-Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Hardware Implementation-Signed operand multiplication.	9
Unit-2 ARITHMETIC & LOGIC UNIT	
Booths Algorithm- fast multiplication – Integer division & it's Hardware Implementation – Restoring and Non Restoring algorithms-Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro-programmed control - Pipelining – Basic concepts – Data hazards – operand forwarding-Instruction hazards-Instruction Set architecture for logical operation	9
Unit-3 8086 MICROPROCESSOR	
Intel 8086 Microprocessor - Internal architecture – segment registers- 8086 memory organization–Flag Register-logical and physical address calculation-Block diagram of Minimum and maximum mode and its operations – Interrupt and Interrupt applications- Assembly language programming of 8086.	9
Unit-4 INTERFACING WITH 8086	
Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – Timer –Interrupt controller – DMA controller – Programming and applications	9
Unit-5 PENTIUM MICROPROCESSOR	
Advanced Intel Microprocessors- Reduced Instruction cycle – five stage instruction pipe line – Integrated coprocessor – On board cache – Burst Bus mode. Pentium – super scalar architecture – u-v pipe line – branch prediction logic – cache structure – BIST (built in self-test) – Introduction to MMX technology. Case Study	9
Self-study : NIL	

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Summarize the architectural features of a computer

CO2: Discover the basic functional units in ALU and perform various arithmetic operations of ALU

CO3: Demonstrate the dataflow and program execution process in Computer

CO4: Summarize various memory architectures and their data storage behaviour

CO5: Interpret unique architectural features of 8086 and Pentium processors.

Text Books:

T1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 7th Edition "Computer Organization", McGraw-Hill, 2011

T2. Douglous V. Hall "Microprocessor and Interfacing" 3rd edition ,Tata McGraw Hill,2015.

T3. James L. Antonakos , " The Pentium Microprocessor '' Pearson Education, 2007

Reference Books:

R1. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10h Edition, Pearson Education, 2015.

R2. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 3rd Edition, Morgan Kaufmann, 2008

R3. John P.Hayes, "Computer Architecture and Organization", 4th Edition, McGrawHill, 2003.

Online Resources:

O1. https://link.springer.com/book/10.1007/978-0-230-00060-5

Course Name: Professional Ethics					
Course Code : HS421					
	L	**T**	**P**	**Category**	HSMC
Contact Hrs./Week	2	0	0	**CIA Marks**	50
Contact Hrs./Sem.	30	0	0	**ESE Marks**	50
Credits.	2	0	0	**Exam Hours**	3

Course objectives:
(a) To understand the moral values that ought to guide the Engineering profession.
(b) To resolve the moral issues in the profession.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO ETHICS	
Introduction to Profession, Engineering and Professionalism, Three types of Ethics / Morality , Positive and Negative faces of Engineering Ethics	6
Unit-2 RESPONSIBILITY IN ENGINEERING AND ENGINEERING ETHICS	
Introduction, Engineering Standards, Blame – Responsibility and Causation, Liability, Design Standards. Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.	6
Unit-3 SOCIAL AND VALUE DIMENSIONS IN TECHNOLOGY	
Technology – The Promise and Perils, Computer Technology – Privacy and Social Policy, Ownership of Computer Software and public Policy, Engineering Responsibility in Democratic Deliberation on Technology Policy, The Social Embeddedness of Technology.	6
Unit-4 ELECTRONICS ENGINEERING AND BUSINESS ETHICS	
Ethics in Business – HR, Marketing, Finance and Accounting, Production and Operation Ethics in Global Business – Ethical principles governing global business, ethical relations to adapting host countries, culture and norms. Ethics in Electronics Engineering - IEEE Code of Ethics, Computer Ethics, Case Studies on ethical conflicts, Corporate Social Responsibility	6
Unit-5 ETHICS AND ENVIRONMENT	
Environment in Law and Court Decisions, Criteria for "Clean Environment", The progressive Attitude towards the Environment, Going beyond the Law, Respect for nature, Scope of Professional Engineering obligations to Environment.	6

Self-study : Nil

Site/Industrial Visits : Nil

Course outcomes: The students will be able to

CO1: Outline professional ethics and human values by realizing the holistic attributes.{L1}{PO6,PO8}

CO2: Specify the Engineering Professional Ethics to identify and solve problems related to society, safety, health & legal aspects. {L1}{PO6,PO8}

CO3: Explain the importance of being ethical while using technology in the digital space. {L2}{PO8,PO12}

CO4: Understand the various Business functions and the ethical principles that govern the global business. {L2}{PO6,PO8,PO9,PO12}

CO5: Explain the Importance of ethical conduct to safeguard environment and its resources. {L1}{PO7,PO8}

Text Books:

T1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.

T2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference Books:

R1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint).

R2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)

R3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

R4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

Online Resources:

Nil

Course Name: Cyber Security					
Course Code : CY321					
	L	**T**	**P**	Category	MC
Contact Hrs./Week	2	0	0	CIA Marks	50
Contact Hrs./Sem.	30	0	0	ESE Marks	NA
Credits.	0	0	0	Exam Hours	NA

Course objectives: This mandatory course is aimed at providing a comprehensive overview of the different facets of Cyber Security. In addition, the course will detail into specifics of Cyber Security with Cyber Laws both in Global and Indian Legal environments

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1	
Security Fundamentals-4 As Architecture Authentication Authorization Accountability, Social Media, Social Networking and Cyber Security.Cyber Laws, IT Act 2000-IT Act 2008-Laws for Cyber-Security, Comprehensive National Cyber-Security Initiative CNCI – Legalities	9
Unit-2	
Cyber Attack and Cyber Services Computer Virus – Computer Worms – Trojan horse.Vulnerabilities - Phishing - Online Attacks – Pharming - Phoarging – Cyber Attacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood	9
Unit-3	
Cyber Security Management Risk Management and Assessment - Risk Management Process - Threat Determination Process -Risk Assessment - Risk Management Lifecycle.Security Policy Management - Security Policies - Coverage Matrix Business Continuity Planning - DisasterTypes - Disaster Recovery Plan - Business Continuity Planning Process	9
Unit-4	
Vulnerability - Assessment and Tools: Vulnerability Testing - Penetration Testing Black box- white box.Architectural Integration: Security Zones - Devicesviz Routers, Firewalls, DMZ. Configuration Management - Certification and Accreditation for Cyber-Security.	9
Unit-5	
Authentication and Cryptography: Authentication - Cryptosystems - Certificate Services, Securing Communications: Securing Services - Transport – Wireless - Steganography and NTFS Data Streams. Intrusion Detection and Prevention Systems: Intrusion - Defense in Depth - IDS/IPS -IDS/IPS Weakness and Forensic AnalysisCyber Evolution: Cyber Organization – Cyber Future	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

Reference Books:

R1**.** Matt Bishop, "Introduction to Computer Security", Pearson, 6th impression, ISBN: 978-81-7758-425-7.

R2. Thomas R, Justin Peltier, John, "Information Security Fundamentals", Auerbach Publications.

R3. AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill.2003

R4. Nina Godbole, SunitBelapure, "Cyber Security", Wiley India 1st Edition 2011

R5. Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, "Cyber Security Policy Guidebook", Wiley; 1 edition , 2012

R6. Dan Shoemaker and Wm. Arthur Conklin, "Cyber security: The Essential Body Of Knowledge", Delmar Cengage Learning; 1 edition, 2011

R7. Stallings, "Cryptography & Network Security - Principles & Practice", Prentice Hall, 6th Edition 2014

Online Resources:

NIL

Course Name: Object Oriented Programming using Java					
Course Code : ECE431P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This course presents the concept of object oriented programming and also introduces the concept in C++ . The students will be familiarized with concepts like data abstraction, polymorphism and inheritance.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Approaches to Software Design - Functional Oriented Design, Object Oriented Design, Case Study of Automated Fire Alarm System. Object Modeling Using Unified Modeling Language (UML) – Basic Object Oriented concepts, UML diagrams, Use case model, Class diagram, Interaction diagram, Activity diagram, State chart diagram. Introduction to Java - Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. Java Virtual Machine (JVM), Java compiler, Bytecode, Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues	**9**
Unit-2 CORE JAVA FUNDAMENTALS	
Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class. Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements. Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Inner Classes, Command Line Arguments, Variable Length Arguments. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance	**9**
Unit-3 PRIMARY FEATURES OF JAVA	
Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces. Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Input/Output - I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class, Object Streams and Serialization, Working with Files	**9**
Unit-4 ADVANCED JAVA FEATURES	

Java Library - String Handling – String Constructors, String Length, Special String Operations - Character Extraction, String Comparison, Searching Strings, Modifying Strings, using valueOf(), Comparison of StringBuffer and String. Collections framework - Collections overview, Collections Interfaces- Collection Interface, List Interface. Collections Class – ArrayList class. Accessing a Collection via an Iterator. Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Model. Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads	**9**
Unit-5 GRAPHICAL USER INTERFACE ANDDATABASE SUPPORT OF JAVA	
Swings fundamentals - Swing Key Features, Model View Controller (MVC), Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, The Swing Buttons, JTextField. Java DataBase Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select	**9**
LIST OF EXPERIMENTS (IF ANY)	**Practical Hours**
Basic programs using datatypes, operators, and control statements in Java 1. Write a Java program that checks whether a given string is a palindrome or not 2. Write a Java Program to find the frequency of a given character in a string 3. Write a Java program to multiply two given matrices	6
Exception handling and multi-threading applications 1. Write a Java program that shows the usage of try, catch, throws and finally 2. Write a Java program that implements a multi-threaded program which has three threads. First thread generates a random integer every 1 second. If the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the value of cube of the number 3. Write a Java program that shows thread synchronization	6
Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection 1. Write a Java program which creates a class named 'Employee' having the following members: Name, Age, Phone number, Address, Salary. It also has a method named 'printSalary( )' which prints the salary of the Employee. Two classes 'Officer' and 'Manager' inherits the 'Employee' class. The 'Officer' and 'Manager' classes have data members 'specialization' and 'department' respectively. Now, assign name, age, phone number, address and salary to an officer and a manager by making an object of both of these classes and print the same. (Exercise to understand inheritance) 2. Write a java program to create an abstract class named Shape that contains	6

an empty method named numberOfSides( ). Provide three classes named Rectangle, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides( ) that shows the number of sides in the given geometrical structures. (Exercise to understand polymorphism) 3. Write a Java program to demonstrate the use of garbage collector	
Handling different types of files as well as input and output management methods 1. Write a file handling program in Java with reader/writer 2. Write a Java program that read from a file and write to file by handling all file related exceptions 3. Write a Java program that reads a line of integers, and then displays each integer, and the sum of all the integers	6
Graphics Programming 1. Write a Java program that works as a simple calculator. Arrange Buttons for digits and the + - * % operations properly. Add a text field to display the result. Handle any possible exceptions like divide by zero. Use Java Swing 2. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time. No light is on when the program starts 3. Write a Java program to display all records from a table using Java Database Connectivity (JDBC)	6
Self-study: Nil	
Site/Industrial Visits : Nil	
Course outcomes: CO1: Write Java programs using the object oriented concepts - classes, objects, constructors, data hiding, inheritance and polymorphism [L3] CO2: Utilise datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs[L3] CO3: Illustrate how robust programs can be written in Java using exception handling mechanism[L2] CO4: Write application programs in Java using multithreading and database connectivity [L3] CO5: Write Graphical User Interface based application programs by utilising event handling features and Swing in Java [L3]	
Text Books: T1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011. T2. Rajib Mall, Fundamentals of Software Engineering, 4th edition, PHI, 2014 T3. Paul Deitel, Harvey Deitel, Java How to Program, Early Objects 11th Edition, Pearson, 2018	

Reference Books:

R1. Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013
R2. Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008
R3. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005
R4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004
R5. Sierra K., Head First Java, 2/e, O'Reilly, 2005
R6. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014

Online Resources: Nil

Course Name: Artificial Intelligence					
Course Code : ECE432					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: This course aims to introduce artificial intelligence by knowledge representation using semantic networks and rules, concepts of logic in artificial intelligence, concepts of planning and learning with an introduction of the expert systems.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction, History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications. Problem Solving – State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.	9
Unit-2 KNOWLEDGE REPRESENTATION AND LOGIC	
Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming. Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Representing Knowledge using rules – Rules based deduction system, Knowledge Representation using Frames	9
Unit-3 REASONING UNDER UNCERTAINITY	
Introduction to uncertain knowledge review of probability – Baye's Probabilistic inferences and Dempster Shafer theory –Heuristic methods – Symbolic reasoning under uncertainty- Statistical reasoning – Fuzzy reasoning – Temporal reasoning- Non monotonic reasoning.	9
Unit-4 PLANNING AND LEARNING	
Planning - Introduction, Planning in situational calculus - Representation for planning – Partial order planning algorithm- Learning from examples- Discovery as learning – Learning by analogy – Explanation based learning – Introduction to Neural nets – Genetic Algorithms	9
Unit-5 EXPERT SYTEMS	
Expert Systems – Architecture Of Expert Systems, Roles Of Expert Systems – Knowledge Acquisition –Meta Knowledge, Heuristics. Typical Expert Systems – MYCIN, DART, XOON, Expert Systems Shells.	9
Self-study : NIL	

Site/Industrial Visits : NIL
Course outcomes: At the end of the course, the student will be able to : **CO1:** Formulate an efficient problem space for a problem in artificial intelligence **CO2**: Select a search algorithm for a problem and characterize its time and space complexities **CO3:** Understand the concepts of knowledge representation using an appropriate technique **CO4:** Apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing **CO5:** Explain expert systems based on architecture, roles and knowledge acquisition.
Text Books: T1. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011 T2. Patrick Henry Winston," Artificial Intelligence", Addison Wesley, Third edition, 2010 T3. Kevin Night And Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008
Reference Books: R1. George F Luger, Artificial Intelligence, Pearson Education, 6th edition,2009 R2. Engene Charniak and Drew Mc Dermott," Introduction to Artificial intelligence, Addison Wesley, 2009 R3. Nils J. Nilsson,"Principles of Artificial Intelligence", Narosa Publishing House, 2000
Online Resources: NIL

Course Name: Signals and Systems					
Course Code : ECE433					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
This course provides the mathematical representation of signals and systems using various transforms such as laplace, fourier and z-transforms. The course is designed to make the students familiar with the signals and their variations so that the fundamental of electronics engineering is well placed out.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one dimensional/ multidimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their interrelationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables)	**9**
Unit-2 LAPLACE TRANSFORM	
One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC)	**9**
Unit-3 FOURIER TRANSFORM	
Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT, Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT.	**9**
Unit-4 Z-TRANSFORM	
One sided and Bilateral Z- transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s-to z-plane mapping	**9**
Unit-5 LINEAR TIME INVARIANT SYSTEMS	
Continuous Time Systems: Linear Time invariant Systems and their properties. Differential equation & Block diagram representation, Impulse response, Convolution integral, Frequency response (Transfer Function), Fourier transforms analysis. Discrete Time System: Difference equations, Block diagram representation, Impulse response, Convolution sum, MATLAB tutorials	**9**

Self-study: Nil

Site/Industrial Visits : Nil
Course outcomes: CO1: Understand the relation among transfer function, convolution and the impulse response [L2]{PO1, PO2} CO2: Understand the relationship between the stability and causality of systems and the region of convergence of their Laplace transforms {L2}{PO1,PO2,PO3} CO3: Express periodic signals in terms of Fourier series and represent an arbitrary signal in terms of a fourier transform. {L2}{PO1,PO2,PO3} CO4: Apply the Z- transform of continuous-time and discrete-time signals for stability analysis {L3}{PO1,PO2,PO3} CO5: Explain basics of signals and systems to find the response of LTI system using convolution {L2}{PO1, PO2}
Text Books: T1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New DelhIi. T2. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003
Reference Books: R1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition R2. Principles of Linear Systems and Signals, BP Lathi, Oxford University Press, 2015 R3. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008
Online Resources: Nil

Course Name: Microcontroller Based System Design					
Course Code : ECE434P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: This course aims at learning the architecture programming and interfacing of Microcontrollers

Prerequisites: Computer organization & Architecture

Units	**Teaching Hours**
Unit-1 8051 ARCHITECTURE	
Architecture – Program memory organization – Data memory organization-Internal RAM-SFR-Flag Register- Timers/Counters & its operation registers – Interrupts of 8051 - I/O ports and its structures Interfacing I/O Devices – External memory interfacing-8051 addressing modes.	9
Unit-2 8051 PROGRAMMING	
Instruction set –Data Transfer Instructions - Arithmetic Instructions – Logical Instructions –Control transfer-Bit Manipulation Instructions – Timer/ Counter Programming – Serial Communication Programming- Interrupt Programming & its structure – I/O port Programming Assembly language programming, Introduction to Embedded C.	9
Unit-3 SYSTEM DESIGN USING 8051	
Interfacing LCD Display – Matrix Keypad Interfacing – ADC Interfacing –DAC Interfacing –Sensor Interfacing –Interfacing with 8255 Controlling AC appliances – Stepper Motor Control – DC Motor Interfacing.	9
Unit-4 HIGH PERFORMANCE RISC ARCHITECTURE: ARM	
The ARM architecture– Bus Architecture-ARM organization and implementation – Addressing Modes-The ARM instruction set - The thumb instruction set– ARM assembly language program	9
Unit-5 REAL TIME OPERATING SYSTEMS	
Processors and hardware units in an embedded system-Embedded Systems on a Chip (SoC) –Serial Communication Devices -Parallel Port Devices-Advanced I/O Serial high speed buses-Interrupt Routines Handling in RTOS- RTOS Task scheduling models-Inter process communication and synchronisation -Case Study.	9
List of Experiments (If any):	**Practical Hours**
1. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051microcontroller.	3
2. Programming and verifying Timer and UART operations of 8051 microcontroller.	3
3. Programming and verifying Interrupt operations of 8051 microcontroller	3

4. Communication between 8051 Microcontroller kit and PC.	3
5. Interfacing and Programming of Stepper Motor and DC Motor Speed control using 8051.	3
6. Interfacing and Programming of Seven segment display using 8051.	3
7. Interfacing and Programming of LCD display using 8051.	3
8. Interfacing and Programming of ADC and DAC using 8051.	3
9. Interfacing and Programming of LEDs with switches display using 8051.	3
10. Programming using Arithmetic, Logical and Bit Manipulation instructions of ARM.	3
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Summarize the architectural features of 8051 microcontroller **CO2:** Apply the knowledge of ALP, Embedded C to solve embedded software concepts **CO3:** Examine and demonstrate the working of I/O devices **CO4:** Relate the advance features of ARM processors for efficient embedded system **CO5 :** Interpret unique architectural features of advance processors	
Text Books: T1. Gibson, "Microprocessor and Interfacing" Tata McGraw Hill,II edition T2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' 8051 Microcontroller and Embedded Systems using Assembly and C ' ,2nd edition, Prentice Hall of India,2008	
Reference Books: R1. Myke Predko, "Programming and customizing the 8051 microcontroller", Tata McGraw Hill 2001. R2. Steve Furber , '' ARM System On –Chip architecture "Addision Wesley , 2nd edition,2000.	
Online Resources: O1. https://www.springer.com/in/book/9783319764382 O2. NPTEL course- "Microprocessor and microcontroller", https://onlinecourses.nptel.ac.in/noc18_ec03/	

Course Name: Engineering Biology Laboratory					
Course Code : BS451					
	L	**T**	**P**	Category	BSC
Contact Hrs./Week	0	0	2	CIA Marks	50
Contact Hrs./Sem.	0	0	30	ESE Marks	50
Credits.	0	0	1	Exam Hours	3 hrs

Course objectives:

Prerequisites: Biology for Engineers

List of Experiments :	**Practical Hours**
1. Blood Pressure Measurement using Arduino	2
2. Measuring HRV using the data from pulse measurement in Matlab.	4
3. Measure heart rate and SPO2 with Arduino	2
4. Measuring BMI, heart rate, SPO2, HRV using MATLAB and indicating health of person.	4
5. Analyzing breast cancer, EEG, ECG and CT images using MATLAB from online data sources and detecting irregularties (arrhythmia, tumor, cancer, epilepsy).	4
6. Analyzing force developed in muscles when performing any given task (to move servo motor and subsequently robotic arm).	4
7. Measuring water content in given soil using temperature, pH using Arduino.	4
8. IR thermal imaging to determine effect of mobile radiation.	2
9. Synthesis of biopolymers from starch.	4

Self-study : Nil

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Examine the various applications of bioengineering and using common tool boxes for analysing medical information.

CO2:

CO3:

Text Books:

NIL

Reference Books:

NIL

Online Resources:

NIL

Course Name: Project Management and Finance					
Course Code : HS421					
	L	**T**	**P**	**Category**	HSMC
Contact Hrs./Week	3	0	0	**CIA Marks**	50
Contact Hrs./Sem.	45	0	0	**ESE Marks**	50
Credits.	3	0	0	**Exam Hours**	3

Course objectives: The objective of the course is to familiarize the students with the concepts of Project management, Project networking, Project equipment, Project quality, Project safety and Project finance.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1	
Definition of project purpose - Scope, time, quality and organization structure. Basic and detailed engineering: Degree of automation, Project S curves, manpower considerations, inter-department and inter-organization interactions, Multi agency interaction. Types of projects and types of contracts e.g. EPC, BOOT etc	9
Unit-2	
Project management functions - Controlling, directing, project authority, responsibility, accountability, interpersonal influences and standard communication formats, project reviews. project planning and scheduling, life project engineering and management cycle phases	9
Unit-3	
Project Cost & Estimation - Types and estimates, pricing process, salary and other overheads, man-hours, materials and support costs. program evaluation and review techniques (PERT) and critical path method (CPM), estimating activity time and total program time, total PERT/CPM planning crash times, software's used in project management	9
Unit-4	
Engineering Design Criteria - Pneumatic versus electronics system, Control centers, Future and spare capacity Specifications for various measurement and control groups: Flow, Pressure, Level, Temperature, Control valves, Control panels, Analytical instruments Transmission systems: Pneumatic & Electronic – Materials, Distribution, Terminations and Identification Process connections – Take-offs and Piping, Location of taps, Sealing instruments from process, Manifolds and gage valves Miscellaneous Design Criteria: Mounting instruments, Selections of units, charts, ranges; Instrument identification, Winterizing, Material of construction, Package equipment systems Electrical safety: NEC code, Purging and pressurization, Enclosures, Intrinsic safety	9
Unit-5	

Introduction to project finance, Uses of project finance, Motivations for using project finance, Unique features of infrastructure projects, Essential elements of project financing, Trends in project financing, Market for project finance Project finance in the power sector, Project finance in the roads sector, Project finance in airports(Build Own Operate (BOO) / Build Own Operate Transfer (BOOT) Projects / Build Operate and Transfer (BOT)), Financial analysis, Valuation - Free Cash Flows, Equity Cash Flows, Project Risk identification, assessment, management, Public Private Partnerships.	9
Self-study : Nil	
Site/Industrial Visits : Project site visit	
Course outcomes: The students will be able to **CO1:** Understand elements of project management and describe the contracts used in engineering terms **CO2:** Describe the project management functions in engineering **CO3**: Understand the nuances of project planning and scheduling **CO4:** Apply the project cost estimation methods to estimate the cost of a given project **CO5** :Interpret the design criteria of electrical & electronics components from the specifications **CO4:** Understand the fundamentals of Project finance.	
Text Books: T1. Chitkara, K.K "Construction Project Management Plan, Se (English) 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2010. T2. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education, 2012. T3. B C Punmia and KK Khandelwal, Project planning and Control with PERT & CPM. T4. J O Brien, "Construction Management", Mcgraw Hill, 2016.	
Reference Books: R1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education, 9th edition, 2018. R2. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, "Modern Construction Management", Wiley-Blackwell, 7th edition, 2013.	
Online Resources: W1. https://onlinecourses.nptel.ac.in/noc17_mg01/ W2: https://nptel.ac.in/courses/105103133/31	

Course Name: Environmental Science					
Course Code : EVS421					
	L	**T**	**P**	Category	MC
Contact Hrs./Week	2	0	0	CIA Marks	50
Contact Hrs./Sem.	30	0	0	ESE Marks	-
Credits.	0	0	0	Exam Hours	-
Course objectives: To understand the scope and importance of environmental science towards developing a conscious community for environmental issues, both at global and local scale.					
Prerequisites: NIL					

Units	**Teaching Hours**
Unit-1	
Introduction: Environment and Eco systems – Definition, Scope and importance. Components of environment. Concept and Structure of eco systems. Material Cycles – Nitrogen, Carbon, Sulphur, Phosphorous, Oxygen. Energy Flow and classification of Eco systems	9
Unit-2	
Natural Resources: Classification and importance- Forest, Water, Mineral, Food, Energy. Management of natural resources – challenges and methods. Sustainable development – Goals, Agriculture, Industries	6
Unit-3	
Environmental Pollution: Causes and Impacts – Air pollution, Water pollution, Soil Pollution, Noise Pollution, Marine Pollution, Municipal Solid Wastes, Bio Medical and E-Waste. Solid Waste Management	6
Unit-4	
Climate change/Global Atmospheric Change: Global Temperature, Greenhouse effect, global energy balance, Global warming potential, International Panel for Climate Change (IPCC) Emission scenarios, Oceans and climate change. Adaptation methods. Green Climate fund. Climate change related planning- small islands and coastal region. Impact on women, children, youths and marginalized communities	6
Unit-5	
Environmental Protection- Technology, Modern Tools – GIS & Remote Sensing, Institutional Mechanisms - Environmental Acts & Regulations, Role of government, Legal aspects. Role of Nongovernmental Organizations (NGOs) , Environmental Education & Entrepreneurship	6
Self-study:	
Site/Industrial Visits: Nil	
Course Outcomes:	

CO1. Explain the components and concept of various ecosystems in the environment (L2)
CO2. Explain the necessity of natural resources management (L2)
CO3. Relate the causes and impacts of environmental pollution (L4)
CO4. Relate climate change/global atmospheric changes and adaptation (L4)
CO5. Appraise the role of technology and institutional mechanisms for environmental protection (L5)

Text Books:

T1 Gopinath, R &Balasubramanya, N (2018), "Environmental Science and Engineering", CENGAGE.
T2 Benny Joseph (2005), **"Environmental Studies"**, Tata McGraw – Hill Publishing
T3 Company Limited.
T4 R Rajagopalan, **"Environmental Studies – From Crisis to Cure**", OxfordUniversity Press, 2005,
T5 Aloka Debi, **"Environmental Science and Engineering",** Universities Press (India)Pvt. Ltd. 2012.

Reference Books:

R1. Masters, G & Ela, W.P (2015), Introduction to environmental Engineering and Science, 3rd Edition. Pearson.
R2. Raman Sivakumar, **"Principals of Environmental Science and Engineering",** Second Edition, Cengage learning Singapore, 2005.
R3. P. Meenakshi, **"Elements of Environmental Science and Engineering",** Prentice Hall of India Private Limited, New Delhi, 2006.
R4. S.M. Prakash, **"Environmental Studies",** Elite Publishers Mangalore, 2007
R5. ErachBharucha, **"Textbook of Environmental Studies"**, for UGC, University press, 2005.
R6. Dr. Pratiba Sing, Dr. AnoopSingh and Dr. PiyushMalaviya, **"Textbook of Environmental and Ecology"**, Acme Learning Pvt. Ltd. New Delhi.

Online Resources:

NIL

Course Name: Data Base Management Systems					
Course Code : ECE531P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**30**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:

This course is provides the fundamentals of data models and to conceptualize and depict a database system using ER diagram. To make a study of SQL and relational database design. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure. To have an introductory knowledge about the emerging trends in the area of distributed DB- OO DB- Data mining and Data Warehousing and XML. To implement the design of the tables in DBMS. To write queries to get optimized outputs. To store, retrieve and view the contents. To generate report based on customized need.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION AND CONCEPTUAL MODELING	
Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.	**9**
Unit-2 RELATIONAL MODEL	
SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF).	**9**
Unit-3 DATA STORAGE AND QUERY PROCESSING	
Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+ Tree – Query Processing.	**9**
Unit-4 TRANSACTION MANAGEMENT	
Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging	**9**
Unit-5 CURRENT TRENDS	
Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML- Data- XML Document- Schema- Querying and Transformation. – Data Mining and Data Warehousing.	**9**

Self-study: Nil
Site/Industrial Visits : Nil
Course outcomes: CO1: Summarize the fundamental concepts of databases and Entity-Relationship (E-R) model [L2]{PO1, PO2} CO2: Apply E-R Model and Normalization principles to create relational databases for the given problems. {L3}{PO1,PO2,PO3} CO3: Compare and contrast different file organization concepts for data storage in Relational databases {L4}{PO1,PO2,PO4} CO4: Apply the transaction management principles on relational databases{L3}{PO1,PO2,PO3} CO5: Understand the current trends such as object oriented databases, distributed data storage in database technology{L2}{PO1, PO2}
Text Books: T1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2010
Reference Books: R1. Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Third Edition, Pearson Education, 2008. R2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 2003.
Online Resources: Nil

Course Name: Digital Signal Processing					
Course Code : EC532P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives:

- Analyze and Compute FFT of a discrete time signal.
- Design the various FIR filter techniques.
- Design the various IIR filter techniques.
- Analyze the finite word length effects in signal processing.
- Learn the fundamentals of digital signal processors.

Prerequisites: Signals & Systems

Units	**Teaching Hours**
Unit-1 FAST FOURIER TRANSFORM AND CONVOLUTION	
Introduction to DFT – Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –sectioned convolution- overlap add method- overlap save method.	9
Unit-2 FINITE IMPULSE RESPONSE DIGITAL FILTERS	
Linear phase filters-Frequency response of linear phase FIR filters-Fourier series method of designing FIR filters-Windowing techniques for design of linear phase FIR filters:Rectangular- Hamming- Hanning-Blackman windows - Gibbs phenomenon –principle of frequency sampling technique- FIR Filter Realization-Direct form,Cascade ,Linear phase FIR realization.	9
Unit-3 INFINITE IMPULSE RESPONSE DIGITAL FILTERS	
Review of design of analogue Butterworth and Chebyshev Filters- Design of IIR digital filters using impulse invariance technique –bilinear transformation – pre warping –Frequency transformation in digital domain – IIR Filter Realization - Direct form I, Direct form II, cascade and parallel.	9
Unit-4 FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS	
Binary fixed point and floating point number representations - Comparison-Quantization noise – truncation and rounding-derivation for quantization noise power – input quantization error-coefficient quantization error –limit cycle oscillations-dead band problems - Overflow error-signal scaling.	9
Unit-5 DIGITAL SIGNAL PROCESSOR	
Introduction to DSP Architecture – Dedicated MAC unit - Features of C6X Processor - Internal Architecture - Functional Units and Operation - Addressing Modes	9
List of Experiments (If any):	**Practical Hours**
USING MATLAB	

1. Generation of Discrete Time Signals.	2
2. Computation of FFT and IFFT.	2
3. Computation of Linear convolution	2
4. Computation of Circular convolution	2
5. Verification of Sampling Theorem	2
6. Design of FIR Filter (window design).	2
7. Design of IIR Filter (Butterworth & Chebychev).	2
8. Modelling of pulse generator, signal generator, signal builder using Simulink	2
USING TMS320C6713 DSP PROCESSOR	
1. Study of Architecture of C6X DSP processor	2
2. Generation of Discrete Time Signals	2
3. Linear Convolution	2
4. Implementation of a FIR filter	4
5. Implementation of a IIR filter	4
Self-study : Packet Voice Digital Signal Processor Module (PVDM)	
Site/Industrial Visits : Samsung India Electronics, ISRO Telemetry,Tracking and Command Network(ISTRAC) and other relevant organization	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Calculate the FFT of a discrete time signal **CO2:** Demonstrate various FIR filter techniques **CO3:** Demonstrate various IIR filter techniques **CO4:** Summarize finite word length effects in signal processing **CO5 :** Explain the fundamentals of Digital signal processor	
Text Books: T1. John G Proakis- Dimtris G Manolakis, Digital Signal Processing Principles-Algorithms and Application, Pearson/PHI- 4th Edition, 2007 T2. S. K. Mitra- "Digital Signal Processing- A Computer based approach", TataMc-Graw-Hill, 2001, New Delhi. T3. B. Venkataramani & M.Bhaskar, Digital Signal Processor Architecture-Programming and Application, Tata Mc-GrawHill 2002	
Reference Books: R1. Allan V.Openheim, Ronald W. Sehafer& John R. Buck-"Discrete Time Signal Processing", Third edition, Pearson/Prentice Hall,2014. R2. Johny R-Johnson: Introduction to Digital Signal Processing, Prentice-Hall- 1984 R3. Emmanuel I Fetchor "Digital Signal Processing: A Practical Approach", 2/E -Prentice Hall R4. Li Tan " Digital Signal Processing" Elsevier-2008 R5. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006	

Online Resources:

O1. https://link.springer.com/book/10.1007/978-981-10-2534-1
O2. https://link.springer.com/book/10.1007/978-981-10-2537-2
O3. https://link.springer.com/book/10.1007/978-981-10-2540-2
O4. https://nptel.ac.in/courses/117102060/

Course Name: Programming Language Paradigm					
Course Code : ECE533					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs
Course objectives: This course aims to explore modern programming languages and the techniques used for programming in order to get idea on evaluation of programming languages and also helps students to analyze a given program from good programming practice perspective					
Prerequisites:					
Units					**Teaching Hours**
Unit-1 INTRODUCTION					
The art of Language design – Programming language spectrum - Compilation and Interpretation – Evaluation of Programming languages – Syntax and Semantics of Language C-lite - Names – Types – Type Systems - Binding – Scope – Static – Dynamic – Abstract Data types					9
Unit-2 SEMANTICS					
Expression – Assignment - Control Flow – Input/Output – Exception Handling – State Transformation – Partial Functions – Semantics with Dynamic Typing – Formal Treatment of Semantics					9
Unit-3 FUNCTIONS					
Call and Return – Parameter Passing – Function Declaration – Semantics Of Call and Return – Formal Treatment of Types and Semantics – Memory Management – Dynamic Arrays – Garbage Collection.					9
Unit-4 PROGRAMMING TECHNIQUES					
Imperative programming – C – ADA – Perl – Object Oriented Programming – Small TalkJava– Python – Functional Programming – Scheme – Haskell					9
Unit-5 MODERN PROGRAMMING TECHNIQUES					
Logic Programming – Prolog – Event-Driven programming – Concurrent Programming – Concepts – Synchronization Strategies – Language Level Mechanism - Interprocess COMMUNICATION – Scripting LANGUAGES					9
List of Experiments (If any): NIL					**Practical Hours**
Self-study : NIL					
Site/Industrial Visits : NIL					

Course outcomes: At the end of the course, the student will be able to : **CO1:** Write programs related to syntax and semantics **CO2:** Compare programs between C, Ada, Perl and Small Talk **CO3:** Write programs using scripting languages **CO4:** Demonstrate event-driven and concurrent programming using prolog **CO5 :** Apply prolog for developing distributed systems
Text Books: T1. Allen B. Tucker and Robert E. Noonan, ―Programming Languages – Principles and Paradigms‖, Second Edition, Tata McGraw Hill, 2009
Reference Books: R1. Robert W. Sebesta, ―Concepts of Programming Languages‖, Sixth Edition, Addison Wesley, 2003 R2. Michael L Scott, ―Programming Language Pragmatics‖, Third Edition, Morgan Kauffman, 2009
Online Resources: NIL

Course Name: VLSI Design					
Course Code : ECE631P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: This course aims at introducing the technology, design concepts required in the design of Very Large Scale Integrated Circuits.

Prerequisites: Digital Electronics

Units	**Teaching Hours**
Unit-1 MOS TRANSISTORS	
Fundamentals of Enhancement Mode MOSFETs, Depletion Mode MOSFETs, CMOS transistor Theory, Long Channel I-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics.	9
Unit-2 CMOS PROCESSING TECHNOLOGY	
Overview of IC industry, CMOS Technologies (Nwell, Pwell, Twin-Tub, SOI, BiCMOS), Layout Design Rules, Stick Diagrams, Euler's Rule for Physical Design.	9
Unit-3 CMOS CHIP DESIGN	
MOSFETS as switches, Basic logic gates in CMOS, Complex logic gates, Transmission gates: Muxes and latches, CMOS chip design options: Full custom ASICs, Std. Cell based ASICs, Gate Array based ASICs Channeled, Channel less and structured GA, Programmable logic structures; 22V10, Programming of PALs, Programmable Interconnect, Reprogrammable GA: Xilinx programmable GA, ASIC design flow.	9
Unit-4 VLSI CIRCUIT DESIGN	
Precharge -Evaluate logic, Static and Dynamic CMOS logic circuits, Combinational Circuit Design, Sequential Circuit Design, Circuit Design of Latches and Flip-Flops.	9
Unit-5 VERILOG HDL	
Basic Concepts: VLSI Design flow, identifiers, gate primitives, value set, ports, gate delays, structural gate level and switch level modelling, Design hierarchies, Behavioral and RTL modelling: Operators, timing controls, Procedural assignments conditional statements, Data flow modelling and RTL. Structural gate level description of combinational and sequential circuits.	9
List of Experiments (If any):	**Practical Hours**
1. Design Entry and Simulation of Combinational Logic circuits a) Basic logic gates b) Half adder and full adder c) Half Sub tractor and full sub tractor d) 8 bit adder	30

e) 4 bit multiplier f) Encoder and Decoder g) Multiplexer and Demultiplexer	
2. Design Entry and Simulation of Sequential Logic Circuits a) Flip-Flops b) Counters c) Registers	
3. Design entry and simulation of parallel and serial adder using FSM Techniques.	
4. Synthesis, P&R and Post P&R simulation for all the blocks/codes developed in Experiment No. 1 and No. 2	
5. Pulse code modulation	
6. Design Entry and Simulation of traffic signal controller using Xilinx ISE Design suite and implementing the same on Spartan FPGA.	
7. Schematic and Layout of a simple CMOS inverter, parasitic extraction and simulation.	
8. Design and simulation of pipelined serial and parallel adder to add/ subtract 8 number of size, 12 bits each in 2's complement	
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Comprehend the basics of CMOS circuits **CO2:** Describe CMOS process technology **CO3:** Identify the techniques of chip design using programmable devices **CO4:** Strategy for designing the CMOS circuits **CO5 :** Design VLSI subsystems and modeling a digital system using Hardware Description Language	
Text Books: T1. Ayan Banerjee, Neil H. E. Weste, David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective" (English) 4th Edition, 2010 T2. Weste-Eshraghian – "Principles of CMOS VLSI Design", 2nd Edition, 2004 T3. Samir Palnitkar, "Verilog HDL", 2 edition, Pearson Education, 2003 T4. M.J.S.Smith, "Application Specific integrated circuits", Pearson Education, 2007	
Reference Books: R1. Puchnell DA & Eshraghian K, "Basic VLSI Design", PHI R2. John P. Uyemura, "Introduction to VLSI circuits and systems", John Wiley R3. Peter.J.Ashenden, "Digital Design: An Embedded Systems Approach Using Verilog", Elsevier 2010	
Online Resources: O1. https://link.springer.com/book/10.1007/978-1-4614-1120-8	

Course Name: Introduction to Machine Learning					
Course Code : ECE632					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course provides an introduction to basic skill set required in this fast expanding field of machine learning. Students will learn relevant basics in machine learning such as regression, clustering and classification. In addition, this course introduces advanced Python programming as a standard and common language for machine learning. This course is proposed to meet the growing business needs of individuals skilled in artificial intelligence, data analytics, statistical programming and other software skills. The proposed course will combine theory and practice to enable the student to gain the necessary knowledge to compete in the ever changing work environment

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 INTORDUCTION TO MACHINE LEARNING	
Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation. Linear Regression: Introduction, Linear regression, Python exercise on linear regression	9
Unit-2 DECISION BASED AND INSTANCE LEARNING	
Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision Tree. Instance based Learning: K nearest neighbor, the Curse of Dimensionality, Feature Selection: forward search, backward search, univariate , multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on KNN and PCA. Recommender System: Content based system, Collaborative filtering based	9
Unit-3 PROBABILITY AND BAYES LEARNING	
Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression. Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem, python exercise on SVM	9
Unit-4 ARTIFICIAL NEURAL NETWORKS	
Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm, python exercise on neural network. Introduction to Computational Learning Theory: Introduction, sample complexity, finite hypothesis space, VC dimension	9

Unit-5 ENSEMBLES	
Introduction, Bagging and boosting, Random forest - Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering	9
List of Experiments (If any):	**Practical Hours**
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Develop an appreciation for what is involved in learning models from data. **CO2:** Understand a wide variety of learning algorithms **CO3:** Understand how to evaluate models generated from data **CO4 :** Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models	
Text Books: T1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997	
Reference Books: R1. Introduction to Machine Learning Edition 2, by EthemAlpaydin R2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012 R3. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007	
Online Resources: NIL	

Course Name: Computer Networks					
Course Code : ECE633					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course aims to introduce the concepts, terminologies, and technologies used in modern data communication and computer networking. It also gives an introduction to the IEEE standards used for WLAN for physical ant MAC layer.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 DATA COMMUNICATIONS	
Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences. TCP/IP.	9
Unit-2 DATA LINK LAYER	
Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control: stop and wait – go back N ARQ – selective repeat ARQ-sliding window techniques – HDLC. LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.11	9
Unit-3 NETWORK LAYER	
Internetworks - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.	9
Unit-4 TRANSPORT LAYER	
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Service	9
Unit-5 IEEE 802.11 WIRELESS LAN – MAC LAYER	
IEEE 802.11–– Architecture, Types of stations, 802.11 MAC- DCF, PCF, Hidden Node Problem, RTS,CTS, 802.11 Frame Format, Adhoc Routing Protocols – Proactive Routing, OLSR, Reactive Routing, AODV, Multipath Routing	9
List of Experiments (If any):	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Explain the network models and terminologies including topologies, transmission media and line coding for a data communication system.

CO2: Understand the data link layer services for error control using parity check, Hamming & cyclic codes and flow control techniques using stop & wait, stop & wait ARQ, Go-back n ARQ protocols

CO3: Find the path for network layer packet delivery for a given topology using intradomain routing protocols

CO4 : Understand the essential principles of transport layer including reliable data transfer, congestion control and quality of service

CO5: Describe the MAC layer functions including DCF,PCF access schemes of Wireless LAN from IEEE 802.11 draft standard

Text Books:

T1. Behrouz A. Foruzan, "Data communication and Networking",5th edition , Tata McGraw-Hill, 2012

Reference Books:

R1. James .F. Kurouse & W. Rouse, "Computer Networking: A Topdown Approach Featuring", 7th edition,Pearson Education,2016

R2. Larry L.Peterson & Peter S. Davie, "COMPUTER NETWORKS", Harcourt Asia Pvt. Ltd., 5th Edition,2011

R3. Andrew S. Tannenbaum, "Computer Networks", PHI, 5th Edition, 2016

R4. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2013

R5. Azzedine Boukerche "Algorithms and Protocols for Wireless, Mobile AdHoc Networks", Wiley-IEEE Press, 2008

Online Resources:

NIL

Course Name: Internet of Things					
Course Code : ECE731					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course aims to introduce the concepts and protocols related to Internet of Things, get an idea where the application areas are available for the Internet of Things to be applied, to understand the middleware for Internet of Things; To understand the concepts of Web of Things, the concepts of Cloud of Things with emphasis on Mobile cloud computing and where the market connected to the network lies.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 INTRODUCTION AND BACKGROUND	
Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT functional Blocks, IoT Communication Blocks, IoT Communication APIs, IoT Enablish Technologies: WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Syestems.	9
Unit-2 IOT HARDWARE, DEVICES AND PLATFORMS	
Basics of Arduino: The Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi: Introduction to Raspberry Pi, Programming with Raspberry Pi, CDAC IoT devices: Ubimote, Wi-Fi mote, BLE mote, WINGZ gateway,Introduction to IoT Platforms, IoT Sensors and actuators	9
Unit-3 IOT ARCHITECTURE AND PROTOCOLS	
IoT Architecture: Web of Things versus Internet of Things – Two Pillars of the Web – Unified Multitier WoT Architecture, Cloud Providers and Systems,The Cloud of Things Architecture. IoT Protocols: Application Protocols, Service Discovery Protocols, Infrastructure Protocols.	9
Unit-4 IOT PROGRAMMING	
Arduino Programming: Serial Communications, Getting input from sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication. Programming with Raspberry Pi: Basics of Python Programming, Python packages of IoT, IoT Programming with CDAC IoT devices	9
Unit-5 DOMAIN SPECIFIC IOT	
Home automation, Smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, Industry and Health & Life style secors. Case Studies: A Case study of Internet of Things Using Wireless Sensor Networks and Smartphones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, OpenIoT platform	9
List of Experiments (If any):	**Practical Hours**

Self-study : NIL
Site/Industrial Visits : NIL
Course outcomes: At the end of the course, the student will be able to : **CO1**: Explain the fundamental building blocks of an IoT environment from a logical and physical perspective. **CO2**: Experiment with Arduino and Raspberry Pi to choose the appropriate hardware for different IoT projects **CO3**: Summarize IoT protocols in Application and Network layers by outlining their advantages and disadvantages **CO4**: Develop IoT solutions using Arduino and Raspberry Pi to solve real life problems **CO5** :Survey successful IoT products and solutions to analyze their architecture and technologies
Text Books: T1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
Reference Books: R1. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012 R2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012 R3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010 R4. Al-Fuqaha, Ala, et al. "Internet of things: A survey on enabling technologies, protocols, and applications." *IEEE Communications Surveys & Tutorials* 17.4 (2015): 2347-2376 R5. Tsitsigkos, Alkiviadis, et al. "A case study of internet of things using wireless sensor networks and smartphones." *Proceedings of the Wireless World Research Forum (WWRF) Meeting: Technologies and Visions for a Sustainable Wireless Internet, Athens, Greece*. Vol. 2325. 2012 R6. Ye, Mengmei, et al. "Security Analysis of Internet-of-Things: A Case Study of August Smart Lock."
Online Resources: NIL

Course Name: Digital Image Processing and Computer Vision					
Course Code : ECE732					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: The course will cover techniques and tools for digital image processing, and finally also introduce image analysis techniques in the form of image segmentation and pattern classification.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO DIGITAL IMAGE PROCESSING	
Part1: Introduction, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Part 2: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing. Image Enhancement Techniques – Histogram Processing, Fundamentals of Spatial Filtering, Smoothing (Lowpass) Spatial Filters, Sharpening (Highpass) Spatial Filters	9
Unit-2 IMAGE RESTORATION AND SEGMENTATION	
Part 1: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Part 2: Image Reconstruction from Projections Part 3 : Segmentation: Fundamentals, Point, Line, and Edge Detection, Thresholding, Feature Extraction: Background, Boundary Pre-processing, Boundary Feature Descriptors, Region Feature Descriptors	9
Unit 3 MORPHOLOGICAL IMAGE PROCESSING AND PATTERN CLASSIFICATION	
Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform, Basic Morphological Algorithms Patterns and Pattern Classes, Pattern Classification by Prototype Matching, Neural Networks and Deep Learning, Deep Convolutional Neural Networks	9
Unit-4 LOW LEVEL IMAGE PROCESSING	
Introduction to Low-level Image Processing: Convolution and filtering, Image enhancement, Restoration	9

Feature extraction: Edges - Canny; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, SIFT , Scale-Space Analysis, Gabor filter	
Unit-5 MOTION ANALYSIS	
Motion Analysis: Background Subtraction and Modeling, Optical Flow, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Demonstrate various image enhancement techniques in spatial domain **CO2**: Explain fundamentals of image restoration and segmentation **CO3:** Understand fundamentals of morphological image processing **CO4:** Understand the fundamentals of low-level image processing applied for image enhancement, restoration and feature extraction processes **CO5:** Apply the concept of motion estimation for image and video processing applications	
Text Books: T1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018 T2. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011 T3. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003	
Reference Books: R1. Anil Jain K, "Fundamentals Of Digital Image Processing", PHI Learning Pvt. Ltd., 2011 R2. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992 R3. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006	
Online Resources: O1. https://nptel.ac.in/syllabus/106105032/ O2. http://www2.engr.arizona.edu/~dial/	

Course Name: Python for Machine Learning					
Course Code : ECE733					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: This course is aimed to provide learners an insight into Python programming, and develop programming skills to manage the development of software systems. It covers programming environment, important instructions, data representations, intermediate level features, Object Oriented Programming and file data processing of Python.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO PYTHON	
Getting Started with Python Programming - Running code in the interactive shell, Editing, Saving, and Running a script. Using editors - IDLE, Jupyter. The software development process - Case Study. Basic coding skills - Working with data types, Numeric data types and Character sets, Keywords, Variables and Assignment statement, Operators, Expressions, Working with numeric data, Type conversions, Comments in the program. Input, Processing, and Output. Formatting output. How Python works. Detecting and correcting syntax errors. Using built in functions and modules in math module	9
Unit-2 INTRODUCTION TO BUILDING PROGRAMS IN PYTHON	
Control statements - Selection structure (if-else, switch-case), Iteration structure(for, while), Testing the control statements, Lazy evaluation. Functions - Hiding redundancy and complexity, Arguments and return values, Variable scopes and parameter passing, Named arguments, Main function, Working with recursion, Lambda functions. Strings and number systems - String function, Handling numbers in various formats	9
Unit 3 DATA REPRESENTATION	
Lists - Basic list Operations and functions, List of lists, Slicing, Searching and sorting list, List comprehension. Work with tuples. Sets. Work with dates and times. Dictionaries - Dictionary functions, dictionary literals, adding and removing keys, accessing and replacing values,traversing dictionaries, reverse lookup. Case Study - Data Structure Selection	9
Unit-4 OBJECT ORIENTED PROGRAMMING	
Design with classes - Objects and Classes, Methods, Instance Variables, Constructor, Accessors and Mutators. Structuring classes with Inheritance and Polymorphism. Abstract Classes. Exceptions - Handle a single exception, handle multiple exceptions	9
Unit-5 PYTHON FOR MACHINE LEARNING	

Python Basics For Data Analysis and Visualization: Loading, Cleaning and Exploring and Visualization. Python Libraries For Data Science (Numpy ,Pandas , Matplotlib, Seaborn ,Scikit-Learn), Data Science and Machine Learning – Use Cases	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Write python programs and execute [L3] **CO2**: Illustrate uses of conditional (if, if-else, if-elif-else and switch-case) and iterative (while and for) statements in Python programs [L3] **CO3:** Write programs by utilizing the modules Lists, Tuples, Sets and Dictionaries in Python [L3] **CO4:** Implement Object Oriented programs with exception handling [L3] **CO5:** Write Python programs to process data stored in files by utilizing the modules Numpy, Matplotlib, and Pandas [L3]	
Text Books: T1Kenneth A Lambert., Fundamentals of Python : First Programs, 2/e, Cengage Publishing, 2016 T2. Wes McKinney, Python for Data Analysis, 2/e, Shroff / O'Reilly Publishers, 2017	
Reference Books: R1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2/e, Schroff, 2016 R2. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016 R3. David M.Baezly, Python Essential Reference. Addison-Wesley Professional; 4/e, 2009 R4. Charles Severance. Python for Informatics: Exploring Information	
Online Resources: NIL	

Course Name: Service Learning					
Course Code : ECE735					
	L	**T**	**P**	Category	HSMC
Contact Hrs./Week	1	0	2	CIA Marks	100
Contact Hrs./Sem.	15	0	30	ESE Marks	NA
Credits.	1	0	1	Exam Hours	NA

Course objectives: This course aims to inculcate the purpose of serving the community or society with practical solutions to existing problems. The theme of service learning is selected to be precision agriculture. Through this course, the understanding of soil with their properties is provided along with the information about sensors which they will be applying to solve societal problems by development of final solutions as a working model or a prototype.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1	
Properties of Soil: Soil - definition - major components - soil forming processes- soil profile -Physical properties - texture – structure-absolute specific gravity - capillary and non-capillary porosity - soil colour - soil consistency - plasticity. Soil air - soil temperature - soil water - soil moisture constants – classification of soil water. Soil water movement. Soil colloids - organic – inorganic. Ion exchange- soil organic matter - pH - nutrient availability. Introduction to precision Agriculture	3
Unit-2	
Sensors for Precision Farming: Soil electrical conductivity as a function of soil water content-Near infrared reflectance spectroscopy-prediction of soil macronutrients content using near infrared spectroscopy	3
Unit-3	
GPS/GIS for Precision Farming: GPS satellites and their orbits-components of a GPS receiver-Accuracy and errors of a GPS receiver-Differential correction-Introduction to Geographic information system-Analyzing GIS Field work: simple operation on a GPS receiver-how to use a GPS receiver-Locating and plotting coordinates on a map	3
Unit-4	
Spatial Data Collection and Soil Sampling: Spatial features and attributes-identifying spatial data-creating a data dictionary-analyzing spatial data and features-Soil Sampling: Dividing a field into grids for sampling-pros and cons of grid sampling-exploring alternatives to grid sampling	3
Unit-5	
Precision Agriculture system Design: Wireless sensor networks for precision agriculture-Sensor motes: TelosB mote, MicaZ motes-prototype wireless sensor network for precision agriculture-design and deploy a wireless sensor network for precision agriculture-WSN for precision agriculture using WiFi and ZigBee-WSN for precision agriculture using custom protocol	3
List of Experiments (If any):	**Practical Hours**

1. Field Work and deployment	30

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Apply the concepts of electronics & communication to solve given real world societal problems through prototypes

CO2: Design solutions to given real world societal problems through working prototypes

CO3: Select appropriate hardware and software as per the requirement of the project designed to solve given real world societal problems

CO4: Understand the impact of the developed projects on environmental factors

CO5: Demonstrate project management skills including handling the finances in doing projects for given real world societal problems

Text Books:

T1. Terry A.Brase, "Precision Agriculture" Thomson/Delmar Learning, 2006

T2. Qin Zhang, " Precision Agriculture Technology for Crop Farming", CRC Press, 2015

Reference Books:

R1. Jao, J.; Bo Sun; Kui Wu, "A Prototype Wireless Sensor Network for Precision Agriculture," in *Distributed Computing Systems Workshops (ICDCSW), 2013 IEEE 33rd International Conference on* , vol., no., pp.280-285, 8-11 July 2013

R2. Tuan Dinh Le; Dat Ho Tan, "Design and deploy a wireless sensor network for precision agriculture," in *Information and Computer Science (NICS), 2015 2nd National Foundation for Science and Technology Development Conference on* , vol., no., pp.294-299, 16-18 Sept. 2015

R3. Maribeth Price, "Mastering ArcGIS", 6th Edition, McGraw Hill Co., 2103

Online Resources:

NIL

Course Name: Internship					
Course Code : EC781					
	L	**T**	**P**	Category	PROJ
Contact Hrs./Week	0	0	4	CIA Marks	50
Contact Hrs./Sem.	0	0	60	ESE Marks	NA
Credits.	0	0	2	Exam Hours	NA

Course objectives: This course aims to expose the students to physical applications of engineering in their related domains. This course enables the students to get a first-hand exposure regarding the working of the industry and also help them to understand the work ethics and principles, time management and project management.

Prerequisites: NIL

Units	**Teaching Hours**
NA	

List of Experiments (If any):	**Practical Hours**
NA	

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Design solutions to real time complex engineering problems using the concepts of Electronics & Communication engineering through independent study

CO2: Demonstrate teamwork and leadership skills with professional ethics

CO3: Prepare an internship report in the prescribed format and demonstrate oral communication through presentation of the internship work

Text Books:

NA

Reference Books:

NA

Online Resources:

NIL

Course Name: Project Work					
Course Code : EC881					
	L	**T**	**P**	Category	PROJ
Contact Hrs./Week	0	0	24	CIA Marks	100
Contact Hrs./Sem.	0	0	360	ESE Marks	100
Credits.	0	0	12	Exam Hours	NA

Course objectives: This course provides the students an opportunity to independently design, develop and conduct investigation of real world societal problems pertaining to the knowledge and application of electronics and communication engineering. This course also aims at building the team working skills in addition to making them work as an individual team member and also provides the students the skills of project management including the finance aspects.

Prerequisites: NIL

Units	**Teaching Hours**
NA	

List of Experiments (If any):	**Practical Hours**
NA	

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Design engineering solutions to complex real world problems using research literature for societal applications through self-study

CO2: Use appropriate hardware and software depending on the nature of the project with an understanding of their limitations

CO3: Demonstrate teamwork and leadership skills with professional ethics and prepare a project report in the prescribed format

CO4: Understand the impact of the developed projects on environmental factors

CO5: Demonstrate project management skills including handling the finances in doing projects for given real world societal problems

Text Books:

NA

Reference Books:

NA

Online Resources:

NIL

PROGRAM ELECTIVE COURSES
PROGRAM ELECTIVE – 1

Course Name: Software Engineering					
Course Code : ECE534E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course aims to be aware of Different life cycle models; Requirement dictation process; Analysis modeling and specification; Architectural and detailed design methods; Implementation and testing strategies; Verification and validation techniques; Project planning and management and Use of CASE tools.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 SOFTWARE PROCESS	
Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy.	9
Unit-2 SOFTWARE REQUIREMENTS	
Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -S/W document. Agile methods, Extreme Programming, SCRUM	9
Unit-3 DESIGN CONCEPTS AND PRINCIPLES	
Design process and concepts – modular design – design heuristic – design model and document. Architectural design – software architecture – data design – architectural design – transform and transaction mapping – user interface design – user interface design principles. Real time systems - Real time software design – system design – real time executives – data acquisition system - monitoring and control system. SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items.	9
Unit-4 TESTING	
Taxonomy of software testing – levels – test activities – types of s/w test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large. S/W testing strategies – strategic approach and issues - unit testing – integration testing – validation testing – system testing and debugging	9
Unit-5 SOFTWARE PROJECT MANAGEMENT	
Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphi method.-	9

Defining a Task Network – Scheduling – Earned Value Analysis – Error Tracking - Software changes – program evolution dynamics – software maintenance – Architectural evolution. Taxonomy of CASE tools – Case Study	
List of Experiments (If any):	**Practical Hours**
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1**: Describe the Software Development Life cycle and various Software process models. **CO2**: Explain software requirement elicitation process and SRS document **CO3**: Determine the user requirements and assign suitable software design model **CO4**: Illustrate different techniques of software testing and maintenance **CO5**: Manipulate the cost estimation techniques and project scheduling methods in software development process	
Text Books: T1. Roger S. Pressman, Software engineering- A Practitioner's Approach, McGraw-Hill International Edition, 6th Edition 2012	
Reference Books: R1. Anirban Basu, "Software Quality Assurance, Testing and Metrics", First Edition, PHI Learning, 2015 R2. Ian Sommerville, "Software engineering," Pearson education Asia, 9th Edition 2013 R3. Pankaj Jalote- "An Integrated Approach to Software Engineering," Narosa publishing house 2011 R4. James F Peters and Witold Pedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2010 R5. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", OUP India 2012	
Online Resources: NIL	

Course Name: Web Programming					
Course Code : ECE534E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The objective of this course is to enable students to understand usage of JAV and HTML tools for internet programming and also to get an exposure in the scripting language of Java script.

Prerequisites:

Units	**Teaching Hours**
Unit-1 HTML 5	
Why HTML5 exists? Structuring a Web Page, Forms, Multimedia (video, audio) markup and APIs, Canvas, Data Storage, Drag & Drop, Messaging & Workers	9
Unit-2 CSS 3	
Understanding CSS and the Modern Web, Learning CSS Syntax and Adding Presentational Styles, Creating Styles Using Property Values, Adding Presentational Styles, Creating A Basic Page Structure, Understanding Display, Position, and Document Flow, Changing and styling fonts, Adding transitions and animations.	9
Unit-3 JAVASCRIPT	
Basic JavaScript Instructions, Functions, Methods & Objects, Decisions & Loops, Document Object Model, Events	9
Unit-4 NoSQL	
Installing MariaDB, Configuring MariaDB, MariaDB Security, MariaDB User Account Management, Using MariaDB.	9
Unit-5 node.js	
The Node Module System, The Node Programming Model, Events and Timers, The Command Line Interface, The File System, Streams, Binary Data, Executing Code, Network Programming, HTTP.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Understand the basic web programming concepts used for internet applications.
CO2: Illustrate the principles of CSS3 used in web programming
CO3: Develop applications using java script

CO4: Explain the database configuration including installation, security and management of Maria DB. **CO5:** Develop web applications using node.js platform.
Text Books: T1. Bruce Lawson, Remy Sharp, "Introducing HTML 5", Pearson Education, 2011 T2. Ian Lunn, "CSS3 Foundations", Wiley Publishers, 2012 T3.Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley Publishers: 2014 T4. Daniel Bartholomew, "Getting started with MariaDB", 2013 T5. Colin J. Ihrig, "Pro Node.js for Developers", APRESS, 2013
Reference Books: R1. Matt West, "HTML5 Foundations", Wiley Publishers: 2012 R2. Training Guide Programming in HTML5 with JavaScript and CSS3 (MCSD) (Microsoft Press Training Guide), 2013.
Online Resources: NIL

Course Name: JAVA Programming					
Course Code : ECE534E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs
Course objectives: The aim of the course is to give a thorough grounding in object-oriented techniques for Java, as well as to examine the major uses of Java - internet programming, design pattern, user interfaces and Networking.					
Prerequisites: NIL					

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
The History of Java, Java's Key Features, The Java Virtual Machine, The First Application. Basic Syntax - Identifiers, Comments, Keywords, The Eight Primitives, Using Objects. Expression and Arrays : Using Operators, The 'If-Else' Statements, Using 'While' Loop, Selecting with 'Switch' statement, Dealing with Primitive Casts. Using Arrays - Creating an Array, Array Initialization, Working with Arrays, Using Multi-dimensional Arrays. Classpath & JARs: The 'Classpath' in Java, Java Archives	9
Unit-2 CLASSES	
Classes & Packages, The 'import' Statement, The Importance of Encapsulation, Java Constructors, Access Modifiers (private, default and public), Method Overloading. Polymorphism and Inheritance: The 'Protected' Modifier, Using 'this' and 'super', The 'final' keyword, Static Members & Methods. Interfaces & Abstract Classes, The Complete Construction Process, The Class 'Object', Nested Classes, Enums in Java	9
Unit-3 BASIC DESIGN PATTERNS	
Basic Concepts of Design Patterns, Iterators, The Pattern Concept, The OBSERVER Pattern, Layout Managers and the STRATEGY Pattern, components, Containers, and the COMPOSITE Pattern, Scroll Bars and the DECORATOR Pattern. The Java Object Model: The Java Type System, Type Inquiry, the Object Class, Shallow and Deep Copy, Serialization, Reflection.	9
Unit-4 EXCEPTIONS, COLLECTIONS AND IO	
Exceptions & Assertions: Types of Program Errors, The Exception Model, Checked and Unchecked Exceptions, Defining Custom Exceptions, Assertions. Working with Common Classes: java.lang.String, java.lang.System, java.util.Calendar. The Java Collection Framework & Generics: List Basics, Using Lists Wisely, Other Collection Classes. Java IO: Input Stream/Output Stream, Java Serialization, Readers & Writers, Working with Files	9
Unit-5 THREAD AND APPLET	

Threads: The Java Thread Model, Thread Priorities, Synchronization, Messaging, Thread Class, Runnable Interface. Applet Architecture – Skeleton- Simple Applet Display Methods- HTML APPLET tag – Passing Parameters to the Applet- AudioClip and AppletStub Interface - Delegation Event Model – Event Classes.Networking: Overview, TCP/IP Sockets, Writing Your Own Web Server	9
List of Experiments (If any): NIL	**Practical Hours**
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1**: Understand the Object Basics, Platform independency, Arrays. **CO2**: Apply the object oriented concept of Classes and Objects, encapsulation, Inheritance, Polymorphisms to solve real problems. **CO3**: Demonstrate the design pattern using JAVA **CO4**: Explain the exception cases and the I/O operations in JAVA Programming **CO5**: Develop simple web applications using Applet	
Text Books: T1. Herbert Schildt, "Java The Complete Reference", Eighth Edition, Tata Mc Graw-Hill Edition India, 2011 T2. Cay Horstmann, "Object Oriented Design & Patterns", John Wiley & Sons, 2004.	
Reference Books: R1. Bruce Eckel, "Thinking in Java", 4th edition, Pearson Education, 2006 R2. Ramesh Vasappanavara et al, "Object-oriented Programming Using C++ and Java", First Impression, Pearson, 2011 R3. Cay Horstmann, "Big Java 4e for Java 7 and 8", John Wiley & Sons, 2010	
Online Resources: NIL	

Course Name: Operating Systems					
Course Code : ECE534E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: The Objectives of this course is to have an overview of different types of operating systems. They also include an understanding of the components of an operating system; To develop knowledge of process management and have a thorough knowledge of storage management; To know the concepts of I/O and file systems.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
What operating systems do, Computer System Architecture, Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security; System Structures: Operating System Services, User Operating System Interface, System Calls, Types of System Calls.	9
Unit-2 PROCESS MANAGEMENT	
Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; Threads: Overview, Multithreading Models, Thread Libraries; CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling	9
Unit-3 PROCESS SYNCHRONIZATION AND DEADLOCKS	
Background, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples.	9
Unit-4 MEMORY MANAGEMENT AND VIRTUAL MEMORY	
Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging, Virtual Memory: Background, Demand Paging, Copy on Write, Page Replacement, Allocation of frames, Thrashing, Allocating Kernel Memory	9
Unit-5 FILE SYSTEM INTERFACE AND FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE	
File System Interface: File System: File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection; File System Implementation & Mass Storage Structure: Implementing File Systems: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management. Disk structure, Disk Attachment, Disk Scheduling Methods, Disk Management, Swap-Space Management	9
List of Experiments (If any):	**Practical Hours**

Self-study : NIL
Site/Industrial Visits : NIL
Course outcomes: At the end of the course, the student will be able to : **CO1**: Explain structure, services and functionalities of operating systems. **CO2**: Compute system performance with respect to Job Scheduling and process synchronization concepts **CO3**: Analyze deadlocks and memory management strategies to improve fault tolerance **CO4**: Illustrate virtual memory management technique to reduce access time of data from memory **CO5**: Implement File System to distribute file structure across the memory
Text Books: T1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2013
Reference Books: R1. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education Pvt. Ltd, 2007 R2. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt. Ltd, 2009 R3. William Stallings, "Operating System", Pearson Education 2009 R4. Pramod Chandra P. Bhatt – "An Introduction to Operating Systems, Concepts and Practice", PHI, 2010
Online Resources: NIL

PROGRAM ELECTIVE -2

Course Name: Sensors and Transducers					
Course Code : ECE535E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The aim of this course is to enable the student to understand the basic requirements of measurement in industrial applications. It will enable the student to determine the types of transducers to be used for the measurement of various physical quantities and principle of measurement of strain, force, torque and pressure.

Prerequisites:

Units	**Teaching Hours**
Unit-1 MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS	
Measurements, Basic method of measurement, Generalized scheme for measurement systems, Errors, Classification of errors, error analysis, Statistical methods, Sensor, Transducer, Classification of transducers, Basic requirement of transducers	9
Unit-2 MEASUREMENT OF STRAIN	
Introduction, Factors affecting strain measurements, Types of Strain Gauges, Theory of operation of resistance strain gauges, Types of Electrical Strain Gauges – Wire gauges, unbounded strain gauges, foil gauges, semiconductor strain gauges principle, types, Materials for Strain Gauges, Strain gauge Circuits – Wheatstone bride circuit, Applications.	9
Unit-3 MEASUREMENT OF FORCE & TORQUE	
Introduction, Force measuring sensor – Load cells – column types devices, proving rings, cantilever beam, pressductor. Hydraulic load cell, Electronic weighing system. Torque measurement: Absorption type, transmission type, stress type & deflection type.	9
Unit-4 MEASUREMENT OF PRESSURE	
Introduction, Diaphragms Other elastic elements, Transduction methods – potentiometric device, strain gauge transducer, variable reluctance, LVDT type, variable capacitance device, force balance transducer with analysis, thin-film pressure transducers, piezoelectric pressure transducer, pressure multiplexer, pressure calibration.	9
Unit-5 MISCELLANEOUS SENSORS AND TRANSDUCERS	

Noise (sound) Sensors, Speed Sensors, Thickness Measurement, Weather stations. Piezoelectric transducer, Hall Effect transducers, Smart sensors, Fiber optic sensors, Film sensors, MEMS, Nano sensors, Digital transducers.	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand the need for measurement and error analysis **CO2**: Relate the physical quantities with the electrical parameters **CO3:** Choose the appropriate transducer for the measurement of strain, force, torque, pressure **CO4:** Create electronic systems with the various sensors and transducers	
Text Books: T1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai , 2007 T2. C. S. Rangan, G. R. Sarma, V. S. V. Mani , "Instrumentation: Devices and Systems", 2nd Edition, McGraw Hill Education (India), 2014	
Reference Books: R1. John. P, Bentley, "Principles of Measurement Systems", 3rd Edition, Pearson Education, 2000 R2. Murthy. D. V. S, "Transducers and Instrumentation", Prentice Hall of India, 2001	
Online Resources: NIL	

Course Name: Control Systems					
Course Code : ECE535E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs
Course objectives: This course aims at providing students knowledge in the basic concepts of linear control theory, modern control theory and design of control systems.					
Prerequisites: NIL					

Units	**Teaching Hours**
Unit-1 SYSTEMS AND THEIR REPRESENTATION	
Basic elements in control systems – Open and closed loop systems – Transfer function. Mathematical Modeling of Systems: Electrical Systems, Mechanical Systems[Translational and Rotational Mechanical Systems], Electro Mechanical Systems. Liquid Level Systems. Electrical analogy of mechanical Systems– Force Voltage and Force Voltage Analogy Block Diagram - Block diagram reduction techniques – Signal flow graphs – Mason's Gain Formula	9
Unit-2 TIME RESPONSE	
Time response – Transient and Steady State Response. Order and Type of System. Concept of Poles and Zeros. Response of First Order Systems to Unit Impulse Input, Unit Step Input and Unit Ramp Input. Response of Second Order Systems to Unit Impulse Input, and Unit Step Input. Time domain specifications – Peak Time, Rise Time, Maximum Overshoot, Settling Time. Error: Steady State Error, Static Error Constants - Generalized error series – Dynamic Error Constants – Controllers, P, PI, PID modes of feedback control	9
Unit-3 STABILITY OF CONTROL SYSTEM	
Stability of Control Systems: BIBO Stability. Location of poles and stability. Characteristics equation –Routh Hurwitz criterion Root Locus – Effect of pole, zero addition, Simple design using Root Locus.	9
Unit-4 FREQUENCY RESPONSE	
Frequency response – Frequency Response Specifications – Gain Margin, Phase Margin, Bandwidth, Resonant Peak, Resonant Frequency. Bode plot – Constant Gain, Simple and Repeated Pole, Simple and Repeated Zero. Polar plot – Nyquist Stability Criterion. Determination of closed loop response from open loop response. Compensation - Lead, Lag, Lead Lag Compensation	9
Unit-5 INTRODUCTION TO MODERN CONTROL THEORY	
State Space Analysis - State Model - State vector - Modeling of electrical and mechanical systems in state space. Decomposition of transfer function - Direct, Cascade, Parallel. State Transition Matrix, Properties, Solution of State Space Equation - Observability and Controllability – Kalman's and	9

Gilbert's Test	

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Describe and categorize linear continuous- time control systems and able to apply the mathematical tool of Laplace transform with aim of obtaining transfer function of physical systems.

CO2: Developing the ability to describe and apply the methods of block diagram reduction and signal flow graph for analysis of transfer function of linear continuous time systems.

CO3: Describe and categorize parameters like time constant of first order systems and rise time, overshoot, settling time of second order systems and able to determine the response for standard inputs and errors.

CO4: Analyze the stability of a linear continuous- time system using method of Routh-Hurwitz criteria and to construct root locus, bode plot, polar plot and M-N circles for systems.

CO5: Solve continuous-time systems in state space form in general, also in different standard forms of state space representation and can carry conversion from transfer function representation to state space form and vice versa.

Text Books:

T1. K. Ogata,"Modern Control Engineering", 5th edition, Pearson Education, NewDelhi, 2014 / PHI.

T2. I.J. Nagrath & M. Gopal, "Control Systems Engineering", 4th edition,New Age International Publishers, 2015

Reference Books:

R1**.** M. Gopal, "Control Systems, Principles & Design", 4th edition, Tata McGraw Hill, New Delhi, 2012

Online Resources:

NIL

Course Name: Industrial Instrumentation					
Course Code : ECE535E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:

The aim of this course is to enable the student to understand various measuring techniques for force, torque velocity, acceleration, vibration, density, pressure and temperature and have an in-depth knowledge in units, different techniques, and significance of measuring devices

Prerequisites:

Units	**Teaching Hours**
Unit-1 MEASUREMENT OF FORCE, TORQUE, VELOCITY	
Basic methods of measurement of force (weight) :scales and balances- mechanical balances- electro magnetic balance – Different types of load cells : hydraulic load cells - pneumatic loadcell - magneto elastic (pressductor)- strain gauge loadcell - proving ring. Different methods of torque measurement: Strain gauge, Relative regular twist-measurement of torque with spur gears – and proximity sensors. Speed and velocity measurement: Revelution counter- Capacitive tachometer -Drag cup type tacho meter- D.C and A.C tacho generators – Stroboscope- translational velocity transducers. Velocity measurement using variable reluctance proximity pickup. Calibration methods	9
Unit-2 MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY	
Accelerometers – potentiometric type – LVDT- Piezo-electric, capacitive - Strain gauge and variable reluctance type accelerometers. Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – measurement of relative motion - Calibration of vibration pickups, Units of density, specific gravity and viscosity used in industries – Baume scale API scale – hydro meter- density measurement using LVDT- differential pressure method- pressure head type densitometer – float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer- coriolis densitometer	9
Unit-3 PRESSURE MEASUREMENT	
Units of pressure – different types of pressure- Manometers – Different types –errors in manometers- Elastic type pressure gauges – Bourden tube - Bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – potentiometric pressure transducers- Capacitive type pressure gauge –Piezo electric pressure sensor –Resonator pressure sensor – optical pressure transducers- pressure switches- Measurement of vacuum – McLeod gauge –Thermal vacuum gauges – Ionization gauge -Testing and calibration of pressure gauges – Dead weight tester- Bulk gauge(high pressure measurement).	9
Unit-4 TEMPERATURE MEASUREMENT	

Definitions and standards – Primary and secondary fixed points – Calibration of thermometers - Different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – resistance thermometers-3 lead and 4 lead RTDs - Thermistors –Linearization techniques.	9
Unit-5 THERMOCOUPLES	
Thermocouple junctions- Law of thermocouple – Fabrication of industrial thermocouples– Signal conditioning of thermocouple output –– Commercial circuits for cold junction compensation –– Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement –Radiation fundamentals – Total radiation pyrometers – Optical pyrometer – infra red pyrometers- Two colour radiation pyrometer.- IC temperature sensors- fiber optic temperature measurement- calibration of temperature transducers.	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Describe and categorize measurement of physical parameters like pressure, torque, temperature, velocity , acceleration, density **CO2**: apply the methods of measurements of parameters like pressure, torque, temperature, velocity , acceleration, density **CO3:** Develop the ability to calibrate and understand the variety of methods of industrial instrumentation **CO4:** Describe the units of pressure, vibration, density, acceleration, temperature and relate to the principles used to quantify these parameters using applicable transducers **CO5:** Analyze the special techniques to measure low values and high values of physical parameters and the special types of transducers used for these applications	
Text Books: T1. A.K.Sawhney, A course in mechanical measurements and Instrumentation–Dhanpat Rai and Sons, New Delhi, 2009 T2. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi	
Reference Books: R1. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi R2. B.C.Nakra and K.K.Chaudary, Instrumentation Measurement and Analysis, Tata McGraw Hill Publishing Company Ltd., New Delhi R3. S.K.singh, industrial instrumentation and control, Tata McGraw Hill Publishing Ltd., New Delhi, 2006	
Online Resources: NIL	

Course Name: NEMS and MEMS for Engineers					
Course Code : ECE535E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The aim of this course is to introduce scope and recent development of the science and technology of micro-and nano-systems, understand the physical knowledge underlying the operation principles and design of micro-and nano-systems and some typical or potentially applicable micro-and nano-systems at the frontier of the development of the field

Prerequisites:

Units	**Teaching Hours**
Unit-1 OVERVIEW OF NANO- AND MICROELECTROMECHANICAL SYSTEMS	
New trends in Engineering and Science: Micro and Nano scale systems, Introduction to Design of MEMS and NEMS, Micro electromechanical systems, devices and structures	9
Unit-2 MEMS nanofabrication	
Photolithography, Ion Implantation, Diffusion, Oxidation, LPCVD, Sputtering, Evaporation, Electroplating, Dry and wet etching, electrochemical etching, Bulk Micromachining, Surface micromachining	9
Unit-3 MEMS and NEMS Architecture	
Classification, biomimetics, scaling laws, MEMs architectures, CMOS and NEMS hybrid architectures, Silicon in MEMS, Silicon-on-Insulator, material selection for application in MEMS	9
Unit-4 Microsensors and Microactuators	
Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors, Design of Actuators using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals	9
Unit-5 MEMS/NEMS Applications	
Molecular and carbon nanoelectronics, MEMS packaging for space applications, micro energy harvesting, RF MEMs-NEMS antenna, polymer MEMS, case study of selected MEMS products – blood pressure sensor, microphone, acceleration sensors	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Understand the recent trends in engineering for small scale devices
CO2: Understand the various process and techniques used for the fabrication of MEMS and

NEMS devices

CO3 : Understand basic architecture for MEMS-NEMS design and the criteria for material selection

CO4 : Describe microsensors and microactuators

CO5: Understand the various application of MEMS-NEMS devices

Text Books:

T1. Sergey Edward Lyshevski, "Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering", Second Edition, 2nd Edition, , CRC Press, 2005

T2. Chang Liu, 'Foundations of MEMS', Pearson Education India, 2012

Reference Books:

R1. Mems/Nems: (1) Handbook Techniques and Applications Design Methods, (2) Fabrication Techniques, (3) Manufacturing Methods, (4) Sensors and Actuators, (5) Medical Applications and MOEMS, Springer Science & Business Media, Cornelius T. Leondes, 2007

R2. Laurent Duraffourg, Julien Arcamone, "Nanoelectromechanical Systems" , John Wiley & Sons, 2015

Online Resources:

NIL

PROGRAM ELECTIVE-3

Course Name: ARM System Architecture					
Course Code : ECE634E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs
Course objectives: The objective of this course is to understand the ARM architecture, memory and programming concepts					
Prerequisites:					

Units	**Teaching Hours**
Unit-1 ARM PROCESSOR ARCHITECTURE	
The RISC and ARM design philosophy, Embedded System Hardware. ARM PROCESSOR FUNDAMENTALS**:** Data Flow model, Registers, modes of operation, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table ARM nomenclature and families. Big Endian and Little Endian	9
Unit-2 ARM INSTRUCTIONS SETS AND INTERRUPTS	
ARM and Thumb Instruction Sets, Data Processing Instructions, Branch Instructions, Load- Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Conditional Execution, Stack Instructions, Software Interrupt Instruction. Arm processor exceptions and modes**:** vector table, priorities, link Register offsets, interrupts, and IRQ / FIQ exceptions interrupt stack design and implementation. SIMPLE PROGRAM**:** Addition, Subtraction, Multiplication in assembly	9
Unit-3 CACHE MECHANISM	
Introduction to cache memory, memory hierarchy and cache memory, Cache architecture and cache policies. Concept of flushing and cleaning cache**:** Flushing and Cleaning ARM cache core. Concept of cache lockdown**:** Locking Code and Data in Cache. Cache and write buffer.	9
Unit-4 MEMORY PROTECTION AND MANAGEMENT UNIT	
Introduction to protection unit, Protected Regions, and Demonstration of an MPU system. Virtual Memory working principle	9
Unit-5 EMBEDDED OS AND RTOS	
Fundamental Components to Embedded OS, Simple Little Operating System: Initialization, memory model, interrupts and exceptions handling, Scheduler, and context switch. Introduction to RTOS: Real-time systems concepts, foreground/background systems, critical sections, resources, multitasking, Context switching, scheduling, re-entrancy, task priorities, mutual exclusion	9

Self-study : NIL
Site/Industrial Visits : NIL
Course outcomes: At the end of the course, the student will be able to : **CO1:** Demonstrate concepts of programming model of ARM processors. **CO2**: Describe the programming techniques using ARM processors. **CO3:** Understand the Memory organization & management concepts of ARM processors **CO4**: Use concepts of embedded Real-time operating systems
Text Books: T1. Andrew Sloss, "ARM System Developer's Guide Designing and Optimizing", Elsevier publication, 2004. T2. Jean J. Labross, "MicroC/OS – II" second edition The Real Time Kernel , Viva Books Private Ltd 2nd edition , 2002
Reference Books: R1**.** B.Kantha Rao, "Embedded systems", PHI publishers, Eastern Economy Edition, PHI Learning Pvt.Ltd 2011 R2. Steve Furbe, "ARM System-on-Chip Architecture" 2nd Edition, Pearson Publications, 2000 R3. Dr. K.V.K.K PRASAD, "Embedded/Real Time Systems", Dream tech press, 2009
Online Resources: O1: https://www.springer.com/in/book/9783540899327

Course Name: Automotive Electronics					
Course Code : ECE634E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The aim of this course is to enable student to understand the complete dynamics of automotive electronics, design and implementation of the electronics that contributes to the safety of the automobiles, add-on features, and comforts.

Prerequisites:

Units	**Teaching Hours**
Unit-1 AUTOMOTIVE FUNDAMENTALS	
Use of Electronics In The Automobile, Antilock Brake Systems, (ABS), Electronic steering control, Power steering, Traction control, Electronically controlled suspension	9
Unit-2 AUTOMOTIVE INSTRUMENTATION CONTROL	
Sampling, Measurement and signal conversion of various parameters. Sensors and Actuators, Applications of sensors and actuators	9
Unit-3 BASICS OF ELECTRONIC ENGINE CONTROL	
Integrated body- Climate controls, Motivation for Electronic Engine Control, Concept of An Electronic Engine Control System, Definition of General Terms, Definition of Engine Performance Terms, Electronic fuel control system, Engine control sequence, Electronic Ignition, air flow rate sensor, Indirect measurement of mass air flow, Engine crankshaft angular position sensor, Automotive engine control actuators, Digital engine control, Engine speed sensor ,Timing sensor for ignition and fuel delivery, Electronic ignition control systems, Safety systems, Interior safety, Lighting, Entertainment systems	9
Unit-4 VEHICLE MOTION CONTROL AND AUTOMOTIVE DIAGNOSTICS	
Cruise control system, Digital cruise control, Timing light, Engine analyzer, On-board and off-board diagnostics, Expert systems. Stepper motor based actuator, Cruise control electronics, Vacuum – antilock braking system, Electronic suspension system Electronic steering control, Computer-based instrumentation system, Sampling and Input\output signal conversion, Fuel quantity measurement, Coolant temperature measurement, Oil pressure measurement, Vehicle speed measurement, Display devices, Trip-Information- Computer, Occupant protection systems	9

Unit-5 FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS	
Alternative Fuel Engines, Collision Wide Range Air/Fuel Sensor, Alternative Engine, Low Tire Pressure Warning System, Collision avoidance Radar Warning Systems, Low Tire Pressure Warning System, Radio Navigation, Advance Driver information System. Alternative-Fuel Engines, Transmission Control , Collision Avoidance Radar Warning System, Low Tire Pressure Warning System, Speech Synthesis Multiplexing in Automobiles, Control Signal Multiplexing, Navigation Sensors, Radio Navigation, Sign post Navigation , Dead Reckoning Navigation Future Technology, Voice Recognition Cell Phone Dialing Advanced Driver information System, Automatic Driving Control	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Implement various control requirements in the automotive system **CO2**: Comprehend dashboard electronics and engine system electronics **CO3:** Identify various physical parameters that are to be sensed and monitored for maintaining the stability of the vehicle under dynamic conditions **CO4:** Understand and implement the controls and actuator system pertaining to the comfort and safety of commuters **CO5:** Design sensor network for mechanical fault diagnostics in an automotive vehicle	
Text Books: T1. A William B. Ribbens, "Understanding Automotive Electronics",6th Edition SAMS/Elsevier publishing, 2007	
Reference Books: R1. Robert Bosch Gmbh,"Automotive Electrics and Automotive Electronics- Systems and Components, Networking and Hybrid Drive", 5th Edition, Springer**,** Vieweg, 2007	
Online Resources: NIL	

Course Name: Real Time Operating Systems					
Course Code : ECE634E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course aims at exposing the students to the fundamentals of interaction of OS with a computer and study on programming logic of modeling Process based on range of OS features, make them understand the fundamental concepts of how process are created and controlled with OS and User computation.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 REVIEW OF OPERATING SYSTEMS	
Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems	9
Unit-2 OVERVIEW OF RTOS	
RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks	9
Unit-3 REAL TIME MODELS AND LANGUAGES	
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements	9
Unit-4 REAL TIME KERNEL	
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.	9
Unit-5 APPLICATION DEVELOPMENT	
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application – Case study.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Operating System structures and types

CO2: Explain scheduling, disciplining of various processes execution.

CO3: Apply RTOS support modeling to real time problems.

CO4: Understand commercial RTOS Suite features to work on real time processes design.

CO5: Develop an application using the RTOS fundamentals.

Reference Books:

R1**.** Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003.

R2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997

R3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006.

R4. Karim Yaghmour,Building Embedded Linux System",O'reilly Pub,2003

R5. Mukesh Sighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill,2000

Online Resources:

NIL

Course Name: Electromagnetic Fields					
Course Code : ECE634E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

Course objectives: This course aims at imparting the fundamental concepts of Electrostatics and static magnetic fields, basic concepts of Time varying fields and their behaviour in different media, give understanding about analysis of fields in different geometries and application areas of electromagnetic fields

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 STATIC ELECTRIC FIELDS	
Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Coordinate System – Introduction to line, Surface and Volume Integrals – Flux and circulation- Definition of Curl, Divergence and Gradient – Meaning of Strokes theorem and Divergence theorem. Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Principle of Superposition – Electric Flux Density – Gauss Law – Proof of Gauss Law – Applications. Charge distributions-line, surface, volume Electric Scalar Potential – Relationship between potential and electric field - Potential due to electrical dipole - Poisson's and Laplace's equation – Electrostatic energy and energy density - Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current	9
Unit-2 STATIC MAGNETIC FIELD	
The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite current carrying wire – Magnetic field intensity on the axis of a circular and rectangular current carrying loop – Ampere's circuital law and simple applications. Current distributions –line, surface and volume. Magnetic flux density – The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential-Energy density in magnetic fields – Nature of magnetic materials – magnetization and permeability - magnetic boundary conditions.	9
Unit-3 TIME VARYING ELECTRIC AND MAGNETIC FIELDS	
Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law –Equation expressed in point form. Displacement current – Ampere's circuital law in integral form – Modified form of Ampere's circuital law as Maxwell's first equation in integral form – Equation	9

expressed in point form. Maxwell's four equations in integral form and differential form	
Unit-4 ELECTROMAGNETIC WAVES	
Derivation of Wave Equation – Uniform Plane Waves – Maxwell's equation in Phasor form – Wave equation in Phasor form – Plane waves in free space and in a homogenous material. Wave equation for a conducting medium – Plane waves in lossy dielectrics –Propagation in good conductors – Skin effect- Problems. Poynting Vector and the flow of power. Poynting theorem - Instantaneous Average and Complex Poynting Vector.	9
Unit-5 REFLECTION AND REFRACTION OF UNIFORM PLANE WAVES	
Polarization-Boundary conditions in vector form - Interaction of waves with dielectric materials- Normal incidence, Oblique incidence, Snell's law, Field distribution in both the cases. Total internal reflection-Brewster angle. Interaction of waves with perfect conductor- Normal and oblique incidence- Field distribution in both the cases- Field equations on perfect conductor parallel plates.	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Demonstrate the field's potentials due to static changes **CO2:** Demonstrate behaviour of static electric and magnetic fields. **CO3:** Understand the behaviour of electric and magnetic fields in different media. **CO4:** Demonstrates the electric and magnetic fields with respect to time. **CO5:** Demonstrates the uniform wave propagation in electric field.	
Text Books: T1. M. N. O. Sadiku., "Elements of Engineering Electromagnetics", Oxford University Press, 5th Edition 2010. T2. E.C. Jordan and K.G. Balmain., "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2/E 2ndEdition 2003. T3. Karl E. Lonngren, Sava V. Savov, Randy J. Jost.,"Fundamentals of Electromagnetics with MATLAB", SciTech Publishing Inc.,2nd Edition 2007.	
Reference Books: R1**.** RamoWhinnery and Van Duzer., "Fields and Waves in Communications Electronics", John Wiley & Sons, 3rd Edition 2003. R2. NarayanaRao, N., "Elements of Engineering Electromagnetics", Prentice Hall of India, New Delhi, 6thEdition 2004. R3. William H.Hayt and John A Buck., "Engineering Electromagnetics", McGraw-Hill, 6th Edition 2003.	
Online Resources: NIL	

PROGRAM ELECTIVE-4

Course Name: Cryptography and Network Security					
Course Code : ECE635E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs
Course objectives: This course introduces the various aspects of secured data transmission and reception. It deals with the study about various encryption and decryption techniques and standards. Finally it discusses about network security practices and system security					
Prerequisites:					
Units					**Teaching Hours**
Unit-1 SYMMETRIC CIPHERS – TECHNIQUES AND STANDARDS I					
Introduction: Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques:Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data Encryption Standard: Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation					9
Unit-2 SYMMETRIC CIPHERS – TECHNIQUES AND STANDARDS II					
Advanced Encryption Standard: Evaluation Criteria for AES, AES Cipher; More on Symmetric Ciphers: 2DES, Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation					9
Unit-3 PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS					
Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems: Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication Protocols- Digital Signatures, Authentication Protocols, Digital Signature Standards					9
Unit-4 NETWORK SECURITY PRACTICE					
Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security-					9

Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction	
Unit-5 SYSTEM SECURITY	
Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems	9
List of Experiments (If any): Nil	**Practical Hours**
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Explain the symmetric ciphers using DES **CO2:** Describe the symmetric ciphers based on AES standard **CO3:** Understand the key management and public key cryptosystem **CO4:** Illustrate the Hash Functions, Authentication Protocol and Digital Signature **CO5 :** Understand system security measures against Malicious Software	
Text Books: T1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007 T2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012 T3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012. T4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012	
Reference Books: R1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012 R2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007 R3. Pete Warden, "Big Data Glossary", O'Reilly, 2011 R4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier, Reprinted 2008. R5. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007 R6. .Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012 R7. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach",VPT, 2016 R8. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014	
Online Resources: NIL	

Course Name: C# and .NET					
Course Code : ECE635E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The objective of this course is to make the students understand the foundations of CLR execution and the technologies of the .NET framework along with the object oriented aspects of C#

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO C#	
Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	9
Unit-2 OBJECT ORIENTED ASPECTS OF C#	
Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading	9
Unit-3 APPLICATION DEVELOPMENT ON .NET	
Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration	9
Unit-4 WEB BASED APPLICATION DEVELOPMENT ON .NET	
Programming web application with web forms, ASP.NET introduction, working with XML and .NET,Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server	9
Unit-5 CLR AND .NET FRAMEWORK	
Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes: At the end of the course, the student will be able to : **CO1:** Explain the major elements of the .NET frame work, **CO2**: Analyze the basic structure of a C# application **CO3:** Develop programs using C# on .NET. **CO4:** Design and develop Web based applications on .NET. **CO5**: Explain CLR framework.
Text Books: T1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2012. T2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012
Reference Books: R1. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010 R2 Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O□Reilly, 2010.
Online Resources: NIL

Course Name: Big Data Analytics					
Course Code : ECE635E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: This course provides an overview about the fundamentals of big data analytics, analyze the big data using intelligent techniques, understand the various search methods and visualization technique and also to use various techniques for mining data stream.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction to big data : Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.	9
Unit-2 MINING DATA STREAMS	
Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions	9
Unit-3 HADOOP	
History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce FeaturesHadoop environment.	9
Unit-4 FRAMEWORKS	
Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams.	9
Unit-5 PREDICTIVE ANALYTICS	
Simple linear regression- Multiple linear regression- Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.	9
List of Experiments (If any): Nil	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Explain the basic concepts of analog modulation schemes

CO2: Discriminate analog modulated waveforms in time /frequency domain and also find modulation index

CO3: Understand the types of pulse modulation techniques and Conversion of analog signal to digital format

CO4: Illustrate the baseband pulse transmission

CO5 : Understand the fundamental concept of spread spectrum modulation

Text Books:

T1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007

T2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012

T3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

T4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012

Reference Books:

R1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012

R2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007

R3. Pete Warden, "Big Data Glossary", O'Reilly, 2011

R4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2 nd Edition, Elsevier, Reprinted 2008.

R5. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007

R6. .Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012

R7. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach",VPT, 2016

R8. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014

Online Resources:

NIL

Course Name: Cloud Computing and Grid Computing					
Course Code : ECE635E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The objective of this course is to enable students to understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges, know the concepts pertaining to the grid Computing environment and to nurture the students to design and applications and infrastructures for Grid.

Prerequisites:

Units	**Teaching Hours**
Unit-1 UNDERSTANDING CLOUD COMPUTING	
Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages/Disadvantages of Cloud Computing – Types of Cloud – Architecture of Cloud– Cloud Services- Web-Based Application – Pros and Cons of Cloud Service Development	9
Unit-2 CLOUD COMPUTING TECHNOLOGY	
Hardware and Infrastructure: Clients – Security – Network –Services; Accessing the Cloud: Platforms – Web Applications – Web API; Cloud Storage: Overview – Cloud storage providers – Standards: Application – client – Infrastructure – Service.	9
Unit-3 USING CLOUD PLATFORMS	
Understanding Abstraction and Virtualization– Capacity Planning – Exploring Platform as a Service – Using Google web services – Using Amazon web services – Using Microsoft Cloud services	9
Unit-4 INTRODUCTION TO GRID COMPUTING	
Grid Computing Concept, History of Distributed Computing Computational Grid Applications, Grid Computing Infrastructure Development, Grid Computing Software Interface Job Submission: Introduction, Globus Job Submission, Transferring Files	9
Unit-5 GRID INFRASTRUCTURE	
System Infrastructure I Web Services: Service-Oriented Architecture, Web Services and Web Service Implementation. System Infrastructure II: Grid Computing Services: Grid Computing and Standardization Bodies, Interacting Grid Computing Components, Open Grid Services Architecture (OGSA), WSRF. User-Friendly Interfaces: Introduction Grid Computing Workflow Editors, Grid Portals.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Explain the core concepts of the cloud computing paradigm including the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO2: Apply cloud computing in existing web applications

CO3: Use cloud platforms including the Google, Amazon and Microsoft web services.

CO4: Explain the concept of grid computing with respect to applications, interface and job submission.

CO5: Examine grid services and interfaces for developing grid based applications.

Text Books:

T1. Anthony Velte, Toby Velte, and Robert Elsenpeter, "Cloud Computing – A Practical Approach", McGraw Hill. 2010

T2. Rajkumar Buyya, Vecchiola, Selvi, "Mastering Cloud Computing", McGraw Hill. 2013

T3. Barry Wilkinson, "Grid Computing Techniques and Applications", CRC Press, 2010

T4. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, "Introduction to Grid Computing", CRC Press, 2009

Reference Books:

R1. Matt Massimo Cafaro and Giovanni Aloisio, "Grids, Clouds and Virtualization", Springer 2011

R2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley 2011.

R3. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008

R4. Vladimir Silva, "Grid Computing for Developers ", Dreamtech Press, 2006

R5. Ian Foster, Carl Kesselman. "The Grid 2- Blueprint for a new computing Infrastructure", Elsevier Series, 2004

R6. Fran Berman, Geoffrey Fox. Anthony J.G Hey, "Grid Computing: Making the Global Infrastructure a Reality", Wiley, 2003.

Online Resources:

NIL

Course Name: Mobile Computing					
Course Code : ECE635E5					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The objective of this course is to enable students to understand the basic concepts of mobile computing and mobile telecommunication system and be familiar with the network layer protocols and Ad-Hoc networks.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA	9
Unit-2 MOBILE TELECOMMUNICATION SYSTEM	
Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRSUMTS – Architecture – Handover - Security	9
Unit-3 MOBILE NETWORK LAYER	
Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security	9
Unit-4 MOBILE TRANSPORT AND APPLICATION LAYER	
Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML	9
Unit-5 MOBILE PLATFORMS AND APPLICATIONS	
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Explain the basics of mobile telecommunication systems.
CO2: Illustrate the generations of telecommunication systems in wireless networks
CO3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
CO4: Explain the functionality of Transport and Application layers.

CO5: Develop a mobile application using android/blackberry/ios/Windows SDK.
Text Books: T1. Jochen Schiller, ―Mobile Communications‖ , PHI, Second Edition, 2003 T2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖ , PHI Learning Pvt.Ltd, New Delhi – 2012
Reference Books: R1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005 R2Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing, Springer, 2003. R3. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition,TataMcGraw Hill Edition ,2006 R4. C.K.Toh, ―AdHoc Mobile Wireless Networks‖ , First Edition, Pearson Education, 2002
Online Resources: O1. Android Developers : http://developer.android.com/index.html O2. Apple Developer : https://developer.apple.com/ O3. Windows Phone DevCenter : http://developer.windowsphone.com

Course Name: Soft Computing					
Course Code : ECE635E6					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
The objective of this course is to enable students to basic concepts of Soft Computing and become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems and apply soft computing techniques to solve problems

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO SOFT COMPUTING	
Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.	9
Unit-2 ARTIFICIAL NEURAL NETWORKS	
Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network-Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models	9
Unit-3 FUZZY SYSTEMS	
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making	9
Unit-4 GENETIC ALGORITHMS	
Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm	9
Unit-5 HYBRID SYSTEMS	
Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Explain the fundamental concepts involved in Soft Computing

CO2: Understand the neural network concepts and the major neural networks

CO3: Describe the fundamental aspects of fuzzy logic.

CO4: Summarize the concepts of genetic algorithms.

CO5: Explain hybrid systems which involves neural networks and fuzzy logic.

Text Books:

T1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015

T2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011

T3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017

Reference Books:

R1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002

R2. Kwang H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer, 2005

R3. George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996

R4. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003

Online Resources:

NIL

PROGRAM ELECTIVE-5

Course Name: Biomedical Signal Processing					
Course Code : ECE734E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs
Course objectives: The objective of the course is to apply knowledge of math, engineering and science to understand the principle of biomedical signal processing, also understand how specific mathematical techniques are applied to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum and calculation of Heart Rate Variability)					
Prerequisites:					
Units					**Teaching Hours**
Unit-1 INTRODUCTION TO BIOMEDICAL SIGNALS					
Objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, Nature of biomedical signals - types, classification, origin, Computer aided diagnosis, Neurological signal processing, Time frequency analysis- wavelets, types, characteristics, applications, Examples of biomedical signals - ENG, EOG, EGG, bioimpedance signals, Mechanical signals, bioacoustic signals, biochemical signals, IoT in biomedical signal processing-tutorial/assignment					9
Unit-2 CARDIOLOGICAL SIGNAL PROCESSING					
Basic ECG - electrical activity of heart, Event detection – ECG, Concurrent coupled and correlated process-ECG,PCG, AOG and Carotid, ECG data acquisition, parameters and estimation, Use of multiscale analysis for parameter estimation, QRS detection, template matching techniques, Arrythymia detection algorithms, Pattern recognition, heart rate variability analysis, ST segment analyser, Maternal-fetal ECG, Muscle contraction interference, donor heart interference in heart transplant					9
Unit-3 NEUROLOGICAL SIGNAL PROCESSING					
EEG waveforms and rhythms – origin, Brain potential, EEG recording techniques, EEG applications - epilespy and sleep disorders, Brain computer interface - tutorial/assignment, Independent component Analysis- Cocktail problem applied to EEG, EEG segmentation, joint time frequency analysis, EEG coherence and correlation analysis MRI- signal generation, detection, characteristics, artifacts					9
Unit-4 SIGNAL PROCESSING					

Noise- introduction, random, structured, high frequency, physiological interference, Artifacts - ECG, EEG - characteristics and processing, power line interference, muscle noise filtering –ECG, Time domain filters - averaging, removal of artifacts Adaptive filtering - principle, steepest descent algorithm, adaptive noise canceller, Optimal filtering - winer filtering, widrow hopf LMS algorithm, Adaptive filter design- tutorial/lab	9
Unit-5 DATA PROCESSING	
Linear prediction theory, Autoregression method, recursive estimation of AR parameters, AR moving average model, estimation of AR, ARMA parameters, ECG signal processing - baseline wandering, EEG modeling - linear stochastic, nonlinear,model base spectral analysis, Lossy and lossless data compression - ECG algorithms, introduction to ECG data compression using Turning point, AZTEC, Hoffman coding	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand biomedical signals generated by the human body and highlighting the various signal processing techniques. **CO2**: Analyse cardiological signals based on event detection of QRS detection, arrhythmia detection, and distinction between ECG interference. **CO3:** Analyse neurological signals for detecting sleep disorders and epilepsy. **CO4:** Discuss the various noises and artefacts associated with biomedical signals and algorithms for filtering noise. **CO5:** Analyze different algorithms for biomedical signal processing along with lossy and lossless compression.	
Text Books: T1. Leif Sörnmo, Pablo Laguna, "Bioelectrical Signal Processing in Cardiac and Neurological Applications", 1st Ed., Elsevier 2005. T2. Willis J Tompkins, "Biomedical Signal Processing", ED, Prentice – Hall, 2008	
Reference Books: R1. R. Rangayan, Biomedical Signal Analysis, Wiley, 2002 R2. Bruce, Biomedical Signal Processing & Signal Modeling, Wiley, 2007 R3. Semmlow, Bio-signal and Biomedical Image Processing, Marcel Dekker,2014 R4. Enderle, Introduction to Biomedical Engineering, 2/e, Elsevier, 2005	
Online Resources: NIL	

Course Name: Advanced Digital Signal Processing					
Course Code : ECE734E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: The course aims at making the students understand mathematical description and modelling of discrete time random signals, concepts of power spectral algorithms, estimation, prediction and optimum filtering of Random signals and concepts involved in audio signal processing

Prerequisites:

Units	**Teaching Hours**
Unit-1 DISCRETE TIME SIGNALS AND TRANSFORMS	
DTFT and its properties, DFT and its properties, Relation between DTFT and DFT, FFT, Decimation in Time Decimation in Frequency. Convolution and correlation; random signals. Discrete Random Processes - Ensemble Averages, Stationary processes, Bias and Estimation, Auto-covariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density.	9
Unit-2 POWER SPECTRAL ESTIMATION	
Bias and Consistency of estimators - Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation.	9
Unit-3 LINEAR PREDICTION AND ESTIMATION	
Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walker method - Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion – Wiener filter - Discrete Wiener Hoff equations – Mean square error.	9
Unit-4 MULTIRATE DIGITAL SIGNAL PROCESSING	
Multirate Signal Processing: Introduction, Decimation, Interpolation, Fractional Sampling rate conversion, Multistage Implementation of Sampling Rate Conversion, Computational Efficiency. Filter design & Implementation for sampling rate conversion, Polyphase Implementation of FIR filters for decimation and interpolation. Applications of Multirate Signal Processing. Digital Filter Banks – Two Channel QMF – Perfect reconstruction two – channel FIR Filter Banks. L – Channel QMF Banks.	9
Unit-5 OPTIMAL FILTERING OF RANDOM SIGNALS	
Adaptive Digital Filters: Concepts -Wiener filter –LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms -LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes in long distance	9

telephone. Introduction to RLS Algorithm, Statement of Kalman filtering problem.	
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand and analyse the modelling of any discrete time random signals **CO2**: Analyse the power spectral algorithms **CO3**: Analyse the concepts of Linear prediction and Estimation **CO4:** Analyse and implement the Concepts in audio signal processing **CO5:** Represent Random signals and estimate prediction which can be used in optimum filtering	
Text Books: T1. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Fourth Edition, Mc. Graw Hill,2013. T2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006	
Reference Books: R1. John G. Proakis, Dimitris K Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, PHI,2007 R2. Alan V.Oppenheim, Ronald W. Schafer, "Discrete Time Signal Processing", Second Edition, Pearson Education,1998 R3. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992	
Online Resources: O1: https://ece.gmu.edu/~hayes/courses/dsp/index.html	

Course Name: Statistical Signal Processing					
Course Code : ECE734E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: The course aims at providing an understanding on the mathematical description and modelling of discrete time random signals, concepts of spectral estimation algorithms, linear estimation and prediction of Random signals, audio signal processing and also designing adaptive filters.

Prerequisites:

Units	**Teaching Hours**
Unit-1 DISCRETE RANDOM SIGNAL PROCESSING	
Wide sense stationary process – Ergodic process – Mean – Variance - Auto-correlation and Auto-correlation matrix - Properties - Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem–Finite Data records, Simulation of uniformly distributed/Gaussian distributed white noise.	9
Unit-2 SPECTRUM ESTIMATION	
Bias and Consistency of estimators - Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation.	9
Unit-3 LINEAR ESTIMATION AND PREDICTION	
Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walker method - Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion – Wiener filter - Discrete Wiener Hoff equations – Mean square error.	9
Unit-4 ADAPTIVE FILTERS	
Recursive estimators - Kalman filter - Linear prediction – Forward prediction and Backward prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.	9
Unit-5 MULTIRATE ALGORITHMS	
FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters - Exponentially weighted RLS – Sliding window RLS - Simplified IIR LMS Adaptive filter	9
Self-study : NIL	
Site/Industrial Visits : NIL	

Course outcomes:

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

CO1: Analyse signals and develop their statistical models for efficient processing

CO2: Formulate filtering problems from real life applications and design filtering solutions to estimate a desired signal from a given mixture by minimizing a cost function

CO3: Design and analyse efficient algorithms for estimation of various parameters of signals with different constraints

CO4: Develop efficient methods for spectrum and frequency estimation suiting the requirements derived from practical problems

CO5: Analyse multi-rate algorithms for estimation of various signals

Text Books:

T1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005

T2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006

Reference Books:

R1. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall

R2. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000

R3. Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englehood Cliffs, NJ

R4. S. Kay," Modern spectrum Estimation theory and application", Prentice Hall, Englehood, Cliffs, NJ

Online Resources:

O1. https://ece.gmu.edu/~hayes/courses/dsp/index.html

O2. https://www.comm.utoronto.ca/~dimitris/ece1511/

Course Name: Speech Processing					
Course Code : ECE734E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: This course aims to introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression

Prerequisites:

Units	**Teaching Hours**
Unit-1 NATURE OF SPEECH SIGNAL	
Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis	9
Unit-2 TIME DOMAIN METHODS FOR SPEECH PROCESSING	
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation	9
Unit-3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING	
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems	9
Unit-4 LINEAR PREDICTIVE CODING OF SPEECH	
Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains	9
Unit-5 HOMOMORPHIC SPEECH ANALYSIS	
Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Demonstrate models for speech production
CO2: Explain methods to develop time and frequency domain techniques for estimating speech parameters
CO3: Explain a predictive technique for speech compression
CO4: Understand speech recognition, synthesis and speaker identification

Text Books: T1. L.R. Rabiner and R.E Schafer : Digital processing of speech signals, Prentice Hall
Reference Books: R1. J.L Flanagan : Speech Analysis Synthesis and Perception - 2nd Edition - Springer Vertigo R2. .H.Witten :Principles of Computer Speech , Academic press
Online Resources: NIL

Course Name: Natural Language Processing					
Course Code : ECE734E5					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
This course provides the students a general introduction including the use of state automata for language processing, fundamentals of syntax including a basic parse, advanced feature like feature structures and realistic parsing methodologies, basic concepts of remotes processing and details about a typical natural language processing application

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction to Natural Language Processing, Different Levels of language analysis, Representation and understanding, Linguistic background	9
Unit-2 GRAMMARS AND PARSING	
Grammars and parsing, Top down and Bottom up parsers, Transition Network Grammars, Feature systems and augmented grammars, Morphological analysis and the lexicon, Parsing with features, Augmented Transition Networks	9
Unit-3 GRAMMARS FOR NATURAL LANGUAGE	
Grammars for natural language, Movement phenomenon in language, Handling questions in context free grammars, Hold mechanisms in ATNs, Gap threading, Human preference in parsing, Shift reduce parsers, Deterministic parsers, Statistical methods for Ambiguity resolution.	9
Unit-4 SEMANTIC INTERPRETATION	
Semantic Interpretation, word senses and ambiguity, Basic logical form language, Encoding ambiguity in logical from, Thematic roles, Linking syntax and semantics, Recent trends in NLP	9
Unit-5 LANGUAGE MODEL	
Language Model: the Milton Model , THE META MODEL, Vision for the Future', Strategies, NLP Change Techniques, Principle based NLP, Reframing, and Chunking Patterns, Recent Trends, Research Issues, Case studies	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Remember the approaches of Automata Theory, Probability Theory, Predicate Logic and Statistical techniques

CO2: Describe the process of top down parsing and bottom up parsing of string and morphological analysis of lexicons.

CO3: Experiment the techniques for handling questions and analyze the movement phenomenon in language

CO4: Describe shift reduce and deterministic parsers for ambiguity resolution and specifies language models

CO5: Explain recent trends in natural language and case studies in natural language processing.

Text Books:

T1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python", O'Reilly Media; 1 edition (July 10, 2009)

T2. Pushpak Bhattacharyya, "Machine Translation", Chapman and Hall/CRC; 1 edition (January 22, 2015)

T3. Matthew A Russell , "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More", O'Reilly Media; Second Edition edition (October 20, 2013)

Reference Books:

R1. James Allen, Natural Language Understanding, Second Edition, 2003, Pearson Education

R2. Daniel Jurafsky & James H.Martin, " Speech and Language Processing", Pearson Education (Singapore) Pte. Ltd., 2002

Online Resources:

NIL

Course Name: High Speed Networks					
Course Code : ECE734E6					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: This course aims to highlight the features of different technologies involved in High Speed Networking and their performance with respect to congestion and traffic management. The course also introduces the Quality of Service aspect required in networking

Prerequisites:

Units	**Teaching Hours**
Unit-1 HIGH SPEED NETWORKS	
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11	9
Unit-2 CONGESTION AND TRAFFIC MANAGEMENT	
Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control	9
Unit-3 TCP AND ATM CONGESTION CONTROL	
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM.Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management	9
Unit-4 INTEGRATED AND DIFFERENTIATED SERVICES	
Integrated Services Architecture – Approach, Components, Services-Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services	9
Unit-5 PROTOCOLS FOR QOS SUPPORT	
RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking,	9

Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.	
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand the architecture of high speed networks including frame relay, Ethernet and wireless LAN **CO2**: Describe the queuing models used in traffic management and congestion control **CO3:** Explain techniques involved to support real-time traffic and congestion control in ATM networks **CO4:** Differentiate the integrated and differentiated services models **CO5:** Distinguish levels of quality of service (QoS) to networking applications	
Text Books: T1. William Stallings, "High Speed Networks And Internet", Pearson Education, Second Edition, 2002	
Reference Books: R1. Warland & Pravin Varaiya, "High Performance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001 R2. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003	
Online Resources: NIL	

PROGRAM ELECTIVE-6

Course Name: Mobile Application Development					
Course Code : ECE831E1					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
This course provides the students an understanding of the concepts corresponding to the Mobile applications, know the various architectures for different mobile systems, Understand how to work with various mobile application development frameworks and understand the capabilities and limitations of mobile devices

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction to mobile applications – cost of development - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications. Third party Frameworks. - Mobile Content- Mobile Applications	9
Unit-2 BASIC DESIGN	
Introduction to Web Services– Web service language Format –Creating a Web service using Microsoft stack – Using the Linux Apache MySQL PHP (LAMP) Stack-Debugging Web Services. Mobile User Interface Design.- Mobile Web Apps Using HTML5.Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications	9
Unit-3 TECHNOLOGY I – WINDOWS 7	
Introduction- architecture of windows 7- Establishing the development environment-Tools- Hardware- Visual studio and windows phone SDK-Windows 7 Project-Building the Derby App in Windows 7-Offline Storage-Notifications-GPS-Accelerometer-Web Services.	9
Unit-4 TECHNOLOGY II - ANDROID	
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.	9
Unit-5 TECHNOLOGY III - iOS	

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi – CASE STUDY- iPhone marketplace and mobile application development	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

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

CO1: Explain the requirements for mobile application development

CO2: Understand the principles involved in mobile application development.

CO3: Develop applications in Windows 7

CO4: Design and develop applications in Android

CO5: Design and develop applications in iOS.

Text Books:

T1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012,Wiley Publications

T2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012

T3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012

Reference Books:

R1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013

Online Resources:

NIL

Course Name: Database Administration					
Course Code : ECE831E2					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:

This course will discuss the rationale, current trends and features of modern database practice. It provides students with the tools and techniques to implement and administer complex database systems including backup and recovery. It equips students with the skills required to develop creative solutions to information system problems using the latest database technologies

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
General Definition of DBA and Security, System Management & Database Design Roles of DBA – DBA Job Classification. Types of Databases: Online Transaction Processing System and Decision Support System Databases, Development, Test & Production Databases. Daily Routine of a DBA	9
Unit-2 ORACLE 10G ARCHITECTURE	
Database Structures: Logical & Physical, Trace Files, Data Files & Tablespaces, Oracle Managed Files. Processes: Interaction between User & Oracle Processes, The Server Process, Background Processes. Memory Structures: SGA, PGA. Oracle Transactions: Anatomy of SQL Transactions. Data Consistency & Concurrency: Database Writer & Write Ahead Protocol, The System Change Number, Undo Management. Backup and Recovery Architecture: User managed, RMAN, Flashback Techniques Data Dictionary and Dynamic Performance Views: Data Dictionary, V$ views, The Oracle Optimizer. Oracle utilities, Automatic Database Management, Advisory Framework	9
Unit-3 DATABASE CREATION, CONNECTIVITY AND NETWORKING	
Installing Oracle 10g: Following OFA, System and Owners Pre-Installation Tasks, Installing Software, System Administrator and Oracle Owner's Post-Installation Tasks, Uninstalling Oracle 10g. Database Creation: Creating SPFILE and pfile, Initialization Parameters, Creating a new Database, Using SPFILE, Starting up and Shutting Down Database. Database Connectivity and Networking: Working of Oracle Network – instance names, global database names, connect descriptors, identifiers and strings, Establishing Connectivity, Oracle Client, Installing the Client, Naming and Connectivity – Local, Easy connect, External and Directory naming methods	9
Unit-4 DATABASE USER MANAGEMENT AND DATABASE SECURITY	

Managing Users: Creating, altering and dropping users, Creating user Profiles & Resources, Database Resource Manager, Controlling Access to Data – Roles, Privileges and using Views, Stored Procedures to Manage Privileges, Auditing Database – Standard Auditing, Authentication – Database, External, Centralized user and Proxy Authentication. Database Security Do's & Don'ts: User Accounts, Passwords, OS authentication, Auditing Database, Granting Appropriate Privileges, Permissions, Application Security	9
Unit-5 DATA LOADING, BACKUP, RECOVERY AND DATABASE PERFORMANCE TUNING	
Overview of extraction loading and Transformation, Loading Data: Using the SQL Loader Utility, Using External Tables to Load Data. Overview of Common Techniques used for Transforming Data, Introduction to Data Pump Technology – Benefits, Uses and Components of Data Pump. Access method, Data Pump Files, Privileges, Mechanics of Data Pump Job. Backing Up Oracle Databases: Backup Terms, Guidelines, Strategies, Examining Flash Recovery Area – benefits of Flash recovery Area, Looking into Flash Recovery Area, Setting size of Flash Recovery Area Creating Flash Recovery Area, Backing up Flash Recovery Area, RMAN – Benefits, Architecture, Connecting to RMAN. SQL Query Optimization: Approach to Performance Tuning, Optimizing Oracle Query Processing, Cost-based Optimizer, Drawbacks of CBO. SQL Performance Tuning Tools – EXPLAIN PLAN, Autotrace, SQL Trace and TKPROF. Tuning the instance: Introduction, Automatic Tuning vs. Dynamic Views. Tuning Oracle Memory: Tuning Shared Pool – Library Cache, Dictionary Cache, Hard vs. Soft Parsing, Sizing Shared Pool, Tuning Buffer Cache – Sizing buffer Cache, Multiple pools for Buffer Cache, Tuning Large, Streams and Java Pools. Tuning PGA Memory – Automatic PGA Memory Management. Introduction to iSQL*Plus: Installation, configuration, Starting and Stopping iSQL*Plus, Logging into and disconnecting from iSQL*Plus. Case study	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand the process and steps involved in database administration. **CO2**: Explain the ORACLE 10G Architecture and its functionalities. **CO3:** Apply the concepts of database administration for database creation, connectivity and networking. **CO4:** Describe the processes involved in database user management and database security **CO5:** Explain data loading, backup, recovery and database performance tuning using the relevant methods.	
Text Books: T1. Ross Mistry, Stacia Misner , "Introducing Microsoft SQL Server 2014", (2014)	

T2. Arup Nanda and Steven Fewrstein, "Oracle PL/SQL for DBAs", O'Reilly Media, Inc
T3. Craig S. Mullins, "Database Administration: The Complete Guide to DBA Practices and Procedures", Addison-Wesley, 11-Oct-2012
T4. Alapati, Sam R., Expert Oracle Database 10g Administration, Springer India Pvt. Ltd., 2005

Reference Books:

R1. Kyte, Thomas, "Expert Oracle", Oracle Press Publication, Signature Edition, 2005
R2. Day, John & Craig Van Slyke, "Starting Out with…Oracle", Dreamtech Publication
R3. Loney, Kevin & Koch, George, "Oracle9i The Complete Reference", Author's Press/ Dreamtech Publication

Online Resources:

NIL

Course Name: Software Testing					
Course Code : ECE831E3					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:
This course provides the students an overview of the software testing techniques and it also helps them to design and understand test cases, various levels of testing and related concepts.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples– Developer/Tester Support for Developing a Defect Repository	9
Unit-2 TEST CASE DESIGN	
Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing – Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing – cause effect graphing – error guessing - compatibility testing – user documentation testing – domain testing Using White–Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing - Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.	9
Unit-3 LEVELS OF TESTING	
The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests. The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing – defect bash elimination -System Testing – types of system testing - Acceptance testing – performance testing - Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests – testing OO systems – usability and accessibility testing	9
Unit-4 TEST MANAGEMENT	
People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results – The role of three groups in Test Planning	9

and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.	
Unit-5 CONTROLLING AND MONITORING	
Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation - Test metrics and measurements – project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – Evaluating software quality – defect prevention – testing maturity model – Case Studies	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand the role of an engineer in the process of software testing and quality management. **CO2**: Explain the test cases that can be generated for software and other applications. **CO3:** Describe the levels of testing involved in software testing and their functionalities. **CO4:** Summarize the steps, methods and process involved in software test management **CO5:** Design test cases and monitor the same for a given application.	
Text Books: T1. Boris Beizer, "Software Testing Techniques", Dreamtech. Second Edition, 2009 T2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson education, 2008	
Reference Books: R1. Elfriede Dustin, "Effective Software Testing", Pearson Education, First Edition, 2008. R2. Edward Kit, "Software Testing in the Real World", Pearson Education, 2008 R3. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education, 2011	
Online Resources: NIL	

Course Name: Web Services and Service Oriented Architecture					
Course Code : ECE831E4					
	L	**T**	**P**	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:

This course provides the students an understanding of the meaning of service-oriented paradigm and the aspects affecting the efficient utilization of it. Students achieve understanding of SOA for sustainable service development. Students are able to design and implement service-oriented applications.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO SOA - TERMINOLOGY, CONCEPTS AND GOALS	
Service Terminology - Service Terminology Context - Basic Terminology and Concepts - Further Reading - Case Study Example - REST Constraints - Goals of the REST Architectural Style	9
Unit-2 SERVICE CONTRACTS AND SERVICE-ORIENTATION WITH REST	
Uniform Contract Elements - REST Service Capabilities and REST Service Contracts - REST Service Contracts vs. Non-REST Service Contracts - The Role of Hypermedia - REST Service Contracts and Late Binding - "SOA vs. REST" or "SOA + REST"? - Design Goals - Design Principles and Constraints.	9
Unit-3 SOA METHODOLOGY, ANALYSIS AND SERVICE MODELING AND SERVICE-ORIENTED DESIGN WITH REST	
Service Inventory Analysis - Service-Oriented Analysis (Service Modeling) - Service-Oriented Design (Service Contract) - Service Logic Design - Service Discovery - Service Versioning and Retirement - Uniform Contract Modeling and REST Service Inventory Modeling - REST Service Modeling - Uniform Contract Design Considerations - REST Service Contract Design - Complex Method Design	9
Unit-4 FUNDAMENTAL AND ADVANCED SERVICE COMPOSITION WITH REST WITH CASE STUDY	
Service Composition Terminology - Service Composition Design Influences - Composition Hierarchies and Layers - REST Service Composition Design Considerations - A Step-by-Step Service Activity - Service Compositions and Stateless - Cross-Service Transactions with REST - Event-Driven Interactions with REST - Service Composition with Dynamic Binding and Logic Deferral - Service Composition Across Service Inventories - Revisiting the Confer Student Award Process - Application Submission and Task Service Invocation - Confer Student Award Service Composition Instance - Review of Pending Applications and Task Service Invocation.	9
Unit-5 DESIGN PATTERNS, SERVICE VERSIONING WITH REST AND UNIFORM	

CONTRACT PROFILES	
REST-Inspired SOA Design Patterns - Other Relevant SOA Design Patterns - Versioning Basics - Version Identifiers - Uniform Contract Profile Template - REST Service Profile Considerations –Case Study Example	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Apply SOA-specific methodologies, technologies and standards in REST style. **CO2**: Analyze case studies to map it as a "set of services". **CO3:** Develop logical models for a given SOA. **CO4:** Convert SOA to a buildable specification **CO5:** Orchestrate services to create new applications.	
Text Books: T1. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian, "SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST", Prentice Hall Service Technology 2012 T2. Arnon Rotem-Gal-Oz, "SOA Patterns, Manning"	
Reference Books: R1. Java Web Services: Up and Running, 2nd Edition, A Quick, Practical, and Thorough Introduction", O'Reilly 2013. R2. Bill Burke, "RESTful Java with JAX-RS 2.0, Designing and Developing Distributed Web Services", 2nd Edition, O'Reilly 2013 R3. "Developing RESTful Services with JAX-RS 2.0, WebSockets, and JSON, A complete and practical guide to building RESTful Web Services with the latest Java EE7 API", Packet Publishing, 2013	
Online Resources: NIL	