



# **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]  
2021-25**

**January 2021**

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Christ University, Bengaluru  
Karnataka, India  
[www.christuniversity.in](http://www.christuniversity.in)

Syllabus for BTech- Electronics and Computer Engineering [with Specialization in Artificial Intelligence and Machine Learning] for batch 2021-25 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

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- **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. ELIGIBILITY CRITERIA

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### ❖ **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

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- 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.

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

## 7. GRADING SCHEME FOR EACH PAPER: Undergraduate Courses

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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				
	Comp onent	Asse ssed for	Scale d down to	Mini mu m marks to pass	Max imu m marks	Componen t	Asse ssed for	Scale d down to	Mini mu m 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	Atten dance	05	05	-	05	Attendanc e	NA	NA	-	-
5	ESE	100	30	12	30	ESE	NA	NA	-	-
		TOT AL	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
<b>Total</b>	<b>: 50 marks</b>

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

## I SEMESTER - CHEMISTRY CYCLE

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	MA131	Mathematics - I	3	0	0	100	3	0	0	3
2	CH132P	Chemistry	3	0	2	100	3	0	1	4
3	EC133P	Basic Electronics	3	0	2	100	3	0	1	4
4	CS134P	Computer Programming	3	0	2	100	3	0	1	4
5	ME135	Basic Mechanical Engineering and Nanoscience	3	0	0	100	3	0	0	3
6	HS136	Technical English	2	0	0	50	2	0	0	2
7	ME151	Workshop Practice Lab	0	0	2	50	0	0	1	1
8	HOL111	Holistic Education-I	1	0	0	---	1	0	0	1
		Total				600				22

## II SEMESTER - PHYSICS CYCLE

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	MA231	Mathematics - II	3	0	0	100	3	0	0	3
2	PH232P	Physics	3	0	2	100	3	0	1	4
3	EE233P	Basic Electrical Engineering	3	0	2	100	3	0	1	4
4	CE234P	Basics of Civil Engineering & Engineering Mechanics	3	0	2	100	3	0	1	4
5	EG235P	Engineering Graphics	2	0	2	100	2	0	1	3
6	BS 236	Biology for Engineers	2	0	0	50	2	0	0	2
7	HOL211	Holistic Education-II	1	0	0	---	1	0	0	1
		Total				550				21

**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**

<b>SL No.</b>	<b>Course Code</b>	<b>Course Name</b>
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**

<b>SI No</b>	<b>Course Name</b>
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 I					
Course Code : MA131					
	L	T	P	Category	BSC
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
<p><b>Course objectives:</b> This course is outlined to those who intend to apply the subject at the proper place and time, while keeping him/her aware to the needs of the society where he/she can lend his/her expert service, and also to those who can be useful to the community without even going through the formal process of drilling through rigorous treatment of Mathematics. At the end of this course, students will</p> <ul style="list-style-type: none"> <li>• Have a solid base of understanding elementary linear algebra as required for further undergraduate work in engineering.</li> <li>• be able to differentiate a function partially with respect to each of its variables in turn</li> <li>• be able to utilize methods of integration to compute length of arcs, surface area and volume of solids</li> <li>• be skilled in using integration to compute problems important in physics and engineering</li> <li>• Learn the meaning and computation of the curl and divergence of a vector field.</li> <li>• be able to solve first order differential equations that are separable, linear or exact</li> </ul>					
<b>Prerequisites:</b> Nil					
Units					Teaching Hours
<b>Unit-1 LINEAR ALGEBRA</b>					
Fundamental concepts of Matrix, Rank of a Matrix, Consistency and solution of linear simultaneous equations, Eigen values and Eigen Vectors, Diagonalization					5
<b>Unit-2 DIFFERENTIAL CALCULUS - I</b>					
Partial Differentiation: Partial derivatives, Total differential coefficient, differentiation of composite and implicit functions, Jacobians and properties. Leibnitz's Rule of differentiation under integral sign.					10
<b>Unit-3 INTEGRAL CALCULUS - I</b>					
Reduction formulae for the integration of $\sin^n x$ , $\cos^n x$ , $\sin^m x \cos^n x$ and evaluation of these integrals with standard limits - Problems. Derivative of arc length, Applications of integration to find surfaces of revolution and volumes of solids of revolution.					10
<b>Unit-4 DIFFERENTIAL EQUATION - I</b>					
Solution of first order and first degree differential equations: Reducible to Homogeneous, Linear and Exact differential equation, Applications of differential equations. orthogonal trajectories.					10

<b>Unit-5 VECTOR CALCULUS - I</b>	
Vector differentiation. Velocity, Acceleration of a particle moving on a space curve. Vector point function. directional derivative, Gradient, Divergence, Curl, Laplacian. Solenoidal and Irrotational vectors - Problems. Standard vector identities.	<b>10</b>
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b></p> <p><b>CO1:</b> Checking the consistency of system of linear equations and hence finding solution</p> <p><b>CO2:</b> Finding the differentiation of multivariable functions using the concept of total derivatives, Jacobian, Evaluating definite integrals by Leibnitz rule of differentiation under integral sign</p> <p><b>CO3:</b> Evaluation of definite integrals as surface area and volume of solid of revolution using reduction formulae</p> <p><b>CO4:</b> Solving first order nonlinear differential equations by reducing into homogenous, linear and exact forms</p> <p><b>CO5:</b> Finding the velocity and acceleration of a moving particle, vector potential, scalar potential</p>	
<p><b>Text Books:</b></p> <p>T1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 39<sup>th</sup> Edition, Khanna Publishers, July 2005.</p> <p>T2. H. K. Das &amp; Rajnish Verma, "Higher Engineering Mathematics", S. Chand &amp; Company Ltd., 2011.</p>	
<p><b>Reference Books:</b></p> <p>R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, John Wiley &amp; Sons, Inc, 2005</p> <p>R2. Thomas and Finney, "Calculus", 9<sup>th</sup> Edition, Pearson Education, 2004</p> <p>R3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Publication, Canada, 2007</p> <p>R4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw - Hill, 2009.</p> <p>R5. Michael Artin, "Algebra", 2<sup>nd</sup> Edition, Prentice Hall of India Private Limited, New Delhi, 2002</p> <p>R6. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2<sup>nd</sup> Edition, Prentice Hall of India Private Limited, New Delhi, 2002</p> <p>R7. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw - Hill, 2006.</p> <p>R8. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) &amp; Co. Ltd., India, March 17, 2005.</p>	
<p><b>Online Resources:</b></p> <p>NIL</p>	

Course Name: Chemistry					
Course Code : CH132P / CH232P					
	L	T	P	Category	BSC
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
<p><b>Course objectives:</b> This paper contains five units which are Chemical Energy Sources, Electrochemical Energy Systems, Corrosion Science, Surface Chemistry &amp; Catalysis, Material Characterization Techniques and Water Technology. This paper aims at enabling the students to know various energy sources, corrosion and its control, basics of surface chemistry, their application in catalysis, water technology and material characterization.</p>					
<p><b>Prerequisites:</b> Nil</p>					
Units					Teaching Hours
<p><b>Unit-1 CHEMICAL ENERGY SOURCES</b></p>					
<p>Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value -definition, Gross and Net calorific values. Ultimate and proximate analysis of fuel, Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Cracking - Thermal Catalytic &amp; fluidised cracking. Reformation, Knocking - mechanism, octane number, cetane number, prevention of knocking- anti-knocking agents, unleaded petrol, Power alcohol. synthetic petrol - Bergius process and Fischer Tropsch process.</p> <p><b>Solar Energy :</b> Physical and chemical properties of silicon, production of silicon for photovoltaic cell - Metallurgical grade, Solar grade. Purification of silicon - Zone refining crystal pulling technique - Photovoltaic cells-Introduction, VB Theory, definition, working of a PV cell, Merits and demerits.</p>					10
<p><b>Unit-2 ELECTROCHEMICAL ENERGY SYSTEMS</b></p>					
<p>Conductance, Ionic conductance, Transport number, Ionic mobility, activity coefficient and mean activity coefficients. Single electrode potential- origin, sign conventions. Derivation of Nernst equation. Standard electrode potential Construction of Galvanic cell-classification - primary, secondary and concentration cells, Concentration cell with and without transference, EMF of a cell, notation and conventions. Reference electrodes -calomel electrode, Ag/AgCl electrode. Measurement of single electrode potential. Numerical problems on electrode potential and EMF. Ion-selective electrode- glass electrode, Determination of pH using glass electrode.</p>					8
<p><b>Unit-3 CORROSION SCIENCE</b></p>					
<p>Corrosion - definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings - Anodizing and Phosphating, Metal coatings -Galvanization and Tinning, Corrosion Inhibitors, Cathodic and Anodic protection.</p>					9

<b>Unit-4 SURFACE CHEMISTRY &amp; CATALYSIS</b>	
Introduction - Terminologies in surface chemistry - Adsorption - Characteristics, Classification, Application , Factors affecting Adsorption - Surface Area, temperature, pressure and nature of gas, desorption Activation Energy life time, Adsorption isotherms- Freudlich, Langmuir, BET <b>Catalysis:</b> Introduction, classification- Homogeneous and Heterogeneous, Active Sites-Single & dual- Solid catalysts- Classification- Supported, Unsupported, Metal Organic Frameworks Imprint catalysts, Hybrid catalysts, shape selective catalyst,- terminologies in material preparation- Precursor, calcination, Ageing, agglomeration regeneration	<b>11</b>
<b>Unit-5 MATERIAL CHARACTERIZATION &amp; WATER TECHNOLOGY</b>	
Theory and Applications of X-ray Photo electron Spectroscopy(XPS), Powder Xray diffraction (pXRD) <b>Water Technology:</b> Impurities in water,. Biochemical Oxygen Demand and Chemical Oxygen Demand. Numerical problems on BOD and COD. Sewage treatment. Purification of water- Desalination - Flash evaporation- Electro dialysis and Reverse Osmosis.	<b>7</b>
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
<b>PART - A</b>	
1. Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.	<b>2</b>
2. Determination of copper by spectrophotometric method.	<b>2</b>
3. Conductometric estimation of an acid using standard NaOH solution	<b>2</b>
4. Determination of pKa value of a weak acid using pH meter.	<b>2</b>
5. Potentiometric estimation of FAS using standard K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> solution.	<b>2</b>
<b>PART - B</b>	
1. Determination of Total Hardness of a sample of water using disodium salt of EDTA.	<b>2</b>
2. Determination of percentage of Copper in brass using standard sodium thiosulphate solution.	<b>2</b>
3. Determination of Calcium Oxide (CaO) in the given sample of cement by Rapid EDTA method	<b>2</b>
4. Determination of Iron in the given sample of Haematite ore solution using potassium dichromate crystals by external indicator method.	<b>2</b>

5. Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.	<b>2</b>
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>  CO1: Students will be able to distinguish between renewable and non-renewable energy sources.  CO2: Students will gain an understanding of oxidation and reduction reactions which are relevant to study the concepts of corrosion science and electrochemistry.  CO3: Students will be able to explain basics of physical and chemical phenomena taking place at solid surfaces.  CO4: Students will be able to describe physiochemical techniques for material characterization.  CO5: Students will be able to explain the fundamentals of water and waste water treatment.</p>	
<p><b>Text Books:</b>  T1. Dr. B.S. Jai Prakash, "Chemistry for Engineering Students", Subhas Stores, Bangalore, Reprint 2015  T2. M. M. Uppal, "Engineering Chemistry", Khanna Publishers, Sixth Edition, 2002  T3. Jain and Jain, "A text Book of Engineering Chemistry", S. Chand &amp; Company Ltd. New Delhi, 2009, Reprint- 2016</p>	
<p><b>Reference Books:</b>  R1. Atkins P.W. "Physical chemistry" ELBS 9 Edition 2009, London  R2. Stanley E. Manahan, "Environmental Chemistry", Lewis Publishers, Reprint 2009  R3. B. R. Puri, L. R. Sharma &amp; M. S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand &amp; Co., 33rd Ed., Reprint- 2016  R4. Kuriakose J.C. and Rajaram J. " Chemistry in Engineering and Technology" Vol I &amp; II, Tata Mc Graw - Hill Publications Co Ltd, NewDelhi, First edition Reprint 2010  R5. Ertl, H. Knozinger and J. Weitkamp, "Handbook of Heterogeneous Catalysis" Vol 1-5, Wiley - VCH.  R6. B. Viswanathan, S. Sivasanker , A.V. Ramaswamy, "Catalysis : Principles &amp; Applications" CRC Press, March 2002, Reprint 2011.  R7. D K Chakrabarthy, B. Viswanathan, "Heterogeneous Catalysis" New Age Internatioanl Publishers,2008.  R8. J. Bassett, R.C. Denny, G.H. Jeffery, "Vogels text book of quantitative inorganic analysis",5<sup>th</sup> Edition  R9. Sunita and Ratan Practical Engineering Chemistry, S.K. Kataria &amp; Sons, 2013.</p>	
<p><b>Online Resources:</b>  NIL</p>	

Course Name: Basic Electronics					
Course Code : EC133P / EC233P					
	L	T	P	Category	ESC
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
<b>Course objectives:</b> This course aims at imparting knowledge about electronic and digital systems, semiconductor theory and operational amplifiers. This course also includes a practical component which allows the students to recognize the different elements used in electronics and digital systems.					
<b>Prerequisites:</b> NIL					
Units					Teaching Hours
<b>Unit-1 BASIC SEMICONDUCTOR AND PN JUNCTION THEORY</b>					
Atomic Theory - Atom, Electron Orbits and Energy Levels - Conduction in solids - Electron Motion and Hole Transfer, Conventional Current and Electron Flow -Conductors, Insulators and Semiconductors - Energy Band Diagrams - Variation of band gap with temperature. Intrinsic and Extrinsic Semiconductors - Doping, n type and p type material, Majority and minority carriers, Charge Carrier Density, Mass Action Law. Semiconductor Conductivity - Drift Current, Diffusion Current, Charge Carrier Velocity, Conductivity. The pn Junction - Biased Junctions - Junction Currents and Voltages.VI Characteristics - Static and Dynamic Resistance. Zener diode characteristics, Zener and Avalanche breakdown.					9
<b>Unit-2 DIODE APPLICATIONS</b>					
Diode Approximations - DC Load Line Analysis - DC voltage applied to diodes (Si and Zener diodes only). (Simple analysis using KCL and KVL). Rectifiers - Half Wave rectifier - Full Wave Rectifier - Bridge Rectifier : dc load current and voltage, rms load current and voltage, ripple factor, efficiency, PIV. Simple Capacitor Filter(Analysis not expected) - Simple Shunt Zener Voltage Regulator					9
<b>Unit-3 BIPOLAR JUNCTION TRANSISTOR</b>					
Bipolar Junction Transistors: Transistor Construction - Operation - Common Base Configuration - Transistor Amplifying action - Common Collector - Common Emitter. Transistor currents. Common emitter current gain - Common Base Current gain - Relationship. Transistor Biasing : Operating Point - Significance - Fixed Bias and Voltage Divider Bias - Simple analysis.					9
<b>Unit-4 INTRODUCTION TO OPERATIONAL AMPLIFIERS</b>					
Block diagram, Op-amp transfer characteristics, Basic Op-amp parameters and its value for IC 741- offset voltage and current, input and output impedance, Gain, slew rate, bandwidth, CMRR, Concept of negative feedback, Inverting and Non-inverting amplifiers, Summing Amplifier, Subtractor, Differential Amplifier, integrator, differentiator, Voltage follower,					9

Introduction to Oscillators, the Barkhausen Criterion for Oscillations, Applications of Oscillator	
<b>Unit-5 DIGITAL ELECTRONICS</b>	
Introduction, decimal system, Binary, Octal and Hexadecimal number systems, addition and subtraction, fractional number, Binary Coded Decimal numbers. Boolean algebra, Logic gates, Half-adder, Full-adder, Logic Design based on two and three input variables only.	9
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
1. Use of basic voltage source and measuring instruments (Power supply, function generator, DSO, Digital Multimeter), familiarization of breadboard. Measurement of Voltage and Frequency using DSO	2
2. Study of step down transformer. Measuring the secondary voltage waveform on DSO and determination of peak and rms value	2
3. Identification and testing of electrical/electronic active and passive components	2
4. Color coding of resistors and capacitor coding	2
5. Study of Series and Parallel circuits to verify Kirchoff's Voltage Law and Current Law - using breadboard, DMM and DC power supply.	4
6. Half Wave Rectifier and Full Wave Rectifier : study of waveforms, determination of DC value of rectified wave	4
7. Study of different types of logic gates - NOT, OR, AND, NAND, NOR and Ex-OR	4
8. Verification of output of a logical expression using Basic gates/NAND gates/NOR gates	2
9. Soldering and de-soldering of electronic components on PCB	2
10. Determination of forward and reverse bias characteristics of silicon diode	4
11. Application of Zener diode as a basic voltage regulator	2
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Describe the basic semiconductor principles , working of p-n junction diode and transistors [L2] [PO1] <b>CO2:</b> Demonstrate the operation of diodes in rectifiers, voltage regulator and clipper [L3] [PO1] <b>CO3:</b> Explain the operation of bipolar junction transistor including the amplification and biasing [L2] [PO1, PO6]	



**CO4:** Explain the operation and applications of Operational Amplifier [L2] [PO1]

**CO5:** Discuss conversions between binary, decimal, octal and hexadecimal number system [L2] [PO1]

**CO6:** Implement digital logic gates and its application as adders. [L3] [PO1, PO6]

**Text Books:**

T1. David A. Bell, "Electronic Devices and Circuits" - Vth Edition, OUP, 2011

T2. N. P. Deshpande, "Electronic Devices and Circuits - Principles and Applications", TMH, 2017

T3. Robert L Boylestad & Louis Nashelsky, "Electronic Devices and Circuit Theory", 3<sup>rd</sup> Edition, 2015

T4. Morris Mano, "Digital Logic and Computer Design", PHI, EEE, 2014

**Reference Books:**

R1. Donald A. Neamen, "Electronic Circuits", 3rd Edition, TMH, 2017

R2. Thomas L. Floyd, "Electronic Devices", Seventh Edition, Pearson Education, 2012

R3. Albert Malvino, David. J. Bates, —Electronic Principle, 8th Edition, Tata McGraw Hill, 2015

**Online Resources:**

NIL

<b>Course Name: Computer Programming</b>					
<b>Course Code : CS134P / CS234P</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>ESC</b>
Contact Hrs./Week	<b>3</b>	<b>0</b>	<b>2</b>	CIA Marks	<b>70</b>
Contact Hrs./Sem.	<b>45</b>	<b>0</b>	<b>30</b>	ESE Marks	<b>30</b>
Credits.	<b>3</b>	<b>0</b>	<b>1</b>	Exam Hours	<b>3</b>
<b>Course objectives:</b>					
<ul style="list-style-type: none"> <li>• To provide exposure to problem-solving through programming.</li> <li>• To provide a basic exposition to the goals of programming</li> <li>• To enable the student to apply these concepts in applications which involve perception, reasoning and learning.</li> </ul>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 ALGORITHMS AND FLOWCHARTS, CONSTANTS, VARIABLES AND DATATYPES, OPERATORS, MANAGING INPUT AND OUTPUT OPERATIONS</b>					
Algorithms and flowcharts: Algorithms, Flowcharts, Examples on algorithms and flowcharts. Basic structure of a C program, C Tokens, Data types. Declaration of variables. Operators: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and Decrement operators, Conditional operator, Bitwise operators, Special operators, Arithmetic expressions, Evaluation of expressions, Precedence of Arithmetic operators, Type conversions in expressions, Operator precedence and associativity. Managing input and output operations: Reading a character, writing a character, Formatted Input, Formatted Output					9
<b>Unit-2 DECISION MAKING AND BRANCHING, LOOPING</b>					
Decision making and branching: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statements, The else ... if ladder, The switch statement, The ?: operator, The Goto statement Looping: The while statement, The do statement, The for statement, Jumps in Loops					9
<b>Unit-3 ARRAYS, USER DEFINED FUNCTIONS</b>					
Arrays: One-dimensional Arrays, Declaration of one-dimensional Arrays, Initialization of one-dimensional Arrays, Two-dimensional Arrays, Initializing two-dimensional Arrays. User-defined functions: Need for User-defined Functions, A multi-function Program, Elements of user - defined Functions, Definition of Functions, Return Values and their types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Value, recursion –recursive functions, Limitations of recursion.					9
<b>Unit-4 POINTERS</b>					

Understanding the pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Pointers as Function Arguments.	9
<b>Unit-5 STRINGS, DERIVED TYPES, FILES</b>	
Strings: String concepts: declaration and initialization, String I/O functions, Array of strings, String manipulation function, Structure: Basic of structures, structures and Functions, Arrays of structures, structure Data types, type definition. Files: Defining, opening and closing of files, Input and output operations, Standard Library Functions for Files	9
<b>List of Experiments :</b>	<b>Practical Hours</b>
1. To understand and realize the use of C tokens, Keywords and Identifiers, Variables, Data types, Declaration of variables, using operators, I/O functions.	4
2. To understand and implement concepts of Decision making statements.	4
3. To understand and implement concepts looping statements.	6
4. To understand and implement concepts of Arrays.	4
5. To understand and implement concepts of Pointers	4
6. To understand and implement concepts of User defined functions.	4
7. To understand and implement concepts of Strings and Structures.	4
<b>Self-study: NA</b>	
<b>Site/Industrial Visits: NA</b>	
<b>Course outcomes:</b> CO1: Solve problems using flowchart and algorithm. (L3, PO1, PO3) CO2: Exhibit the concept of looping and decision-making statements to solve problems. (L3, PO1, PO3) CO3: Demonstrate different Operations on arrays and user defined functions. (L3, PO1, PO3) CO4: Illustrate the appropriate use of pointers. (L3, PO1, PO3) CO5: Illustrate the appropriate use of strings, files, structures to solve real time problems. (L3, PO1, PO3)	
<b>Text Books:</b> T1. Deitel and Deitel, "C How to Program", Prentice Hall 2010 (Reprint). T2. Herbert Schildt, "C++ : The Complete Reference", McGraw - Hill Osborne Media; 3rd edition 2012 ( Reprint). T3. YashvantKanetkar, "Let Us C 13E", BPB Publications - 13th Edition, 2013.	

**Reference Books:**

R1. Shelly and Junt, "Computers and Commonsense", 4th edition, Prentice Hall of India, 2010 (Reprint).

R2. Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, "Information Technology: The Breaking wave", Tata MC GrawHill Companies, 2010 (Reprint).

R3. Peter Norton, "Introduction to Computers", 2011 (Reprint).

**Online Resources:**

O1. V. K. Myalapalli, J. K. Myalapalli and P. R. Savarapu, "High performance C programming," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-6

O2. <https://users.ece.cmu.edu/~eno/coding/CCodingStandard.html>

O3. <https://www.w3resource.com/c-programming-exercises/>

Course Name: Basic Mechanical Engineering and Nanoscience					
Course Code : ME135 / ME235					
	L	T	P	Category	ESC
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
<b>Course objectives:</b>					
<ol style="list-style-type: none"> <li>1. To elucidate and critically demonstrate the Energy sources and basic thermodynamic concepts behind energy transfer.</li> <li>2. To distinguish and elaborate the different types of prime movers.</li> <li>3. To describe the functioning of refrigeration and air-conditioning.</li> <li>4. To evaluate and apply the concepts of nano-science in real engineering applications.</li> <li>5. To demonstrate and apply the process of machining and metal joining in basic applications.</li> </ol>					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 ENERGY RESOURCES, THERMODYNAMICS AND HEAT TRANSFER</b>					
<b>Energy Resources</b> Conventional Energy resources- Fossil fuel and nuclear fuel, Merits and demerits. Non-conventional energy sources- Solar, Wind, hydraulic, Ocean-thermal, Geo-thermal, Tidal energy and bio mass energy plants working principle.					12
<b>Thermodynamics</b> Basic terms: State, path, process (reversible and irreversible), and cycle, System, surroundings and boundary. Closed system, Open system and Isolated Systems. Laws of Thermodynamics (statements and brief description). Heat engine and Heat pump (Definition).					
<b>Heat Transfer</b> Modes of Heat transfer and their basic governing equations. Heat exchangers- types. Fins - types and applications.					
<b>Unit-2 I.C. ENGINE AND TURBINES</b>					
<b>I.C. Engines</b> Classification, I.C. Engines parts and their function, working of 2 Stroke and 4 stroke engines. Basic terms - Indicated power, brake power frictional power, thermal efficiency, mechanical efficiency (simple problems).					10
<b>Steam Generators</b> Boilers, fire and water tube boilers (Lancashire and Babcock and Will Cox boiler-working with simple sketches).					
<b>Steam turbines</b>					

<p>Classifications, Principle of operation of Impulse and reaction turbines.</p> <p><b>Gas Turbines</b> Open cycle and closed cycle gas turbines working principle.</p> <p><b>Water Turbines</b> Classification, working principle of Pelton wheel, Francis turbine and Kaplan turbine.</p>	
<b>Unit-3 REFRIGERATION AND AIR-CONDITIONING</b>	
<p><b>Refrigeration</b> Types of refrigerants and properties of good refrigerant, Refrigerating effect and unit of Refrigeration (definition). Working principle of vapour Compression refrigeration and vapour absorption refrigeration (with sketch). Applications areas of refrigeration system.</p> <p><b>Air Conditioning</b> Definition, types, Room air-conditioning working principle (with sketch), Applications.</p>	6
<b>Unit-4 INTRODUCTION TO NANOTECHNOLOGY</b>	
<p><b>Introduction to Nanotechnology</b> Introduction to about Nanomaterials, characterization of nanomaterials-SEM, XRD, AFM and Mechanical properties, Advantages, limitations and applications of Nanomaterials.</p>	7
<b>Unit-5 MACHINE TOOLS AND METAL JOINING PROCESSES</b>	
<p><b>Machine tools</b> Lathe Machine-Types, Parts and different operations like-turning, facing, grooving, parting off, taper turning, and threading (simple sketch) Drilling Machine-Types, Parts and different operations like-drilling, reaming, boring, counter boring, counter sinking and tapping (simple sketch). Milling Machine-Up milling, down milling, Plane milling, End milling, Slot milling and gear cutting (sketches only for following operations)</p> <p><b>Metal joining</b> Definitions, classification of soldering, Brazing and welding. Differences between soldering, brazing and Welding. Description of Electric Arc welding and Oxy-Acetylene gas welding (Simple sketch).</p>	10
<p><b>Self-study:</b> Unit-1: Distillation process of crude oil, Harnessing of Ocean-thermal Energy. Unit-2: 4 Stroke Diesel Engine, 2 Stroke petrol engine, Water turbines. Unit-3: Office air-conditioning systems. Unit-4: TEM, UTM techniques for characterization of Nanomaterials. Unit-5: Trepanning operation, Vertical milling machine, brazing and soldering applications.</p>	
<p><b>Site/Industrial Visits:</b> 1. Heat Transfer Lab. 2. Fluid mechanics and Machinery Lab. 3. Metal Cutting Lab. 4. I.C. Engine Lab.</p>	

**Course outcomes:**

The students will be able to

CO1: Classify the energy resources and state the basic laws of the thermodynamics and illustrate with an example modes of heat transfer. [L1, L2] [PO1, PO2].

CO2: List the types of I.C. Engines and turbines, discuss the working principle of I.C. engines and turbines. [L1, L3] [PO1, PO2, PO3].

CO3: Define the terms refrigeration and air-conditioning, identify their application areas. [L1, L2, L3] [PO1, PO2, PO3].

CO4: Explain the fundamental concept of nanotechnology and describe the characterization methods for nanomaterials. [L1, L2] [PO1, PO2].

CO5: Summarize the operations performed by using machine tools and distinguish between welding soldering and brazing process. [L1, L2, L4] [PO1, PO2, PO3, PO4].

**Text Books:**

T1. K.R. Gopalkrishna, "A text Book of Elements of Mechanical Engineering", Subhash Publishers, Bangalore, 2008.

T2. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", 3rd revised edition, I.K. International Publishing House Pvt. Ltd., New Delhi. 2010.

T3. P.K.Nag, "Engineering Thermodynamics" Tata McGraw-Hill Education, 2005.

T4. B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, "Nano Science and Nano Technology ", University Press IIM, 2002.

**Reference Books:**

R1. Dr. R. P. Reddy, "Elements of Mechanical Engineering", 1st Edition, Himalaya Publishing House, New Delhi, 2012.

R2. Hajra Choudhury S K, "Elements of Workshop Technology" 13th Edition, Volume 1, Machine Tools, India Book Distributing Company Calcutta, 2010.

R3. Hajra Choudhury S K, "Elements of Workshop Technology" 13th Edition, Volume 2, Machine Tools, India Book Distributing Company Calcutta, 2012.

R4. Charles P. Poole and Frank J. Owens, "Introduction to Nanotechnology", Wiley India Edition, 2012.

**Online Resources:**

O1. [http://www.hds.bme.hu/letoltesek/targyak/BMEGEVGAG01\\_ENG/ime.pdf](http://www.hds.bme.hu/letoltesek/targyak/BMEGEVGAG01_ENG/ime.pdf)

O2. <http://www.nptel.ac.in/downloads/112108148>.

<b>Course Name: Technical English</b>					
<b>Course Code : HS136 / HS236</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>HSMC</b>
Contact Hrs./Week	<b>1</b>	<b>0</b>	<b>2</b>	CIA Marks	<b>25</b>
Contact Hrs./Sem.	<b>15</b>	<b>0</b>	<b>30</b>	ESE Marks	<b>25</b>
Credits.	<b>1</b>	<b>0</b>	<b>1</b>	Exam Hours	<b>2</b>
<b>Course objectives:</b> Upon Successful completion of this course, the student will have reliably demonstrated the ability to respond effectively, efficiently, and appropriately to writing in ways that demonstrate comprehension and evaluation of its purpose and meaning.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 VOCABULARY BUILDING</b>					
Concept of word formation, synonyms , antonyms, homophones, prefixes and suffixes, Misused and confused words.					8
<b>Unit-2 BASIC WRITING SKILLS</b>					
Sentence structure, parts of speech, Fragments, Run-on errors, Phrases and clauses, Misplaced and Dangling modifiers, Structure of paragraphs Techniques of writing precisely.					8
<b>Unit-3 IDENTIFYING COMMON ERRORS IN WRITING</b>					
Subject verb agreement(concord), articles, prepositions, Tenses, Redundancies, cliché's , Misused and confused words					9
<b>Unit-4 ESSAY WRITING ( LANG. LAB)</b>					
ESSAY WRITING ( Lang. Lab), Structure of an Academic essay, writing introduction , thesis statement, writing body paragraphs , writing concluding paragraph, unity, support, coherence and sentence skills , Different types of essay.					10
<b>Unit-5 ORAL COMMUNICATION</b>					
(Interactive practical sessions in lang. lab), listening comprehensions, pronunciation, intonation, stress and rhythm, interview and formal presentation skills.					10
<b>Self-study: NA</b>					
<b>Site/Industrial Visits: NA</b>					



**Course outcomes:**

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

CO1: acquire basic proficiency in all the English language skills: reading , listening comprehension, writing ,and speaking {Level} {PO}

CO2: have a better understanding of the Mechanics of English language {Level} {PO}

CO3: make an organized, and well prepared oral presentation to meet the needs of individuals and small groups. {Level} {PO}

CO4: write good academic essays {Level} {PO}

CO5: take part in group discussions with a better speaking skill. {Level} {PO}

**Text Books:**

T1. Practical English Usage. Michael Swan. OUP. 1995

T2. Remedial English Grammar. F.T. Wood. Macmillan.2007

**Reference Books:**

R1 On Writing Well. William Zinsser. Harper Resource Book. 2001

R2. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

R3. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

R4. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Online Resources:**

NIL

Course Name: Workshop Practice					
Course Code : ME151 / ME251					
	L	T	P	Category	ESC
Contact Hrs./Week	0	0	2	CIA Marks	25
Contact Hrs./Sem.	0	0	30	ESE Marks	25
Credits.	0	0	1	Exam Hours	2
<b>Course objectives:</b> To provide the students with the hands on experience on different trades of engineering like fitting, welding, carpentry & sheet metal.					
<b>Units</b>					<b>Teaching Hours</b>
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
1. Safety Precautions and description of workshop tools and equipments.					1
2. Study of fitting tools and equipments.					2
3. Demonstrate and make a square fitting model.					4
4. Demonstrate and make a V fitting model.					2
5. Demonstrate and make a dovetail fitting model.					4
6. Study of electric arc welding tools and equipments.					1
7. Demonstrate and make a Butt Joint welding model.					2
8. Demonstrate and make a Lap Joint welding model.					2
9. Demonstrate and make a T-Joint welding model.					2
10. Demonstrate and make a L-Joint welding model.					2
11. Study of sheet metal tools and equipments.					1
12. Demonstrate and make a rectangular tray.					2
13. Study and demonstration of Carpentry tools, joints and operations.					1
14. Study and demonstration of MIG welding.					2
15. Study and demonstration of TIG welding.					2
<b>Self-study: NA</b>					
<b>Site/Industrial Visits: NA</b>					
<b>Course outcomes:</b>					
CO1: Demonstrate an understanding of and comply with workshop safety regulations. {L1,L2} {PO1,PO2, PO7, PO10}					
CO2: Select and perform a range of machining operations to produce a given project. { L1,L2,L3} {PO1,PO6,PO7,PO9,PO10}					
CO3: Identify and use marking out tools, handtools, measuring equipment and to work to prescribed tolerances. { L1,L2,L3} {PO1,PO2,PO6,PO9,PO10}					
CO4: Demonstrate a knowledge of welding process selection and capabilities. { L2,L3} {PO1,PO2,PO7,PO9,PO10}					
CO5: Demonstrate a knowledge of welding, joint design and the application of welding.					

{ L2,L3,L4} {PO1,PO2,PO6,PO7,PO9,PO10}

**Text Books:**

T1. S. K. H. Choudhury, A. K. H. Choudhury, Nirjhar Roy, "The Elements of Workshop Technology", Vol 1 & 2, Media Propoters and Publishers, Mumbai, 2018.

**Reference Books:**

R1. P. Kannaiah and K.L. Narayana, "Manual on Workshop Practice", Scitech Publications, (1999).

R2. T Jeyapoovan, "Engineering Practices Lab - Basic Workshop Practice Manual," ISBN: 81-259-1800-0

R3. H.S.Bawa, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, (2007)

**Online Resources:**

W1. <https://nptel.ac.in/noc/>

W2. <http://ecoursesonline.iasri.res.in>

Course Name: Mathematics II					
Course Code : MA231					
	L	T	P	Category	BSC
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
<p><b>Course objectives:</b> Mathematics is a necessary avenue to scientific knowledge which opens new vistas of mental activity. A sound knowledge of engineering Mathematics is a 'sine qua non' for the modern engineer to attain new heights in all aspects of engineering practice. This course provides the student with plentiful opportunities to work with and apply the concepts, and to build skills and experience in mathematical reasoning and engineering problem solving. At the end of this course, the students will</p> <ul style="list-style-type: none"> <li>• be introduced to the tools of integration of multivariate functions over areas and volumes.</li> <li>• learn the technique of multidimensional change of variables to transform the coordinates over which integration proceeds by utilizing Jacobian. Specifically, students will learn how to transform between an integral over an area or volume in Cartesian coordinates to polar coordinates.</li> <li>• be able to solve higher order homogenous/ non-homogenous linear differential equations with constant coefficients</li> <li>• be able to solve Cauchy's and Legendre's equations.</li> <li>• learn the fundamental vector calculus integral theorems of Green, Stokes' and Divergence. Students will also learn how these theorems represent conservation principles for physical vector fields important in gravitation and electric fields.</li> <li>• be able to perform operations with Laplace and inverse Laplace transforms to solve higher order differential equations</li> </ul>					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 DIFFERENTIAL CALCULUS - II</b>					
Polar curves and angle between Polar curves. Pedal equations of polar curves, Radius of curvature - Cartesian, parametric, polar and pedal forms.					8
<b>Unit-2 INTEGRAL CALCULUS - II</b>					
Double integrals, Cartesian and polar co - ordinates, change of order of integration, change of variables between cartesian and polar co - ordinates, triple integration, area as a double integral, volume as a triple integral					14
<b>Unit-3 DIFFERENTIAL EQUATIONS - II</b>					
Linear differential equations of second and higher order with constant coefficients. Method of variation of parameters. Legendre's and Cauchy's homogeneous differential equations.					10
<b>Unit-4 LAPLACE TRANSFORMS</b>					

Definition - Transforms of elementary functions - Properties, Derivatives and integrals of transforms- Problems. Periodic function. Unit step function and unit impulse function Inverse transforms, Solutions of linear differential equations.	<b>10</b>
<b>Unit-5 VECTOR CALCULUS - II</b>	
Vector Integration - Green's theorem in a plane, Gauss's divergence theorems, Stoke's, (without proof) and simple application.	<b>7</b>
<b>Self-study: NA</b>	
<b>Site/Industrial Visits: NA</b>	
<p><b>Course outcomes:</b></p> <p>CO1: Find the angle between the polar curves and radius of curvature by applying differentiation</p> <p>CO2: Calculate the area and volume of solids using double and triple integration.</p> <p>CO3: Solve linear differential equations of higher order by using inverse differential operator, Method of undetermined coefficients and variation of parameters.</p> <p>CO4: Solve initial value problems using Laplace Transforms method</p> <p>CO5: Establish the relation between the line and surface integral, surface and volume integral using Green's, Stoke's and Gauss Divergence theorem</p>	
<p><b>Text Books:</b></p> <p>T1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 39<sup>th</sup> Edition, Khanna Publishers, July 2005.</p> <p>T2. H. K. Das &amp; Rajnish Verma, "Higher Engineering Mathematics", S. Chand &amp; Company Ltd., 2011.</p>	
<p><b>Reference Books:</b></p> <p>R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, John Wiley &amp; Sons, Inc, 2005</p> <p>R2. Thomas and Finney, "Calculus", 9<sup>th</sup> Edition, Pearson Education, 2004</p> <p>R3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Publication, Canada, 2007</p> <p>R4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw - Hill, 2009.</p> <p>R5. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw - Hill, 2006.</p> <p>R6. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) &amp; Co. Ltd., India, March 17, 2005.</p> <p>R7. Paras Ram, "Engineering Mathematics through Applications", 1<sup>st</sup> Edition, CBS Publisher, 2011.</p>	
<p><b>Online Resources:</b></p> <p>NIL</p>	

Course Name: Applied Physics					
Course Code : PH132P / PH232P					
	L	T	P	Category	BSC
Contact Hrs./Week	3	0	2	CIA Marks	50
Contact Hrs./Sem.	45	0	15	ESE Marks	50
Credits.	3	0	1	Exam Hours	3 hrs
<p><b>Course objectives:</b> This paper contains five UNITS which are Modern Physics, Quantum Mechanics, Conductivity in Metals (Electrical and Thermal), Elastic, Dielectric and Optical Properties of Materials, Lasers, Optical Fibers.</p> <p>At the end of the course, the students would be able to</p> <ul style="list-style-type: none"> <li>Identify the fundamental aspects of modern physics and quantum mechanics.</li> <li>Compare classical and quantum free electron theory.</li> <li>Outline the salient properties of elastic and dielectric materials.</li> <li>Apply the concepts learnt in Laser, Fiber optics in the field of Engineering.</li> <li>Apply optical phenomenon in technology.</li> </ul>					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 MODERN PHYSICS</b>					
Introduction, Planck's theory - Deduction of Wien's displacement law and Rayleigh Jean's law from Planck's law, Compton effect, de Broglie hypothesis - extension to electron particle. Phase velocity, group velocity, expression for group velocity based on superposition of waves, relation between group velocity and particle velocity. Problems.					09
<b>Unit-2 QUANTUM MECHANICS</b>					
Heisenberg's uncertainty principle and its physical significance. Application of uncertainty principle (Non-existence of electron in the nucleus). Wave function. Properties and Physical significance of a wave function Schrodinger - Time independent wave equation - Application: Setting up of a one dimensional Schrödinger wave equation of a particle in a potential well of infinite depth : Probability density and Normalization of wave function - Energy Eigen values and Eigen function. Problems.					09
<b>Unit-3 ELECTRICAL AND THERMAL CONDUCTIVITIES OF METALS</b>					
<p><b>Classical free-electron theory.</b> Introduction, assumptions and limitation of classical free-electron theory. Thermal Conductivity. Wiedemann - Franz law, calculation of Lorentz number.</p> <p><b>Quantum free-electron theory</b> - Postulates of quantum free electron theory, Fermi - Dirac Statistics. Fermi-energy - Fermi factor. Density of states. Carrier concentration in metals. Expression for electrical resistivity/conductivity - Merits of Quantum free electron theory. Problems.</p>					10
<b>Unit-4 MATERIALS SCIENCE</b>					

<p><b>Elasticity</b> : Introduction - Bending of beams – Single Cantilever – Application of Cantilever in AFM, Young’s modulus-Non uniform bending. Problems.</p> <p><b>Dielectrics</b> : Dielectric constant and polarisation of dielectric materials. Types of polarisation. Equation for internal fields in liquids and solids (one dimensional). Clausius – Mossotti equation. Ferro and Piezo – electricity(qualitative). Frequency dependence of dielectric constant. Important applications of dielectric materials. Problems.</p>	<b>09</b>
<b>Unit-5 APPLIED OPTICS</b>	
<p><b>Lasers:</b> Principle and production. Einstein’s coefficients (expression for energy density). Requisites of a Laser system. Condition for Laser action. Principle, Construction and working of He-Ne and semiconductor diode Laser. Applications of Laser – Laser welding, cutting and drilling. Measurement of atmospheric pollutants. Problems.</p> <p><b>Optical Fibers:</b> Introduction, Principle and Propagation of light in optical fibers. Angle of acceptance. Numerical aperture. Types of optical fibers and modes of propagation. Applications –optical fiber communication system. Problems.</p>	<b>08</b>
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
<b>PART - A</b>	
<p>1. Basic Measuring Instruments</p> <ul style="list-style-type: none"> <li>• Vernier Callipers</li> <li>• Screw Gauge</li> <li>• Travelling Microscope</li> </ul>	<b>02</b>
2. Verification of Stefan’s law	<b>01</b>
3. Planck’s Constant (Determination of Planck’s constant using LED or using the principle of photoelectric effect)	<b>01</b>
4. Determination of Fermi energy.	<b>01</b>
5. Young’s modulus – Non-uniform bending.	<b>01</b>
6. Measurement of Dielectric Constant ( Charging & discharging of capacitor).	<b>02</b>
7. Ultrasonic Interferometer.	<b>01</b>
8. Interference at a wedge.	<b>02</b>
9. Laser Diffraction (Determination of grating constant and number of rulings per inch using diffraction grating).	<b>01</b>
10. Frequency determination – Melde’s apparatus	<b>02</b>
11. Photo Multiplier Tube – Demonstration only	<b>01</b>

**Course outcomes:**

1. To outline the principles of Classical Physics and Modern Physics.
2. To classify the materials according to the theories of Quantum Physics.
3. To apply the principles of Physics to solve the problems in different relevant topics.
4. To analyze different materials for various scientific applications.
5. To apply the principles of optics in the field of LASERS and Optical Fiber.
6. To evaluate the theories of quantum mechanics in various fields of LASERS, Materials sciences and future engineering applications.

**Text Books:**

- T1. M.N.Avadhanulu and P.G. Kshirsagar, "A Text Book of Engineering Physics", S.Chand & Company Ltd, 9th Edition 2012.
- T2. John Wiley "Engineering Physics", Wiley India Pvt. Ltd, 1st Edition 2014.
- T3. S.O. Pillai, "Solid State Physics", New Age International, 6th Edition 2009.
- T4. S.P. Basavaraju, "Engineering Physics", Revised Edition 2009.
- T5. Charles Kittel, "Introduction to Solid State Physics", 8th Edition.
- T6. Arthur Beiser, "Concepts of Modern Physics", Special Indian Edition 2009.
- T7. Ajoy Ghatak, "Optics", 4th Edition 2009

**Reference Books:**

- R1. R.K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpatrai and Sons, New Delhi, 2001.
- R2. Sehgal Chopra Sehgal, "Modern Physics", Tata McGraw-Hill, 6th Edition, 2005.
- R3. Halliday, Resnick and Krane, "Fundamentals of Physics Extended", John Wiley and Sons Inc., New York, 5th Edition, 1997.
- R4. P.Mani, "Engineering Physics", Dhanam publishers, Revised Edition 2011.
- R5. H.J. Sawant, "Engineering Physics", Technical Publications, 1st Edition, 2010.
- R6. V. Rajendran, "Engineering Physics", Tata Mcgraw Hill Publishing Company Limited, 1st Edition, 2009.
- R7. K.Eric Drexler, "Nanosystems - Molecular Machinery, Manufacturing and Computation", John Wiely & Sons, 2005.
- R8. J David, N Cheeke, "Fundamentals and Applications of Ultrasonic Waves", CRC Press 1st Edition, 2002.
- R9. Frederick J Bueche and Eugene Hecht "Schaum Outline of Theory and Problems of College Physics", Tata McGraw-Hill, 11th Edition, 2012.
- R10. M. Ali Omar, "Elementary Solid State Physics", Addison-Wesley 1st Edition, 1993.

**Online Resources:**

- W1. <https://en.wikipedia.org/wiki/Laser>
- W2. <https://en.wikipedia.org/wiki/Ultrasound>
- W3. [https://en.wikipedia.org/wiki/Optical\\_fiber](https://en.wikipedia.org/wiki/Optical_fiber)



Course Name: Basic Electrical Engineering					
Course Code : EE133P /233P					
	L	T	P	Category	ESC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	24	ESE Marks	30
Credits.	3	0	1	Exam Hours	3
<p><b>Course objectives:</b> This course is aimed to solve and analyse DC and AC networks. It also covers the fundamental principles of alternator, transformer, motors, renewable energy systems and power converters. It also emphasise the concepts in smart grid and electrical vehicles to cope up with current trends in electrical engineering.</p>					
<b>Prerequisites:</b> NA					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 : DC CIRCUITS</b>					
Basic electrical quantities, KCL, KVL, voltage and current division rules, circuit reduction using series, parallel and star-delta transformation of resistors. Superposition theorem, Thevenin's theorem, Source transformations-Electromagnetism- Faraday's laws, comparison of electric and magnetic circuits.					9
<b>Unit-2: AC CIRCUITS</b>					
Comparison of DC and AC , Generation of sinusoidal signal, Representation of AC, inductance and capacitance, behaviour of pure R, L and C in AC circuits, RL, RC and RLC series circuits- derivations, phasor diagrams, real power, reactive power, power factor and resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.					9
<b>Unit-3: POWER SYSTEM COMPONENTS</b>					
Power system components-overview, Alternator-construction, working and generated voltage equation, Transformer - types, construction, working, emf equation, voltage regulation and efficiency, Switchgears (Fuse, MCB, relay), earthing, electric safety, standards and best practices. DC Motor- construction and working, torque and speed equations of shunt motors, Single phase induction motors - construction and working, BLDC motor and its applications in e-mobility.					9
<b>Unit-4: POWER CONVERTERS AND RENEWABLE ENERGY</b>					
Power supplies and converters, SCR as a switch single phase rectifiers and inverters, DC power supply. Solar standalone system and its characteristics, Solar PV grid tied system description, Wind energy systems- types, types of renewable systems- stand alone, grid tied systems and hybrid and micro-grids.					9
<b>Unit-5: SMART GRID AND ELECTRIC VEHICLES</b>					

Introduction to smart grid, Home automation systems, Application of IoT in electrical systems, smart meters, communication systems in electrical systems, Artificial intelligence in power system. Introduction to electric vehicles- building blocks, charging stations. Different types of batteries and terminologies and BMS applications	9
<b>List of Experiments:</b>	
	<b>Practical Hours</b>
1. Verification of superposition theorem	2
2. Wiring practice - multiple switching and two way switching	2
3. Phase angle measurement in R, RL and RLC circuits	2
4. Energy measurement in single phase circuits - with R and RL loads	2
5. Power factor improvement	2
6. Regulation and efficiency of single phase transformer.	2
7. Speed - torque characteristics of a DC shunt motor	2
8. Speed - torque characteristics of single phase induction motor	2
9. Characteristics of solar PV modules	2
10. Electrical appliances control using Arduino	2
11. Variable DC voltage using DC-DC converter (Demonstration)	2
12. Power circuit control using relay and a contactor. (Demonstration)	2
<b>Self-study : NA</b>	
<b>Site/Industrial Visits : NA</b>	
<b>Course outcomes:</b> CO1: To solve DC networks CO2: To solve AC networks CO3: To understand working modes of alternator, transformer and motors CO4: To understand renewable energy systems and power converters CO5: To illustrate concepts smart grid and electrical vehicles	
<b>Text Books:</b> T 1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. T 2. V K. Mehta, Vivek Mehta, "Principles of Power System", S. Chand, 2005, reprint 2015. T 3. D. P. Kothari and K C.Singal, "Renewable Energy Sources and Emerging Technologies", PHI, 2011. T 4. James Larminie, John Lowry, 'Electric Vehicle Technology Explained', Wiley , 2015.	
<b>Reference Books:</b> R 1. Weedy, Cory, Ekanayake, ' Electric Power Systems', John Wiley & Sons; 5th edition, 2012. R 2. Hina Fathima (Editor), 'Hybrid-Renewable Energy Systems in Microgrids: Integration,	

Developments and Control', Woodhead Publishing Series in Energy, 2018.

R 3. Nikos Hatziargyriou, 'Microgrids: Architectures and Control', Wiley, 2014

R 4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

**Online Resources:**

W1. <https://nptel.ac.in/courses/108108076/>

W2. <https://nptel.ac.in/downloads/108105053/>

Course Name: Basics of Civil Engineering and Engineering Mechanics					
Course Code : CE134P / CE234P					
	L	T	P	Category	ESC
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
<b>Course objectives:</b>					
<ul style="list-style-type: none"> <li>• The students will understand the basics of civil engineering and Engineering Mechanics</li> <li>• The students will understand the basic principles and laws of forces of nature, measurements, calculations and SI units.</li> <li>• The students will understand mechanics that studies the effects of forces and moments acting on rigid bodies that are either at rest or moving with constant velocity along a straight path for static condition only.</li> <li>• The students will understand the basic concepts of forces in the member, centroid, moment of inertia and Kinetics of bodies.</li> </ul>					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1</b>					
<b>Introduction To Civil Engineering</b> Scope of different fields of Civil Engineering: Surveying, Building Materials, Construction Technology, Structural Engineering, Geotechnical Engineering, Environmental Engineering, Hydraulics, Water Resources Engineering, Transportation Engineering. Role of Civil Engineers in Infrastructure Development.					9
<b>Introduction to Engineering Mechanics</b> Basic idealizations-Particle, Continuum, Rigid body and Point force, Newtons laws of motion. Force, classification of force systems, Principle of Physical Independence of forces, Principle of Superposition of forces and Principle of Transmissibility of forces, Moment, Couple and its characteristics. Composition and resolution of forces, Parallelogram Law of forces, Polygon law. Resultant of coplanar concurrent force systems.					
<b>Unit-2</b>					
<b>Composition of Coplanar Concurrent and Non Concurrent Force System.</b> Resultant of coplanar concurrent force systems. Varignon's Theorem, Resultant of coplanar non concurrent force systems.					9
<b>Equilibrium of force systems</b> Free body Diagram, Lami's Theorem, Equations of Equilibrium, Equilibrium of coplanar concurrent forces.					

<b>Unit-3</b>	
<b>Support Reactions</b> Types of loads and supports, Types of beams, Statically determinate and indeterminate beams, Support Reactions in beams, Numerical Problems on support reactions for statically determinate beams (point load, Uniformly distributed load, Uniformly varying load and moments) .	9
<b>Unit-4</b>	
<b>Centroid and Moment of inertia</b> Definition of centroid and centre of gravity, Centroid of simple plane figures and built up sections. Moment of inertia / Second Moment of area, Parallel axis theorem and Perpendicular axis theorem, Moment of Inertia of composite areas, Polar Moment of inertia and radius of gyration.	9
<b>Unit-5</b>	
<b>Kinematics</b> Definitions, Displacement, Average velocity, Instantaneous Velocity, Speed, Acceleration, Average Acceleration, Variable Acceleration, Acceleration due to gravity. Types of motion-Rectilinear, Curvilinear and Projectile motion. Relative motion and Motion under Gravity, Numerical Problems.  Kinetics: D Alemberts Principle and its application in Plane motion.	9
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
1.To determine moisture content of fine Aggregates.	2
2.Sieve Analysis of Fine Aggregates.	2
3.Determination of Compressive Strength of Burnt Clay Bricks.	2
4. Determination of Fineness of Cement.	2
5. Setting out of rectangle in the field.	2
6. Setting out of polygon in the field.	2
7. To Verify the Polygon Law of Forces Using Universal Force Table.	2
8. To Verify Parallelogram Law of Forces Using Grave Sand's Apparatus.	2
9. To Determine Weight of Body Using Grave Sand's Apparatus.	2
10. To Verify Triangular law of Forces using Jib Crane Apparatus.	2
11. To determine the reactions for simply supported beam Using Parallel Force	2

Apparatus.	
12. To determine the center of gravity Using Parallel Force Apparatus.	2
<b>Self-study:</b> NA	
<b>Site/Industrial Visits :</b> Nil	
<p><b>Course outcomes:</b> After a successful completion of the course, the student will be able to:</p> <p><b>CO1:</b> Understand basics of Civil Engineering, its scope of study and materials of construction.(L1)(PO1)(PSO1)</p> <p><b>CO2:</b> Comprehend the action of Forces, Moments and other loads on systems of rigid bodies.(L2)(PO1,PO2)(PSO2)</p> <p><b>CO3:</b> Compute the reactive forces and the effects that develop as a result of the external loads.(L3)(PO1)(PSO2)</p> <p><b>CO4:</b> Compute Centroid and Moment of Inertia of regular and built up sections.(L3)(PO1)(PSO1)</p> <p><b>CO5:</b> Express the relationship between the motion of bodies and equipped to pursue studies in allied courses in Mechanics. (L3) (PO1,PO2) (PSO1)</p>	
<p><b>Text Books:</b></p> <p>T1. Bhavikatti S.S. <i>Elements of Civil Engineering</i>, 4<sup>th</sup> Edition and <i>Engineering Mechanics</i> ,2<sup>nd</sup> edition, New Delhi, Vikas Publishing House Pvt. Ltd, 2008.</p> <p>T2. Shesh Prakash and Mogaveer, <i>Elements of Civil Engineering and Engineering Mechanics</i>, 1<sup>st</sup> edition, New Delhi , PHI learning Private Limited,2009.</p> <p>T3. Jagadeesh T.R. and Jay Ram, <i>Elements of Civil Engineering and Engineering Mechanics</i>, 2<sup>nd</sup> edition, Bangalore, Sapana Book House, 2008.</p>	
<p><b>Reference Books:</b></p> <p>R1. Timoshenko, and Young, <i>Engineering Mechanics</i>, Tata McGraw-Hill, New Delhi, 2013.</p> <p>R2. Meriam J. L, and Kraige, L. G, <i>Engineering Mechanics</i>, 5/E, Volume I, Wiley India Edition, India, February 2018</p> <p>R3. Irving H Shames, <i>Engineering Mechanics</i>, 4/E, PHI learning Private Limited, New Delhi, 2008</p> <p>R4. Ferdinand P. Beer and E. Russel Johnston Jr., <i>Mechanics for Engineers: Statics</i>, McGraw-Hill Book Company, New Delhi. International Edition 2013</p> <p>R5. Bansal R. K, <i>Engineering Mechanics</i>, Laxmi Publications (P) Ltd, New Delhi, 2015</p> <p>Goyal and Raghuvanshi, <i>Engineering Mechanics</i>, New Edition, PHI learning Private Limited, New Delhi. 2011</p> <p>R6. Rajasekaran, S, Sankarasubramanian, G., <i>Fundamentals of Engineering Mechanics</i>, Vikas Publishing House Pvt., Ltd., 2011.</p> <p>R6. Kukreja C.B., Kishore K.Ravi Chawla., <i>Material Testing Laboratory Manual</i>, Standard Publishers &amp; Distributors 1996.</p> <p>R7. Gambhir M.L., <i>Concrete Manual</i>, Dhanpat Rai &amp; Sons, New Delhi, 2014</p> <p>Duggal S.K., <i>Surveying</i>, Vol-I, Tata McGraw Hill - Publishing Co. Ltd. New Delhi.</p> <p>R8. Punmia. B.C., <i>Surveying Vol-1</i>, Laxmi Publications, New Delhi.</p>	

**Online Resources:**

W1. <https://nptel.ac.in/courses/112103109/>

W2. <https://nptel.ac.in/courses/122104015/>

Course Name: Engineering Graphics					
Course Code : EG135P / EG235P					
	L	T	P	Category	ESC
Contact Hrs./Week	2	0	2	CIA Marks	50
Contact Hrs./Sem.	30	0	30	ESE Marks	50
Credits.	2	0	1	Exam Hours	3
<b>Course objectives:</b>					
<ul style="list-style-type: none"> <li>To create an awareness and emphasise the need for Engineering Graphics.</li> <li>To teach basic drawing standards and conventions.</li> <li>To develop skills in three-dimensional visualization of engineering components.</li> <li>To develop an understanding of 2D and 3D drawings using the Solidworks software</li> </ul>					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO ENGINEERING DRAWING&amp; ORTHOGRAPHIC PROJECTIONS</b>					
<b>Introduction to Engineering Drawing</b> Principles of Engineering Graphics and their significance, usage of Drawing instruments, BIS conventions, lettering, Scales - Plain, Diagonal and Vernier Scales. <b>Orthographic Projections (First Angle Projection Only)</b> Principles of orthographic projections, introduction to first angle and third angle projection, projections of points, lines (inclined to both planes) and planes. (No application problems)					14
<b>Unit-2 INTRODUCTION OF COMPUTER AIDED ENGINEERING DRAWING</b>					
<b>Introduction of Computer Aided Engineering Drawing (CAED)</b> Introduction and customization of user interface consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning, orthographic constraints, snap to objects manually and automatically, producing drawings by using various coordinate input entry methods to draw straight lines, applying various ways of drawing circles. Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings, setting up and use of layers, layers to create drawings, create, edit and use customized layers, changing line lengths through modifying existing lines.					2
<b>Unit-3 PROJECTIONS OF REGULAR SOLIDS &amp; SECTIONS OF SOLIDS</b>					
<b>Projections of Regular Solids</b> Projection of solids inclined to both the Planes, draw simple annotation, dimensioning and scale (both manual and CAD software). <b>Sections of solids</b> Sections and sectional views of right angular solids - Prism, Cylinder, Pyramid, Cone- Auxiliary Views; (both manual and CAD software)					20
<b>Unit-4 DEVELOPMENT OF SURFACES &amp; ISOMETRIC PROJECTIONS</b>					



<p><b>Development of surfaces</b> Development of surfaces of right regular solids - prism, pyramid, cylinder and cone; draw the sectional orthographic views of geometrical solids.</p> <p><b>Isometric Projections</b> Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of simple and compound Solids, conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.</p>	20
<b>Unit-5 OVERVIEW OF COMPUTER GRAPHICS &amp; INTRODUCTION TO MODELING AND ASSEMBLY</b>	
<p><b>Overview of Computer Graphics</b> Demonstrating knowledge of the theory of CAD software: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Projection of solids, Isometric of Simple and compound Solids, sections of solids and development of surfaces.</p> <p><b>Introduction to Modeling and Assembly</b> Introduction to Computer aided modeling of solid part and assembly using CAD software Parametric and non-parametric solid and wireframe models, part editing and 2D drafting of assembly.</p>	20
<p><b>Self-study:</b> Three Modeling of Simple Machine Parts</p>	
<p><b>Site/Industrial Visits :</b> Nil</p>	
<p><b>Course outcomes:</b> CO1: Understand the importance of BIS standards and scales and be able to use it in Engineering drawings and be Able to graphically construct geometric 2 Dimensional figures with hand tools and solve numericals related to them. {L1,L2}{PO1} CO2: Use the CAD software and be able to create basic 2D computer geometries like points, lines, and planes. {L1,L2}{PO1,PO2} CO3: Understand the concept of projection and sectioning of solids and be able to create the drawings manually. {L1,L2}{PO1,PO2} CO4: To create Drawings of surfaces of regular solids after development Manually. {L1,L2}{PO1,PO2} CO5: To create isometric drawings from Orthographic projections by using isometric scale Manually and using CAD software. {L1,L2}{PO2,PO5} CO6: To create projection of solids, sectioning development of surface using CAD software and be able to draw basic 3D shapes in CAD. {L1,L2}{PO2,PO5}</p>	
<p><b>Text Books:</b> T1. Bhatt N.D., Panchal V.M. &amp; Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House T2. N S Parthasarathy and Vela Murali (2015) Engineering Drawing, Oxford University Press T3. Shah, M.B. &amp; Rana B.C. (2009), Engineering Drawing and Computer Graphics, Pearson Education T4. Agrawal B. &amp; Agrawal C. M. (2012), Engineering Graphics, TMH Publication</p>	

**Reference Books:**

R1. S. Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishing House Pvt. Ltd., New Delhi.

R2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech

R3. K.R. Gopalakrishna, "Engineering Graphics", 15<sup>th</sup> Edition, Subash Publishers Bangalore

**Online Resources:** Nil

<b>COURSE NAME: BIOLOGY FOR ENGINEERS</b>					
<b>Course Code : BS136 / BS236</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>Course Code</b>
Contact Hrs./Week	<b>3</b>	<b>0</b>	<b>0</b>		<b>CIA Marks</b>
Contact Hrs./Sem.	<b>45</b>	<b>0</b>	<b>0</b>		<b>ESE Marks</b>
Total Contact Hrs.	<b>45</b>	<b>0</b>	<b>0</b>		<b>Exam Hours</b>
Credits.	<b>3</b>	<b>0</b>	<b>0</b>		
<b>Course objectives:</b>					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 HUMAN PHYSIOLOGY</b>					
General Anatomy of the body, Tissues level of organization (Types, origin, function & repair), Composition and Function of blood and its components: WBC, RBC, platelets, Hematopoiesis, Structure and function of heart, Properties of cardiac muscle, The Cardiac Cycle, Electrocardiogram -heart beat, HRV, QRS cycle, Functional anatomy of muscular system, types of muscles, respiratory system- mechanics, gas exchange and transport					<b>9</b>
<b>Unit-2 BIOSENSORS</b>					
General principles - Construction of biosensors, immobilization of receptor components in biosensors- Types -metabolism, semiconductor, optical, piezoelectric, immunosensors - Applications - lab-on-a-chip, food and beverage, defence, environmental applications, Medical instruments					<b>10</b>
<b>Unit-3 MODERN IMAGING SYSTEMS</b>					
X ray, digital radiography - x-ray computed tomography- Nuclear medical imaging systems, Magnetic resonance imaging system, Ultrasonic imaging system, thermal imaging, haemodialysis system, anaesthesia and ventilator systems.					<b>8</b>
<b>Unit-4 BIOMECHANICS</b>					
Key mechanical concepts - 9 fundamentals of biomechanics -Muscle action, Range of motion principle, Force motion principle - Tissue loads -Response of tissue to force -Biomechanics of passive muscle tendon unit- Biomechanics of bone - Biomechanics of ligaments - Mechanical characteristics of muscles- Force time principle - Stretch-shortening cycle					<b>10</b>
<b>Unit-5 MATERIALS FOR ORGANS AND DEVICES</b>					

Materials – polymers, metals, ceramics, hydrogels, degradable biomaterials - Host reaction to biomaterials and their evaluation -Application of biomaterials – heart valves, orthopaedic applications, Cochlear and dental implants, soft tissue replacements, Hard tissue replacements	8
<b>Self-study:</b>	
<b>Site/Industrial Visits:</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to do:  CO1: Discuss the hierarchical of life and the classification of species.  CO2: Differentiate between single celled and multi-cellular organisms based on their cell structure.  CO3: Explain structure, types and functioning of key components as proteins, carbohydrates, fats and DNA/RNA.  CO4: Elaborate on the different pathways for energy production, cell division, photosynthesis and genetic transfer.  CO5: Discuss about the construction and working of biosensors for various applications.  CO6: Discuss about the architecture and organization of implantable electronics, which are used to sense and monitor different body functions.  CO7: Discuss the fundamental of the common laboratory equipment, its functioning and the electronics associated with it.</p>	
<p><b>Text Books:</b>  T1. F. Scheller, F. Schubert, “Biosensors, Volume 11 of Techniques and Instrumentation in Analytical Chemistry”, Elsevier.  T2. Vinod Kumar Khanna, “Implantable Medical Electronics: Prosthetics, Drug Delivery, and Health Monitoring”, Springer, 2015  T3. Khandpur, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill Education, 2003  T4. David A. Winter, “Biomechanics and Motor Control of Human Movement”, John Wiley &amp; Sons, 2009  T5. Duane Knudson, “Fundamentals of Biomechanics”, Springer Science &amp; Business Media, 2013  T6. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, “Biomaterials Science: An Introduction to Materials in Medicine”, Academic Press, 2012  T7.G. Pocock, C. D. Richards, and D. A. Richards, Human physiology. Oxford: Oxford University Press, 2018.  T8 L. Sherwood, Fundamentals of human physiology. Belmont, CA: Brooks/Cole, Cengage Learning, 2012.</p>	
<p><b>Reference Books:</b>  R1. Bansi Dhar Malhotra, Anthony Turner, “Advances in Biosensors: Perspectives in Biosensors”, Volume 5 of Advances in Biosensors, Elsevier, 2003</p>	
<p><b>Online Resources:</b>  NIL</p>	

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		
<b>Course objectives:</b>						
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.						
<b>Prerequisites:</b> Mathematics-I and Mathematics-II						
<b>Modules</b>						<b>Teaching Hours</b>
<b>Unit-1 Linear Algebra</b>						
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
<b>Unit-2 Multivariant Calculus</b>						
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
<b>Unit-3 Optimization I</b>						
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
<b>Unit-4 Optimization II</b>						
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
<b>Unit-5 Graph Theory</b>						
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 problem . Shortest path algorithm-Dijkstra's algorithm						9

<b>List of Experiments - NIL -</b>
<b>Self-study: NIL</b>
<b>Site/Industrial Visits: NIL</b>
<p><b>Course outcomes:</b> At the end of the course, the student will be able to do:</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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</li> <li>• Apply multivariable and vector-valued functions and their derivatives, using gradient algorithms to determine local/global maxima and minima, saddle points.</li> <li>• Analyze the type of optimization problem and apply suitable algorithm to find the optimum value of the objective function</li> <li>• Understand the fundamental concepts in graph theory and Apply algorithms and theorems from graph theory on solving problems</li> </ul>
<p><b>Text Books:</b> 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)</p>
<p><b>Reference Books:</b> R1. Singiresu S Rao, Engineering Optimization, 4th ed, Wiley, 2009 R2. Jorge Nocedal and Stephen J. Wright: "Numerical Optimization", second ed, 1999</p>
<b>Online Resources: NIL</b>

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
Definition and basics of: Data Structure, ADT, Algorithms, Time and Space Complexity, Asymptotic Notations ( $O$ , $\theta$ , $\Omega$ ), 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
<b>Unit-2 STACK AND QUEUE</b>					
Stack ADT: basic operations, Queue ADT: basic operations, Circular Queue, Evaluation of Expressions, Another application or Mazing Problem					9
<b>Unit-3 LINKED LIST</b>					
Singly Linked List: concept, representation and operations, Circular Linked List, Polynomial and Sparse Matrix operations using LL, Doubly Linked List: basic concept					9
<b>Unit-4 INTRODUCTION TO ALGORITHMS</b>					
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
<b>Unit-5 ALGORITHM DESIGN TECHNIQUES</b>					
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
<b>List Of Experiments</b>					<b>Practical Hours</b>
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
<b>Self-study:</b> Nil	
<b>Site/Industrial Visits :</b> Nil	
<b>Course outcomes:</b> 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}	
<b>Text Books:</b> T1. Sahni Horwitz,, Freed Anderson, Fundamentals of Data Structures in C, 2nd Edition (or latest) , University Press.\nT2. 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> Basic Electronics					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 BJT - BIASING AND SMALL SIGNAL ANALYSIS</b>					
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
<b>Unit-2 FET - BIASING AND AMPLIFIERS</b>					
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
<b>Unit-3 FREQUENCY RESPONSE AND HIGH FREQUENCY ANALYSIS</b>					
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
<b>Unit-4 FEEDBACK AMPLIFIERS</b>					
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
<b>Unit-5 CASCADE SYSTEMS AND POWER CONTROL DEVICES</b>					
<b>CASCADE SYSTEMS:</b> Analysis of frequency response and gain for BJT and FET amplifiers <b>POWER CONTROL DEVICES:</b> Power control devices: PNP diode (Shockley diode)					9

SCR characteristics - LASCR (Light Activated SCR) - TRIAC - DIAC - Structure & Characteristics. Characteristics and equivalent circuit of UJT - intrinsic stand-off ratio	
<b>List of Experiments:</b>	<b>Practical Hours</b>
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
<b>SIMULATION USING PSPICE/MULTISIM</b>	
1. Voltage divider bias	2
2. Shunt feedback amplifiers -frequency response and gain	2
<b>Self-study :</b> Bias Stabilization, Thermal runaway. Transistor as a switch -Unit 3	
<b>Site/Industrial Visits :</b> NIL	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Understand the biasing and small signal analysis of BJT. [L2] <b>CO2:</b> Understand the biasing and small signal analysis of FET. [L2] <b>CO3:</b> Construct the low frequency and high frequency BJT amplifiers. [L3] <b>CO4:</b> Examine the feedback amplifiers for different applications [L4] <b>CO5:</b> Perform analysis of the cascading stages of amplifiers and working principle of power devices. [L4] <b>CO6:</b>	
<b>Text Books:</b> T1. Robert L. Boylestead & Louis Nashelsky, "Electronic Devices and Circuit Theory", 10 <sup>th</sup> ed., Pearson Education, 2009. T2. Jacob Millman & Christos C. Halkias, "Electronic Devices and Circuits", Tata McGraw-Hill Education Pvt. Ltd., 2010.	
<b>Reference Books:</b> 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.	
<b>Online Resources:</b>	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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 BOOLEAN ALGEBRA</b>					
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
<b>Unit-3 COMBINATIONAL CIRCUITS-I</b>					
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
<b>Unit-4 COMBINATIONAL CIRCUITS-II</b>					
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
<b>Unit-5 SEQUENTIAL CIRCUITS</b>					
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.	
<b>List Of Experiments</b>	<b>Practical Hours</b>
NIL	
<b>Self-study:</b> Nil	
<b>Site/Industrial Visits :</b> Nil	
<p><b>Course outcomes:</b></p> <p>CO1: Describe the switching theory and realization of logic gates and logic families. [L2]{L2}{PO1, PO2}</p> <p>CO2: Illustrate the KMAP and Quine Mccluskey methods to minimize the logic functions{L2}{PO1,PO2,PO3,PO4}</p> <p>CO3: Explain the logic of various combinational circuits and obtain the logic diagram.. {L2}{PO1,PO2,PO3,PO4}</p> <p>CO4: Explain the logic of various sequential circuits and obtain the logic diagram.. {L2}{PO1,PO2,PO3,PO4}</p> <p>CO5: Explain the logic of VHDL programming to develop a digital logic circuits[L2]{PO1, PO2}</p> <p>CO6: Implement combinational and sequential circuits to solve real world problems{L4}{PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10}</p>	
<p><b>Text Books:</b></p> <p>T1. Donald P Leach, Albert Paul Malvino &amp; Goutam Saha, "Digital Principles and Applications" , Tata McGraw Hill 7 th Edition, 2010.</p>	
<p><b>Reference Books:</b></p> <p>R1. Stephen Brown. Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", Tata McGraw Hill, 2nd Edition 2005.</p> <p>R2 R D Sudhaker Samuel, "Illustrative Approach to Logic Design. Sanguine- Pearson", 2010.</p> <p>R3. Charles H. Roth, "Fundamentals of Logic Design", Cengage Learning, 5<sup>th</sup> Edition, 2004.</p> <p>R4. Ronald J. Tocci, Neal S. Widmer. Gregory L. Moss, "Digital Systems Principles and Applications," 10<sup>th</sup> Edition. Pearson Education, 2007.</p> <p>R5. M Morris Mano, "Digital Logic and Computer Design", Pearson Education, 10<sup>th</sup> Edition, 2008.</p>	
<b>Online Resources:</b> Nil	

<b>Course Name: Computer Organization and Processors</b>					
<b>Course Code : ECE335</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 BASIC STRUCTURE OF COMPUTERS</b>					
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
<b>Unit-2 ARITHMETIC &amp; LOGIC UNIT</b>					
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
<b>Unit-3 8086 MICROPROCESSOR</b>					
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
<b>Unit-4 INTERFACING WITH 8086</b>					
Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - Timer -Interrupt controller - DMA controller - Programming and applications					9
<b>Unit-5 PENTIUM MICROPROCESSOR</b>					
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
<b>Self-study :</b> NIL					

<b>Site/Industrial Visits :</b> NIL
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Summarize the architectural features of a computer <b>CO2:</b> Discover the basic functional units in ALU and perform various arithmetic operations of ALU <b>CO3:</b> Demonstrate the dataflow and program execution process in Computer <b>CO4:</b> Summarize various memory architectures and their data storage behaviour <b>CO5:</b> Interpret unique architectural features of 8086 and Pentium processors.
<b>Text Books:</b> T1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 7 <sup>th</sup> Edition “Computer Organization”, McGraw-Hill, 2011 T2. Douglas V. Hall “Microprocessor and Interfacing” 3 <sup>rd</sup> edition ,Tata McGraw Hill,2015. T3. James L. Antonakos , “ The Pentium Microprocessor ” Pearson Education, 2007
<b>Reference Books:</b> R1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 10 <sup>h</sup> Edition, Pearson Education, 2015. R2. David A.Patterson and John L.Hennessy, “Computer Organization and Design: The hardware / software interface”, 3 <sup>rd</sup> Edition, Morgan Kaufmann, 2008 R3. John P.Hayes, “Computer Architecture and Organization”, 4 <sup>th</sup> Edition, McGrawHill, 2003.
<b>Online Resources:</b> O1. <a href="https://link.springer.com/book/10.1007/978-0-230-00060-5">https://link.springer.com/book/10.1007/978-0-230-00060-5</a>

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
<b>Course objectives:</b>					
(a) To understand the moral values that ought to guide the Engineering profession.					
(b) To resolve the moral issues in the profession.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO ETHICS</b>					
Introduction to Profession, Engineering and Professionalism, Three types of Ethics / Morality , Positive and Negative faces of Engineering Ethics					6
<b>Unit-2 RESPONSIBILITY IN ENGINEERING AND ENGINEERING ETHICS</b>					
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
<b>Unit-3 SOCIAL AND VALUE DIMENSIONS IN TECHNOLOGY</b>					
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
<b>Unit-4 ELECTRONICS ENGINEERING AND BUSINESS ETHICS</b>					
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
<b>Unit-5 ETHICS AND ENVIRONMENT</b>					
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
<b>Self-study :</b> Nil					
<b>Site/Industrial Visits :</b> 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

<b>Course Name: Cyber Security</b>					
<b>Course Code : CY321</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>MC</b>
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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1</b>					
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
<b>Unit-2</b>					
Cyber Attack and Cyber Services Computer Virus - Computer Worms - Trojan horse.Vulnerabilities - Phishing - Online Attacks - Pharming - Phishing - Cyber Attacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood					9
<b>Unit-3</b>					
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
<b>Unit-4</b>					
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
<b>Unit-5</b>					
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
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> 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, 6<sup>th</sup> impression, ISBN: 978-81-7758-425-7.
- R2. Thomas R, Justin Peltier, John, "Information Security Fundamentals", Auerbach Publications.
- R3. AtulKahate, "Cryptography and Network Security", 2<sup>nd</sup> Edition, Tata McGrawHill.2003
- R4. Nina Godbole, SunitBelapure, "Cyber Security", Wiley India 1<sup>st</sup> 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

<b>Course Name: Object Oriented Programming using Java</b>					
<b>Course Code : ECE431P</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
Contact Hrs./Week	<b>3</b>	<b>0</b>	<b>2</b>	CIA Marks	<b>70</b>
Contact Hrs./Sem.	<b>45</b>	<b>0</b>	<b>30</b>	ESE Marks	<b>30</b>
Credits.	<b>3</b>	<b>0</b>	<b>1</b>	Exam Hours	<b>3</b>
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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					<b>9</b>
<b>Unit-2 CORE JAVA FUNDAMENTALS</b>					
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					<b>9</b>
<b>Unit-3 PRIMARY FEATURES OF JAVA</b>					
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					<b>9</b>
<b>Unit-4 ADVANCED JAVA FEATURES</b>					

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	<b>9</b>
<b>Unit-5 GRAPHICAL USER INTERFACE AND DATABASE SUPPORT OF JAVA</b>	
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	<b>9</b>
<b>LIST OF EXPERIMENTS (IF ANY)</b>	<b>Practical Hours</b>
Basic programs using datatypes, operators, and control statements in Java <ol style="list-style-type: none"> <li>1. Write a Java program that checks whether a given string is a palindrome or not</li> <li>2. Write a Java Program to find the frequency of a given character in a string</li> <li>3. Write a Java program to multiply two given matrices</li> </ol>	<b>6</b>
Exception handling and multi-threading applications <ol style="list-style-type: none"> <li>1. Write a Java program that shows the usage of try, catch, throws and finally</li> <li>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</li> <li>3. Write a Java program that shows thread synchronization</li> </ol>	<b>6</b>
Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection <ol style="list-style-type: none"> <li>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)</li> <li>2. Write a java program to create an abstract class named Shape that contains</li> </ol>	<b>6</b>

<p>an empty method named <code>numberOfSides()</code>. 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 <code>numberOfSides()</code> that shows the number of sides in the given geometrical structures. (Exercise to understand polymorphism)</p> <p>3. Write a Java program to demonstrate the use of garbage collector</p>	
<p>Handling different types of files as well as input and output management methods</p> <ol style="list-style-type: none"> <li>1. Write a file handling program in Java with reader/writer</li> <li>2. Write a Java program that read from a file and write to file by handling all file related exceptions</li> <li>3. Write a Java program that reads a line of integers, and then displays each integer, and the sum of all the integers</li> </ol>	6
<p>Graphics Programming</p> <ol style="list-style-type: none"> <li>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</li> <li>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</li> <li>3. Write a Java program to display all records from a table using Java Database Connectivity (JDBC)</li> </ol>	6
<b>Self-study:</b> Nil	
<b>Site/Industrial Visits :</b> Nil	
<p><b>Course outcomes:</b></p> <p>CO1: Write Java programs using the object oriented concepts - classes, objects, constructors, data hiding, inheritance and polymorphism [L3]</p> <p>CO2: Utilise datatypes, operators, control statements, built in packages &amp; interfaces, Input/Output Streams and Files in Java to develop programs[L3]</p> <p>CO3: Illustrate how robust programs can be written in Java using exception handling mechanism[L2]</p> <p>CO4: Write application programs in Java using multithreading and database connectivity [L3]</p> <p>CO5: Write Graphical User Interface based application programs by utilising event handling features and Swing in Java [L3]</p>	
<p><b>Text Books:</b></p> <p>T1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.</p> <p>T2. Rajib Mall, Fundamentals of Software Engineering, 4th edition, PHI, 2014</p> <p>T3. Paul Deitel, Harvey Deitel, Java How to Program, Early Objects 11th Edition, Pearson, 2018</p>	

**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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 KNOWLEDGE REPRESENTATION AND LOGIC</b>					
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
<b>Unit-3 REASONING UNDER UNCERTAINTY</b>					
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
<b>Unit-4 PLANNING AND LEARNING</b>					
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
<b>Unit-5 EXPERT SYTEMS</b>					
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
<b>Self-study : NIL</b>					



<b>Site/Industrial Visits :</b> NIL
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Formulate an efficient problem space for a problem in artificial intelligence <b>CO2:</b> Select a search algorithm for a problem and characterize its time and space complexities <b>CO3:</b> Understand the concepts of knowledge representation using an appropriate technique <b>CO4:</b> Apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing <b>CO5:</b> Explain expert systems based on architecture, roles and knowledge acquisition.
<b>Text Books:</b> 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
<b>Reference Books:</b> 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
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 LAPLACE TRANSFORM</b>					
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
<b>Unit-3 FOURIER TRANSFORM</b>					
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
<b>Unit-4 Z-TRANSFORM</b>					
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
<b>Unit-5 LINEAR TIME INVARIANT SYSTEMS</b>					
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
<b>Self-study:</b> Nil					

<b>Site/Industrial Visits :</b> Nil
<b>Course outcomes:</b> 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}
<b>Text Books:</b> T1. P. Ramakrishna Rao, 'Signal and Systems' 2008 Ed., Tata McGraw Hill, New DelhIi. T2. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003
<b>Reference Books:</b> 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
<b>Online Resources:</b> Nil

<b>Course Name: Microcontroller Based System Design</b>					
<b>Course Code : ECE434P</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
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
<b>Course objectives:</b> This course aims at learning the architecture programming and interfacing of Microcontrollers					
<b>Prerequisites:</b> Computer organization & Architecture					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 8051 ARCHITECTURE</b>					
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
<b>Unit-2 8051 PROGRAMMING</b>					
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
<b>Unit-3 SYSTEM DESIGN USING 8051</b>					
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
<b>Unit-4 HIGH PERFORMANCE RISC ARCHITECTURE: ARM</b>					
The ARM architecture- Bus Architecture-ARM organization and implementation - Addressing Modes-The ARM instruction set - The thumb instruction set- ARM assembly language program					9
<b>Unit-5 REAL TIME OPERATING SYSTEMS</b>					
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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
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
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Summarize the architectural features of 8051 microcontroller <b>CO2:</b> Apply the knowledge of ALP, Embedded C to solve embedded software concepts <b>CO3:</b> Examine and demonstrate the working of I/O devices <b>CO4:</b> Relate the advance features of ARM processors for efficient embedded system <b>CO5 :</b> Interpret unique architectural features of advance processors	
<b>Text Books:</b> 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 ' ,2 <sup>nd</sup> edition, Prentice Hall of India,2008	
<b>Reference Books:</b> R1. Myke Predko, "Programming and customizing the 8051 microcontroller", Tata McGraw Hill 2001. R2. Steve Furber , " ARM System On -Chip architecture " Addison Wesley , 2 <sup>nd</sup> edition,2000.	
<b>Online Resources:</b> O1. <a href="https://www.springer.com/in/book/9783319764382">https://www.springer.com/in/book/9783319764382</a> O2. NPTEL course- "Microprocessor and microcontroller", <a href="https://onlinecourses.nptel.ac.in/noc18_ec03/">https://onlinecourses.nptel.ac.in/noc18_ec03/</a>	

<b>Course Name: Engineering Biology Laboratory</b>					
<b>Course Code : BS451</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>BSC</b>
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
<b>Course objectives:</b>					
<b>Prerequisites:</b> Biology for Engineers					
<b>List of Experiments :</b>					<b>Practical Hours</b>
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 irregularities (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
<b>Self-study :</b> Nil					
<b>Site/Industrial Visits :</b> NIL					
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Examine the various applications of bioengineering and using common tool boxes for analysing medical information. <b>CO2:</b> <b>CO3:</b>					
<b>Text Books:</b> NIL					
<b>Reference Books:</b> NIL					
<b>Online Resources:</b> NIL					

<b>Course Name: Project Management and Finance</b>					
<b>Course Code : HS421</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>HSMC</b>
<b>Contact Hrs./Week</b>	3	0	0	<b>CIA Marks</b>	50
<b>Contact Hrs./Sem.</b>	45	0	0	<b>ESE Marks</b>	50
<b>Credits.</b>	3	0	0	<b>Exam Hours</b>	3
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1</b>					
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
<b>Unit-2</b>					
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
<b>Unit-3</b>					
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
<b>Unit-4</b>					
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
<b>Unit-5</b>					

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
<b>Self-study</b> : Nil	
<b>Site/Industrial Visits</b> : Project site visit	
<p><b>Course outcomes:</b> The students will be able to</p> <p><b>CO1:</b> Understand elements of project management and describe the contracts used in engineering terms</p> <p><b>CO2:</b> Describe the project management functions in engineering</p> <p><b>CO3:</b> Understand the nuances of project planning and scheduling</p> <p><b>CO4:</b> Apply the project cost estimation methods to estimate the cost of a given project</p> <p><b>CO5 :</b>Interpret the design criteria of electrical &amp; electronics components from the specifications</p> <p><b>CO4:</b> Understand the fundamentals of Project finance.</p>	
<p><b>Text Books:</b></p> <p>T1. Chitkara, K.K “Construction Project Management Plan, Se (English) 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2010.</p> <p>T2. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education, 2012.</p> <p>T3. B C Punmia and KK Khandelwal, Project planning and Control with PERT &amp; CPM.</p> <p>T4. J O Brien, “Construction Management”, Mcgraw Hill, 2016.</p>	
<p><b>Reference Books:</b></p> <p>R1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education, 9<sup>th</sup> edition, 2018.</p> <p>R2. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “Modern Construction Management”, Wiley-Blackwell, 7<sup>th</sup> edition, 2013.</p>	
<p><b>Online Resources:</b></p> <p>W1. <a href="https://onlinecourses.nptel.ac.in/noc17_mg01/">https://onlinecourses.nptel.ac.in/noc17_mg01/</a></p> <p>W2: <a href="https://nptel.ac.in/courses/105103133/31">https://nptel.ac.in/courses/105103133/31</a></p>	



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	-
<b>Course objectives:</b> To understand the scope and importance of environmental science towards developing a conscious community for environmental issues, both at global and local scale.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1</b>					
<i>Introduction:</i> 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
<b>Unit-2</b>					
<i>Natural Resources:</i> Classification and importance- Forest, Water, Mineral, Food, Energy. Management of natural resources - challenges and methods. Sustainable development - Goals, Agriculture, Industries					6
<b>Unit-3</b>					
<i>Environmental Pollution:</i> 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
<b>Unit-4</b>					
<i>Climate change/Global Atmospheric Change:</i> 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
<b>Unit-5</b>					
<i>Environmental Protection-</i> 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
<b>Self-study:</b>					
<b>Site/Industrial Visits:</b> Nil					
<b>Course Outcomes:</b>					

**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", Oxford University 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, 3<sup>rd</sup> 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. Erach Bharucha, "Textbook of Environmental Studies", for UGC, University press, 2005.  
R6. Dr. Pratiba Sing, Dr. Anoop Singh and Dr. Piyush Malaviya, "Textbook of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

**Online Resources:**

NIL

<b>Course Name: Data Base Management Systems</b>					
<b>Course Code : ECE531P</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
Contact Hrs./Week	<b>3</b>	<b>0</b>	<b>0</b>	CIA Marks	<b>70</b>
Contact Hrs./Sem.	<b>45</b>	<b>0</b>	<b>0</b>	ESE Marks	<b>30</b>
Credits.	<b>3</b>	<b>0</b>	<b>0</b>	Exam Hours	<b>3</b>
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b> Nil					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION AND CONCEPTUAL MODELING</b>					
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.					<b>9</b>
<b>Unit-2 RELATIONAL MODEL</b>					
SQL - Data definition- Queries in SQL- Updates- Views - Integrity and Security - Relational Database design - Functional dependences and Normalization for Relational Databases (up to BCNF).					<b>9</b>
<b>Unit-3 DATA STORAGE AND QUERY PROCESSING</b>					
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.					<b>9</b>
<b>Unit-4 TRANSACTION MANAGEMENT</b>					
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					<b>9</b>
<b>Unit-5 CURRENT TRENDS</b>					
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.					<b>9</b>

<b>Self-study:</b> Nil
<b>Site/Industrial Visits :</b> Nil
<b>Course outcomes:</b> 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}
<b>Text Books:</b> T1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2010
<b>Reference Books:</b> 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.
<b>Online Resources:</b> Nil

<b>Course Name: Digital Signal Processing</b>					
<b>Course Code : EC532P</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
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
<b>Course objectives:</b>					
<ul style="list-style-type: none"> <li>• Analyze and Compute FFT of a discrete time signal.</li> <li>• Design the various FIR filter techniques.</li> <li>• Design the various IIR filter techniques.</li> <li>• Analyze the finite word length effects in signal processing.</li> <li>• Learn the fundamentals of digital signal processors.</li> </ul>					
<b>Prerequisites:</b> Signals & Systems					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 FAST FOURIER TRANSFORM AND CONVOLUTION</b>					
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
<b>Unit-2 FINITE IMPULSE RESPONSE DIGITAL FILTERS</b>					
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
<b>Unit-3 INFINITE IMPULSE RESPONSE DIGITAL FILTERS</b>					
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
<b>Unit-4 FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS</b>					
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
<b>Unit-5 DIGITAL SIGNAL PROCESSOR</b>					
Introduction to DSP Architecture - Dedicated MAC unit - Features of C6X Processor - Internal Architecture - Functional Units and Operation - Addressing Modes					9
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
<b>USING MATLAB</b>					

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
<b>USING TMS320C6713 DSP PROCESSOR</b>	
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
<b>Self-study : Packet Voice Digital Signal Processor Module (PVDM)</b>	
<b>Site/Industrial Visits : Samsung India Electronics, ISRO Telemetry, Tracking and Command Network (ISTRAC) and other relevant organization</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :  <b>CO1:</b> Calculate the FFT of a discrete time signal  <b>CO2:</b> Demonstrate various FIR filter techniques  <b>CO3:</b> Demonstrate various IIR filter techniques  <b>CO4:</b> Summarize finite word length effects in signal processing  <b>CO5 :</b> Explain the fundamentals of Digital signal processor</p>	
<p><b>Text Books:</b>  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 &amp; M.Bhaskar, Digital Signal Processor Architecture-Programming and Application, Tata Mc-GrawHill 2002</p>	
<p><b>Reference Books:</b>  R1. Allan V.Openheim, Ronald W. Sehafer&amp; John R. Buck-"Discrete Time Signal Processing", Third edition, Pearson/Prentice Hall,2014.  R2. Johnny 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</p>	

**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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 SEMANTICS</b>					
Expression - Assignment - Control Flow - Input/Output - Exception Handling - State Transformation - Partial Functions - Semantics with Dynamic Typing - Formal Treatment of Semantics					9
<b>Unit-3 FUNCTIONS</b>					
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
<b>Unit-4 PROGRAMMING TECHNIQUES</b>					
Imperative programming - C - ADA - Perl - Object Oriented Programming - Small TalkJava- Python - Functional Programming - Scheme - Haskell					9
<b>Unit-5 MODERN PROGRAMMING TECHNIQUES</b>					
Logic Programming - Prolog - Event-Driven programming - Concurrent Programming - Concepts - Synchronization Strategies - Language Level Mechanism - Interprocess COMMUNICATION - Scripting LANGUAGES					9
<b>List of Experiments (If any):</b> NIL					<b>Practical Hours</b>
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> 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 Kaufman, 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
<b>Course objectives:</b> This course aims at introducing the technology, design concepts required in the design of Very Large Scale Integrated Circuits.					
<b>Prerequisites:</b> Digital Electronics					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 MOS TRANSISTORS</b>					
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
<b>Unit-2 CMOS PROCESSING TECHNOLOGY</b>					
Overview of IC industry, CMOS Technologies (Nwell, Pwell, Twin-Tub, SOI, BiCMOS), Layout Design Rules, Stick Diagrams, Euler's Rule for Physical Design.					9
<b>Unit-3 CMOS CHIP DESIGN</b>					
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
<b>Unit-4 VLSI CIRCUIT DESIGN</b>					
Precharge -Evaluate logic, Static and Dynamic CMOS logic circuits, Combinational Circuit Design, Sequential Circuit Design, Circuit Design of Latches and Flip-Flops.					9
<b>Unit-5 VERILOG HDL</b>					
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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
1. Design Entry and Simulation of Combinational Logic circuits <ul style="list-style-type: none"> <li>a) Basic logic gates</li> <li>b) Half adder and full adder</li> <li>c) Half Sub tractor and full sub tractor</li> <li>d) 8 bit adder</li> </ul>					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	
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Comprehend the basics of CMOS circuits <b>CO2:</b> Describe CMOS process technology <b>CO3:</b> Identify the techniques of chip design using programmable devices <b>CO4:</b> Strategy for designing the CMOS circuits <b>CO5 :</b> Design VLSI subsystems and modeling a digital system using Hardware Description Language	
<b>Text Books:</b> T1. Ayan Banerjee, Neil H. E. Weste, David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective" (English) 4 <sup>th</sup> 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	
<b>Reference Books:</b> 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	
<b>Online Resources:</b> O1. <a href="https://link.springer.com/book/10.1007/978-1-4614-1120-8">https://link.springer.com/book/10.1007/978-1-4614-1120-8</a>	

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
<p><b>Course objectives:</b> 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</p>					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO MACHINE LEARNING</b>					
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
<b>Unit-2 DECISION BASED AND INSTANCE LEARNING</b>					
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
<b>Unit-3 PROBABILITY AND BAYES LEARNING</b>					
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
<b>Unit-4 ARTIFICIAL NEURAL NETWORKS</b>					
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

<b>Unit-5 ENSEMBLES</b>	
Introduction, Bagging and boosting, Random forest - Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering	9
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>            At the end of the course, the student will be able to :  <b>CO1:</b> Develop an appreciation for what is involved in learning models from data.  <b>CO2:</b> Understand a wide variety of learning algorithms  <b>CO3:</b> Understand how to evaluate models generated from data  <b>CO4 :</b> 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</p>	
<p><b>Text Books:</b>            T1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997</p>	
<p><b>Reference Books:</b>            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</p>	
<p><b>Online Resources:</b>            NIL</p>	

<b>Course Name: Computer Networks</b>					
<b>Course Code : ECE633</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
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
<b>Course objectives:</b> 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 and MAC layer.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 DATA COMMUNICATIONS</b>					
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
<b>Unit-2 DATA LINK LAYER</b>					
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
<b>Unit-3 NETWORK LAYER</b>					
Internetworks - Packet Switching and Datagram approach - IP addressing methods - Subnetting - Routing - Distance Vector Routing - Link State Routing - Routers.					9
<b>Unit-4 TRANSPORT LAYER</b>					
Duties of transport layer - Multiplexing - Demultiplexing - Sockets - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion Control - Quality of services (QOS) - Integrated Service					9
<b>Unit-5 IEEE 802.11 WIRELESS LAN - MAC LAYER</b>					
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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> 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. Kurose & W. Rouse, "Computer Networking: A Topdown Approach Featuring", 7<sup>th</sup> edition,Pearson Education,2016

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

R3. Andrew S. Tannenbaum, "Computer Networks", PHI, 5<sup>th</sup> Edition, 2016

R4. William Stallings, "Data and Computer Communication", 8<sup>th</sup> 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
<p><b>Course objectives:</b> 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.</p>					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION AND BACKGROUND</b>					
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 Enablisth Technologies: WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Syestems.					9
<b>Unit-2 IOT HARDWARE, DEVICES AND PLATFORMS</b>					
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
<b>Unit-3 IOT ARCHITECTURE AND PROTOCOLS</b>					
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
<b>Unit-4 IOT PROGRAMMING</b>					
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
<b>Unit-5 DOMAIN SPECIFIC IOT</b>					
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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>



<b>Self-study :</b> NIL
<b>Site/Industrial Visits :</b> NIL
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Explain the fundamental building blocks of an IoT environment from a logical and physical perspective.</p> <p><b>CO2:</b> Experiment with Arduino and Raspberry Pi to choose the appropriate hardware for different IoT projects</p> <p><b>CO3:</b> Summarize IoT protocols in Application and Network layers by outlining their advantages and disadvantages</p> <p><b>CO4:</b> Develop IoT solutions using Arduino and Raspberry Pi to solve real life problems</p> <p><b>CO5 :</b>Survey successful IoT products and solutions to analyze their architecture and technologies</p>
<p><b>Text Books:</b>  T1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014</p>
<p><b>Reference Books:</b>  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." <i>IEEE Communications Surveys &amp; Tutorials</i> 17.4 (2015): 2347-2376  R5. Tsitsigkos, Alkiviadis, et al. "A case study of internet of things using wireless sensor networks and smartphones." <i>Proceedings of the Wireless World Research Forum (WWRF) Meeting: Technologies and Visions for a Sustainable Wireless Internet, Athens, Greece</i>. Vol. 2325. 2012  R6. Ye, Mengmei, et al. "Security Analysis of Internet-of-Things: A Case Study of August Smart Lock."</p>
<p><b>Online Resources:</b>  NIL</p>

<b>Course Name: Digital Image Processing and Computer Vision</b>					
<b>Course Code : ECE732</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PCC</b>
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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO DIGITAL IMAGE PROCESSING</b>					
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
<b>Unit-2 IMAGE RESTORATION AND SEGMENTATION</b>					
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
<b>Unit 3 MORPHOLOGICAL IMAGE PROCESSING AND PATTERN CLASSIFICATION</b>					
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
<b>Unit-4 LOW LEVEL IMAGE PROCESSING</b>					
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	
<b>Unit-5 MOTION ANALYSIS</b>	
Motion Analysis: Background Subtraction and Modeling, Optical Flow, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation	9
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :  <b>CO1:</b> Demonstrate various image enhancement techniques in spatial domain  <b>CO2:</b> Explain fundamentals of image restoration and segmentation  <b>CO3:</b> Understand fundamentals of morphological image processing  <b>CO4:</b> Understand the fundamentals of low-level image processing applied for image enhancement, restoration and feature extraction processes  <b>CO5:</b> Apply the concept of motion estimation for image and video processing applications</p>	
<p><b>Text Books:</b>  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</p>	
<p><b>Reference Books:</b>  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</p>	
<p><b>Online Resources:</b>  O1. <a href="https://nptel.ac.in/syllabus/106105032/">https://nptel.ac.in/syllabus/106105032/</a>  O2. <a href="http://www2.engr.arizona.edu/~dial/">http://www2.engr.arizona.edu/~dial/</a></p>	

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO PYTHON</b>					
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
<b>Unit-2 INTRODUCTION TO BUILDING PROGRAMS IN PYTHON</b>					
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
<b>Unit 3 DATA REPRESENTATION</b>					
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
<b>Unit-4 OBJECT ORIENTED PROGRAMMING</b>					
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
<b>Unit-5 PYTHON FOR MACHINE LEARNING</b>					

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
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b> At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Write python programs and execute [L3]  <b>CO2:</b> Illustrate uses of conditional (if, if-else, if-elif-else and switch-case) and iterative (while and for) statements in Python programs [L3]  <b>CO3:</b> Write programs by utilizing the modules Lists, Tuples, Sets and Dictionaries in Python [L3]  <b>CO4:</b> Implement Object Oriented programs with exception handling [L3]  <b>CO5:</b> Write Python programs to process data stored in files by utilizing the modules Numpy, Matplotlib, and Pandas [L3]</p>	
<p><b>Text Books:</b>  T1 Kenneth 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</p>	
<p><b>Reference Books:</b>  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</p>	
<p><b>Online Resources:</b> NIL</p>	

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
<p><b>Course objectives:</b> 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.</p>					
<p><b>Prerequisites:</b> NIL</p>					
Units					Teaching Hours
<b>Unit-1</b>					
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
<b>Unit-2</b>					
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
<b>Unit-3</b>					
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
<b>Unit-4</b>					
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
<b>Unit-5</b>					
Precision Agriculture system Design: Wireless sensor networks for precision agriculture-Sensor notes: 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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>

1. Field Work and deployment	30
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Apply the concepts of electronics &amp; communication to solve given real world societal problems through prototypes  <b>CO2:</b> Design solutions to given real world societal problems through working prototypes  <b>CO3:</b> Select appropriate hardware and software as per the requirement of the project designed to solve given real world societal problems  <b>CO4:</b> Understand the impact of the developed projects on environmental factors  <b>CO5:</b> Demonstrate project management skills including handling the finances in doing projects for given real world societal problems</p>	
<p><b>Text Books:</b>  T1. Terry A.Braser, "Precision Agriculture" Thomson/Delmar Learning, 2006  T2. Qin Zhang, " Precision Agriculture Technology for Crop Farming", CRC Press, 2015</p>	
<p><b>Reference Books:</b>  R1. Jao, J.; Bo Sun; Kui Wu, "A Prototype Wireless Sensor Network for Precision Agriculture," in <i>Distributed Computing Systems Workshops (ICDCSW), 2013 IEEE 33rd International Conference on</i> , 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 <i>Information and Computer Science (NICS), 2015 2nd National Foundation for Science and Technology Development Conference on</i> , vol., no., pp.294-299, 16-18 Sept. 2015  R3. Maribeth Price, "Mastering ArcGIS", 6<sup>th</sup> Edition, McGraw Hill Co., 2103</p>	
<p><b>Online Resources:</b>  NIL</p>	

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
NA					
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
NA					
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> NIL					
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Design solutions to real time complex engineering problems using the concepts of Electronics & Communication engineering through independent study <b>CO2:</b> Demonstrate teamwork and leadership skills with professional ethics <b>CO3:</b> Prepare an internship report in the prescribed format and demonstrate oral communication through presentation of the internship work					
<b>Text Books:</b> NA					
<b>Reference Books:</b> NA					
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
NA					
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>
NA					
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> NIL					
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Design engineering solutions to complex real world problems using research literature for societal applications through self-study <b>CO2:</b> Use appropriate hardware and software depending on the nature of the project with an understanding of their limitations <b>CO3:</b> Demonstrate teamwork and leadership skills with professional ethics and prepare a project report in the prescribed format <b>CO4:</b> Understand the impact of the developed projects on environmental factors <b>CO5:</b> Demonstrate project management skills including handling the finances in doing projects for given real world societal problems					
<b>Text Books:</b> NA					
<b>Reference Books:</b> NA					
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 SOFTWARE PROCESS</b>					
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
<b>Unit-2 SOFTWARE REQUIREMENTS</b>					
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
<b>Unit-3 DESIGN CONCEPTS AND PRINCIPLES</b>					
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
<b>Unit-4 TESTING</b>					
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
<b>Unit-5 SOFTWARE PROJECT MANAGEMENT</b>					
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	
<b>List of Experiments (If any):</b>	<b>Practical Hours</b>
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Describe the Software Development Life cycle and various Software process models.  <b>CO2:</b> Explain software requirement elicitation process and SRS document  <b>CO3:</b> Determine the user requirements and assign suitable software design model  <b>CO4:</b> Illustrate different techniques of software testing and maintenance  <b>CO5:</b> Manipulate the cost estimation techniques and project scheduling methods in software development process</p>	
<p><b>Text Books:</b>  T1. Roger S. Pressman, Software engineering- A Practitioner’s Approach, McGraw-Hill International Edition, 6th Edition 2012</p>	
<p><b>Reference Books:</b>  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</p>	
<p><b>Online Resources:</b>  NIL</p>	

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>				<b>Teaching Hours</b>	
<b>Unit-1 HTML 5</b>					
Why HTML5 exists? Structuring a Web Page, Forms, Multimedia (video, audio) markup and APIs, Canvas, Data Storage, Drag & Drop, Messaging & Workers				9	
<b>Unit-2 CSS 3</b>					
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	
<b>Unit-3 JAVASCRIPT</b>					
Basic JavaScript Instructions, Functions, Methods & Objects, Decisions & Loops, Document Object Model, Events				9	
<b>Unit-4 NoSQL</b>					
Installing MariaDB, Configuring MariaDB, MariaDB Security, MariaDB User Account Management, Using MariaDB.				9	
<b>Unit-5 node.js</b>					
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	
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Understand the basic web programming concepts used for internet applications. <b>CO2:</b> Illustrate the principles of CSS3 used in web programming <b>CO3:</b> 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 Ducket, "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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 CLASSES</b>					
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
<b>Unit-3 BASIC DESIGN PATTERNS</b>					
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
<b>Unit-4 EXCEPTIONS, COLLECTIONS AND IO</b>					
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
<b>Unit-5 THREAD AND APplet</b>					

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
<b>List of Experiments (If any):</b> NIL	<b>Practical Hours</b>
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Understand the Object Basics, Platform independency, Arrays. <b>CO2:</b> Apply the object oriented concept of Classes and Objects, encapsulation, Inheritance, Polymorphisms to solve real problems. <b>CO3:</b> Demonstrate the design pattern using JAVA <b>CO4:</b> Explain the exception cases and the I/O operations in JAVA Programming <b>CO5:</b> Develop simple web applications using Applet	
<b>Text Books:</b> 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.	
<b>Reference Books:</b> 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	
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 PROCESS MANAGEMENT</b>					
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
<b>Unit-3 PROCESS SYNCHRONIZATION AND DEADLOCKS</b>					
Background, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples.					9
<b>Unit-4 MEMORY MANAGEMENT AND VIRTUAL MEMORY</b>					
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
<b>Unit-5 FILE SYSTEM INTERFACE AND FILE SYSTEM IMPLEMENTATION &amp; MASS STORAGE STRUCTURE</b>					
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
<b>List of Experiments (If any):</b>					<b>Practical Hours</b>



<b>Self-study :</b> NIL
<b>Site/Industrial Visits :</b> NIL
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Explain structure, services and functionalities of operating systems. <b>CO2:</b> Compute system performance with respect to Job Scheduling and process synchronization concepts <b>CO3:</b> Analyze deadlocks and memory management strategies to improve fault tolerance <b>CO4:</b> Illustrate virtual memory management technique to reduce access time of data from memory <b>CO5:</b> Implement File System to distribute file structure across the memory
<b>Text Books:</b> T1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2013
<b>Reference Books:</b> 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
<b>Online Resources:</b> 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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS</b>					
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
<b>Unit-2 MEASUREMENT OF STRAIN</b>					
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 bridge circuit, Applications.					9
<b>Unit-3 MEASUREMENT OF FORCE &amp; TORQUE</b>					
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
<b>Unit-4 MEASUREMENT OF PRESSURE</b>					
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
<b>Unit-5 MISCELLANEOUS SENSORS AND TRANSDUCERS</b>					

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
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Understand the need for measurement and error analysis <b>CO2:</b> Relate the physical quantities with the electrical parameters <b>CO3:</b> Choose the appropriate transducer for the measurement of strain, force, torque, pressure <b>CO4:</b> Create electronic systems with the various sensors and transducers	
<b>Text Books:</b> 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	
<b>Reference Books:</b> 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	
<b>Online Resources:</b> 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
<b>Course objectives:</b> This course aims at providing students knowledge in the basic concepts of linear control theory, modern control theory and design of control systems.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 SYSTEMS AND THEIR REPRESENTATION</b>					
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
<b>Unit-2 TIME RESPONSE</b>					
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
<b>Unit-3 STABILITY OF CONTROL SYSTEM</b>					
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
<b>Unit-4 FREQUENCY RESPONSE</b>					
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
<b>Unit-5 INTRODUCTION TO MODERN CONTROL THEORY</b>					
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	
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>          At the end of the course, the student will be able to :</p> <p><b>CO1:</b> 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.</p> <p><b>CO2:</b> 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.</p> <p><b>CO3:</b> 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.</p> <p><b>CO4:</b> 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.</p> <p><b>CO5:</b> 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.</p>	
<p><b>Text Books:</b>          T1. K. Ogata, "Modern Control Engineering", 5th edition, Pearson Education, NewDelhi, 2014 / PHI.          T2. I.J. Nagrath &amp; M. Gopal, "Control Systems Engineering", 4th edition, New Age International Publishers, 2015</p>	
<p><b>Reference Books:</b>          R1. M. Gopal, "Control Systems, Principles &amp; Design", 4th edition, Tata McGraw Hill, New Delhi, 2012</p>	
<p><b>Online Resources:</b>          NIL</p>	

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
<b>Course objectives:</b>					
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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 MEASUREMENT OF FORCE, TORQUE, VELOCITY</b>					
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: Revelation 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
<b>Unit-2 MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY</b>					
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
<b>Unit-3 PRESSURE MEASUREMENT</b>					
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
<b>Unit-4 TEMPERATURE MEASUREMENT</b>					

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
<b>Unit-5 THERMOCOUPLES</b>	
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
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Describe and categorize measurement of physical parameters like pressure, torque, temperature, velocity , acceleration, density</p> <p><b>CO2:</b> apply the methods of measurements of parameters like pressure, torque, temperature, velocity , acceleration, density</p> <p><b>CO3:</b> Develop the ability to calibrate and understand the variety of methods of industrial instrumentation</p> <p><b>CO4:</b> Describe the units of pressure, vibration, density, acceleration, temperature and relate to the principles used to quantify these parameters using applicable transducers</p> <p><b>CO5:</b> Analyze the special techniques to measure low values and high values of physical parameters and the special types of transducers used for these applications</p>	
<p><b>Text Books:</b>  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</p>	
<p><b>Reference Books:</b>  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</p>	
<p><b>Online Resources:</b>  NIL</p>	

<b>Course Name: NEMS and MEMS for Engineers</b>					
<b>Course Code : ECE535E4</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b>					
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					
<b>Prerequisites:</b>					
<b>Units</b>				<b>Teaching Hours</b>	
<b>Unit-1 OVERVIEW OF NANO- AND MICROELECTROMECHANICAL SYSTEMS</b>					
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	
<b>Unit-2 MEMS nanofabrication</b>					
Photolithography, Ion Implantation, Diffusion, Oxidation, LPCVD, Sputtering, Evaporation, Electroplating, Dry and wet etching, electrochemical etching, Bulk Micromachining, Surface micromachining				9	
<b>Unit-3 MEMS and NEMS Architecture</b>					
Classification, biomimetics, scaling laws, MEMs architectures, CMOS and NEMS hybrid architectures, Silicon in MEMS, Silicon-on-Insulator, material selection for application in MEMS				9	
<b>Unit-4 Microsensors and Microactuators</b>					
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	
<b>Unit-5 MEMS/NEMS Applications</b>					
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	
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					
<b>Course outcomes:</b>					
At the end of the course, the student will be able to :					
<b>CO1:</b> Understand the recent trends in engineering for small scale devices					
<b>CO2:</b> 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
<b>Course objectives:</b> The objective of this course is to understand the ARM architecture, memory and programming concepts					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 ARM PROCESSOR ARCHITECTURE</b>					
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
<b>Unit-2 ARM INSTRUCTIONS SETS AND INTERRUPTS</b>					
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
<b>Unit-3 CACHE MECHANISM</b>					
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
<b>Unit-4 MEMORY PROTECTION AND MANAGEMENT UNIT</b>					
Introduction to protection unit, Protected Regions, and Demonstration of an MPU system. Virtual Memory working principle					9
<b>Unit-5 EMBEDDED OS AND RTOS</b>					
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

<b>Self-study :</b> NIL
<b>Site/Industrial Visits :</b> NIL
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Demonstrate concepts of programming model of ARM processors. <b>CO2:</b> Describe the programming techniques using ARM processors. <b>CO3:</b> Understand the Memory organization & management concepts of ARM processors <b>CO4:</b> Use concepts of embedded Real-time operating systems
<b>Text Books:</b> 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 2 <sup>nd</sup> edition , 2002
<b>Reference Books:</b> 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
<b>Online Resources:</b> O1: <a href="https://www.springer.com/in/book/9783540899327">https://www.springer.com/in/book/9783540899327</a>

<b>Course Name: Automotive Electronics</b>					
<b>Course Code : ECE634E2</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 AUTOMOTIVE FUNDAMENTALS</b>					
Use of Electronics In The Automobile, Antilock Brake Systems, (ABS), Electronic steering control, Power steering, Traction control, Electronically controlled suspension					9
<b>Unit-2 AUTOMOTIVE INSTRUMENTATION CONTROL</b>					
Sampling, Measurement and signal conversion of various parameters. Sensors and Actuators, Applications of sensors and actuators					9
<b>Unit-3 BASICS OF ELECTRONIC ENGINE CONTROL</b>					
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
<b>Unit-4 VEHICLE MOTION CONTROL AND AUTOMOTIVE DIAGNOSTICS</b>					
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

<b>Unit-5 FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS</b>	
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
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>            At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Implement various control requirements in the automotive system  <b>CO2:</b> Comprehend dashboard electronics and engine system electronics  <b>CO3:</b> Identify various physical parameters that are to be sensed and monitored for maintaining the stability of the vehicle under dynamic conditions  <b>CO4:</b> Understand and implement the controls and actuator system pertaining to the comfort and safety of commuters  <b>CO5:</b> Design sensor network for mechanical fault diagnostics in an automotive vehicle</p>	
<p><b>Text Books:</b>            T1. A William B. Ribbens, "Understanding Automotive Electronics",6th Edition SAMS/Elsevier publishing, 2007</p>	
<p><b>Reference Books:</b>            R1. Robert Bosch Gmbh,"Automotive Electrics and Automotive Electronics- Systems and Components, Networking and Hybrid Drive", 5<sup>th</sup> Edition, Springer, Vieweg, 2007</p>	
<p><b>Online Resources:</b>            NIL</p>	

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 REVIEW OF OPERATING SYSTEMS</b>					
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
<b>Unit-2 OVERVIEW OF RTOS</b>					
RTOS Task and Task state -Multithreaded Preemptive scheduler- Process Synchronization- Message queues- Mail boxes -pipes - Critical section - Semaphores - Classical synchronization problem - Deadlocks					9
<b>Unit-3 REAL TIME MODELS AND LANGUAGES</b>					
Event Based - Process Based and Graph based Models - Real Time Languages - RTOS Tasks - RT scheduling - Interrupt processing - Synchronization - Control Blocks - Memory Requirements					9
<b>Unit-4 REAL TIME KERNEL</b>					
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
<b>Unit-5 APPLICATION DEVELOPMENT</b>					
Discussions on Basics of Linux supportive RTOS - uCOS-C Executive for development of RTOS Application - Case study.					9
<b>Self-study :</b> NIL					
<b>Site/Industrial Visits :</b> 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 Sigal 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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b> NIL					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 STATIC ELECTRIC FIELDS</b>					
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
<b>Unit-2 STATIC MAGNETIC FIELD</b>					
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
<b>Unit-3 TIME VARYING ELECTRIC AND MAGNETIC FIELDS</b>					
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	
<b>Unit-4 ELECTROMAGNETIC WAVES</b>	
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
<b>Unit-5 REFLECTION AND REFRACTION OF UNIFORM PLANE WAVES</b>	
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
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Demonstrate the field's potentials due to static changes  <b>CO2:</b> Demonstrate behaviour of static electric and magnetic fields.  <b>CO3:</b> Understand the behaviour of electric and magnetic fields in different media.  <b>CO4:</b> Demonstrates the electric and magnetic fields with respect to time.  <b>CO5:</b> Demonstrates the uniform wave propagation in electric field.</p>	
<p><b>Text Books:</b>  T1. M. N. O. Sadiku., "Elements of Engineering Electromagnetics", Oxford University Press, 5<sup>th</sup> Edition 2010.  T2. E.C. Jordan and K.G. Balmain., "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2/E 2<sup>nd</sup> Edition 2003.  T3. Karl E. Lonngren, Sava V. Savov, Randy J. Jost., "Fundamentals of Electromagnetics with MATLAB", SciTech Publishing Inc., 2<sup>nd</sup> Edition 2007.</p>	
<p><b>Reference Books:</b>  R1. RamoWhinnery and Van Duzer., "Fields and Waves in Communications Electronics", John Wiley &amp; Sons, 3<sup>rd</sup> Edition 2003.  R2. NarayanaRao, N., "Elements of Engineering Electromagnetics", Prentice Hall of India, New Delhi, 6<sup>th</sup> Edition 2004.  R3. William H. Hayt and John A Buck., "Engineering Electromagnetics", McGraw-Hill, 6<sup>th</sup> Edition 2003.</p>	
<p><b>Online Resources:</b>  NIL</p>	

## 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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 SYMMETRIC CIPHERS - TECHNIQUES AND STANDARDS I</b>					
Introduction: Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography; 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
<b>Unit-2 SYMMETRIC CIPHERS - TECHNIQUES AND STANDARDS II</b>					
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
<b>Unit-3 PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS</b>					
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
<b>Unit-4 NETWORK SECURITY PRACTICE</b>					
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	
<b>Unit-5 SYSTEM SECURITY</b>	
Intruders- Intruder Detection, Password Management; Malicious Software- Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems	9
<b>List of Experiments (If any): Nil</b>	<b>Practical Hours</b>
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>          At the end of the course, the student will be able to :  <b>CO1:</b> Explain the symmetric ciphers using DES  <b>CO2:</b> Describe the symmetric ciphers based on AES standard  <b>CO3:</b> Understand the key management and public key cryptosystem  <b>CO4:</b> Illustrate the Hash Functions, Authentication Protocol and Digital Signature  <b>CO5 :</b> Understand system security measures against Malicious Software</p>	
<p><b>Text Books:</b>          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</p>	
<p><b>Reference Books:</b>          R1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley &amp; sons, 2012          R2. Glenn J. Myatt, "Making Sense of Data", John Wiley &amp; 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, Guoqing 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 Madiseti, "Big Data Science &amp; 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 &amp; Sons, 2014</p>	
<p><b>Online Resources:</b>          NIL</p>	

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
<b>Course objectives:</b> 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#					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO C#</b>					
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
<b>Unit-2 OBJECT ORIENTED ASPECTS OF C#</b>					
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
<b>Unit-3 APPLICATION DEVELOPMENT ON .NET</b>					
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
<b>Unit-4 WEB BASED APPLICATION DEVELOPMENT ON .NET</b>					
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
<b>Unit-5 CLR AND .NET FRAMEWORK</b>					
Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET.					9
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					

<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Explain the major elements of the .NET frame work, <b>CO2:</b> Analyze the basic structure of a C# application <b>CO3:</b> Develop programs using C# on .NET. <b>CO4:</b> Design and develop Web based applications on .NET. <b>CO5:</b> Explain CLR framework.
<b>Text Books:</b> 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
<b>Reference Books:</b> 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.
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 MINING DATA STREAMS</b>					
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
<b>Unit-3 HADOOP</b>					
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
<b>Unit-4 FRAMEWORKS</b>					
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
<b>Unit-5 PREDICTIVE ANALYTICS</b>					
Simple linear regression- Multiple linear regression- Interpretation 5 of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.					9
<b>List of Experiments (If any): Nil</b>					<b>Practical Hours</b>
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					

**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, Guoqing 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 Madiseti, "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

<b>Course Name: Cloud Computing and Grid Computing</b>					
<b>Course Code : ECE635E4</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 UNDERSTANDING CLOUD COMPUTING</b>					
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
<b>Unit-2 CLOUD COMPUTING TECHNOLOGY</b>					
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
<b>Unit-3 USING CLOUD PLATFORMS</b>					
Understanding Abstraction and Virtualization- Capacity Planning - Exploring Platform as a Service - Using Google web services - Using Amazon web services - Using Microsoft Cloud services					9
<b>Unit-4 INTRODUCTION TO GRID COMPUTING</b>					
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
<b>Unit-5 GRID INFRASTRUCTURE</b>					
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



<b>Self-study :</b> NIL
<b>Site/Industrial Visits :</b> NIL
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> 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. <b>CO2:</b> Apply cloud computing in existing web applications <b>CO3:</b> Use cloud platforms including the Google, Amazon and Microsoft web services. <b>CO4:</b> Explain the concept of grid computing with respect to applications, interface and job submission. <b>CO5:</b> Examine grid services and interfaces for developing grid based applications.
<b>Text Books:</b> 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
<b>Reference Books:</b> 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.
<b>Online Resources:</b> NIL

<b>Course Name: Mobile Computing</b>					
<b>Course Code : ECE635E5</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
Introduction to Mobile Computing - Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing - Spread spectrum -MAC Protocols - SDMA- TDMA- FDMA- CDMA					9
<b>Unit-2 MOBILE TELECOMMUNICATION SYSTEM</b>					
Introduction to Cellular Systems - GSM - Services & Architecture - Protocols - Connection Establishment - Frequency Allocation - Routing - Mobility Management - Security - GPRS/UMTS - Architecture - Handover - Security					9
<b>Unit-3 MOBILE NETWORK LAYER</b>					
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
<b>Unit-4 MOBILE TRANSPORT AND APPLICATION LAYER</b>					
Mobile TCP- WAP - Architecture - WDP - WTLS - WTP -WSP - WAE - WTA Architecture - WML					9
<b>Unit-5 MOBILE PLATFORMS AND APPLICATIONS</b>					
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
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					
<b>Course outcomes:</b>					
At the end of the course, the student will be able to :					
<b>CO1:</b> Explain the basics of mobile telecommunication systems.					
<b>CO2:</b> Illustrate the generations of telecommunication systems in wireless networks					
<b>CO3:</b> Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.					
<b>CO4:</b> 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>

<b>Course Name: Soft Computing</b>					
<b>Course Code : ECE635E6</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO SOFT COMPUTING</b>					
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
<b>Unit-2 ARTIFICIAL NEURAL NETWORKS</b>					
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
<b>Unit-3 FUZZY SYSTEMS</b>					
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
<b>Unit-4 GENETIC ALGORITHMS</b>					
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
<b>Unit-5 HYBRID SYSTEMS</b>					
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
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					
<b>Course outcomes:</b>					

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
<b>Course objectives:</b> 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)					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO BIOMEDICAL SIGNALS</b>					
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
<b>Unit-2 CARDIOLOGICAL SIGNAL PROCESSING</b>					
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, Arrhythmia detection algorithms, Pattern recognition, heart rate variability analysis, ST segment analyser, Maternal-fetal ECG, Muscle contraction interference, donor heart interference in heart transplant					9
<b>Unit-3 NEUROLOGICAL SIGNAL PROCESSING</b>					
EEG waveforms and rhythms - origin, Brain potential, EEG recording techniques, EEG applications - epilepsy 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
<b>Unit-4 SIGNAL PROCESSING</b>					

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
<b>Unit-5 DATA PROCESSING</b>	
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
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b> At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Understand biomedical signals generated by the human body and highlighting the various signal processing techniques. <b>CO2:</b> Analyse cardiological signals based on event detection of QRS detection, arrhythmia detection, and distinction between ECG interference. <b>CO3:</b> Analyse neurological signals for detecting sleep disorders and epilepsy. <b>CO4:</b> Discuss the various noises and artefacts associated with biomedical signals and algorithms for filtering noise. <b>CO5:</b> Analyze different algorithms for biomedical signal processing along with lossy and lossless compression.</p>	
<p><b>Text Books:</b> 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</p>	
<p><b>Reference Books:</b> R1. R. Rangayan, Biomedical Signal Analysis, Wiley, 2002 R2. Bruce, Biomedical Signal Processing &amp; 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</p>	
<p><b>Online Resources:</b> NIL</p>	

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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 DISCRETE TIME SIGNALS AND TRANSFORMS</b>					
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
<b>Unit-2 POWER SPECTRAL ESTIMATION</b>					
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
<b>Unit-3 LINEAR PREDICTION AND ESTIMATION</b>					
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
<b>Unit-4 MULTIRATE DIGITAL SIGNAL PROCESSING</b>					
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
<b>Unit-5 OPTIMAL FILTERING OF RANDOM SIGNALS</b>					
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.	
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Understand and analyse the modelling of any discrete time random signals  <b>CO2:</b> Analyse the power spectral algorithms  <b>CO3:</b> Analyse the concepts of Linear prediction and Estimation  <b>CO4:</b> Analyse and implement the Concepts in audio signal processing  <b>CO5:</b> Represent Random signals and estimate prediction which can be used in optimum filtering</p>	
<p><b>Text Books:</b>  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</p>	
<p><b>Reference Books:</b>  R1. John G. Proakis, Dimitris K Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4<sup>th</sup> Edition, PHI, 2007  R2. Alan V. Oppenheim, Ronald W. Schaffer, "Discrete Time Signal Processing", Second Edition, Pearson Education, 1998  R3. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992</p>	
<p><b>Online Resources:</b>  O1: <a href="https://ece.gmu.edu/~hayes/courses/dsp/index.html">https://ece.gmu.edu/~hayes/courses/dsp/index.html</a></p>	

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
<b>Course objectives:</b> 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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 DISCRETE RANDOM SIGNAL PROCESSING</b>					
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
<b>Unit-2 SPECTRUM ESTIMATION</b>					
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
<b>Unit-3 LINEAR ESTIMATION AND PREDICTION</b>					
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
<b>Unit-4 ADAPTIVE FILTERS</b>					
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
<b>Unit-5 MULTIRATE ALGORITHMS</b>					
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
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					

**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
<b>Course objectives:</b> This course aims to introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 NATURE OF SPEECH SIGNAL</b>					
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
<b>Unit-2 TIME DOMAIN METHODS FOR SPEECH PROCESSING</b>					
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation					9
<b>Unit-3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING</b>					
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems					9
<b>Unit-4 LINEAR PREDICTIVE CODING OF SPEECH</b>					
Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains					9
<b>Unit-5 HOMOMORPHIC SPEECH ANALYSIS</b>					
Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.					9
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Demonstrate models for speech production <b>CO2:</b> Explain methods to develop time and frequency domain techniques for estimating speech parameters <b>CO3:</b> Explain a predictive technique for speech compression <b>CO4:</b> 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 - 2<sup>nd</sup> 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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
Introduction to Natural Language Processing, Different Levels of language analysis, Representation and understanding, Linguistic background					9
<b>Unit-2 GRAMMARS AND PARSING</b>					
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
<b>Unit-3 GRAMMARS FOR NATURAL LANGUAGE</b>					
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
<b>Unit-4 SEMANTIC INTERPRETATION</b>					
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
<b>Unit-5 LANGUAGE MODEL</b>					
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
<b>Self-study : NIL</b>					
<b>Site/Industrial Visits : NIL</b>					

**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
<p><b>Course objectives:</b> 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</p>					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 HIGH SPEED NETWORKS</b>					
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
<b>Unit-2 CONGESTION AND TRAFFIC MANAGEMENT</b>					
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
<b>Unit-3 TCP AND ATM CONGESTION CONTROL</b>					
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 Framework, Traffic Control - ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations - GFR traffic management					9
<b>Unit-4 INTEGRATED AND DIFFERENTIATED SERVICES</b>					
Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRfq, GPS, WFQ - Random Early Detection, Differentiated Services					9
<b>Unit-5 PROTOCOLS FOR QOS SUPPORT</b>					
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.	
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<b>Course outcomes:</b> At the end of the course, the student will be able to : <b>CO1:</b> Understand the architecture of high speed networks including frame relay, Ethernet and wireless LAN <b>CO2:</b> Describe the queuing models used in traffic management and congestion control <b>CO3:</b> Explain techniques involved to support real-time traffic and congestion control in ATM networks <b>CO4:</b> Differentiate the integrated and differentiated services models <b>CO5:</b> Distinguish levels of quality of service (QoS) to networking applications	
<b>Text Books:</b> T1. William Stallings, "High Speed Networks And Internet", Pearson Education, Second Edition, 2002	
<b>Reference Books:</b> 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	
<b>Online Resources:</b> 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
<b>Course objectives:</b> 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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 BASIC DESIGN</b>					
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
<b>Unit-3 TECHNOLOGY I - WINDOWS 7</b>					
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
<b>Unit-4 TECHNOLOGY II - ANDROID</b>					
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
<b>Unit-5 TECHNOLOGY III - iOS</b>					

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
<b>Self-study :</b> NIL	
<b>Site/Industrial Visits :</b> NIL	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Explain the requirements for mobile application development  <b>CO2:</b> Understand the principles involved in mobile application development.  <b>CO3:</b> Develop applications in Windows 7  <b>CO4:</b> Design and develop applications in Android  <b>CO5:</b> Design and develop applications in iOS.</p>	
<p><b>Text Books:</b>  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</p>	
<p><b>Reference Books:</b>  R1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013</p>	
<p><b>Online Resources:</b>  NIL</p>	

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
<b>Course objectives:</b>					
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					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 ORACLE 10G ARCHITECTURE</b>					
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
<b>Unit-3 DATABASE CREATION, CONNECTIVITY AND NETWORKING</b>					
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
<b>Unit-4 DATABASE USER MANAGEMENT AND DATABASE SECURITY</b>					

<p>Managing Users: Creating, altering and dropping users, Creating user Profiles &amp; 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.</p> <p>Database Security Do's &amp; Don'ts: User Accounts, Passwords, OS authentication, Auditing Database, Granting Appropriate Privileges, Permissions, Application Security</p>	9
<p><b>Unit-5 DATA LOADING, BACKUP, RECOVERY AND DATABASE PERFORMANCE TUNING</b></p>	
<p>Overview of extraction loading and Transformation, Loading Data: Using the SQL Loader Utility, Using External Tables to Load Data.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Tuning the instance: Introduction, Automatic Tuning vs. Dynamic Views.</p> <p>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.</p> <p>Introduction to iSQL*Plus: Installation, configuration, Starting and Stopping iSQL*Plus, Logging into and disconnecting from iSQL*Plus. Case study</p>	9
<p><b>Self-study : NIL</b></p>	
<p><b>Site/Industrial Visits : NIL</b></p>	
<p><b>Course outcomes:</b></p> <p>At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Understand the process and steps involved in database administration.</p> <p><b>CO2:</b> Explain the ORACLE 10G Architecture and its functionalities.</p> <p><b>CO3:</b> Apply the concepts of database administration for database creation, connectivity and networking.</p> <p><b>CO4:</b> Describe the processes involved in database user management and database security</p> <p><b>CO5:</b> Explain data loading, backup, recovery and database performance tuning using the relevant methods.</p>	
<p><b>Text Books:</b></p> <p>T1. Ross Mistry, Stacia Misner , "Introducing Microsoft SQL Server 2014", (2014)</p>	

- 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

<b>Course Name: Software Testing</b>					
<b>Course Code : ECE831E3</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION</b>					
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
<b>Unit-2 TEST CASE DESIGN</b>					
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
<b>Unit-3 LEVELS OF TESTING</b>					
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
<b>Unit-4 TEST MANAGEMENT</b>					
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.	
<b>Unit-5 CONTROLLING AND MONITORING</b>	
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
<b>Self-study : NIL</b>	
<b>Site/Industrial Visits : NIL</b>	
<p><b>Course outcomes:</b>  At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Understand the role of an engineer in the process of software testing and quality management.</p> <p><b>CO2:</b> Explain the test cases that can be generated for software and other applications.</p> <p><b>CO3:</b> Describe the levels of testing involved in software testing and their functionalities.</p> <p><b>CO4:</b> Summarize the steps, methods and process involved in software test management</p> <p><b>CO5:</b> Design test cases and monitor the same for a given application.</p>	
<p><b>Text Books:</b>  T1. Boris Beizer, "Software Testing Techniques", Dreamtech. Second Edition, 2009  T2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson education, 2008</p>	
<p><b>Reference Books:</b>  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</p>	
<p><b>Online Resources:</b>  NIL</p>	



<b>Course Name: Web Services and Service Oriented Architecture</b>					
<b>Course Code : ECE831E4</b>					
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Category</b>	<b>PEC</b>
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
<b>Course objectives:</b>					
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.					
<b>Prerequisites:</b>					
<b>Units</b>					<b>Teaching Hours</b>
<b>Unit-1 INTRODUCTION TO SOA - TERMINOLOGY, CONCEPTS AND GOALS</b>					
Service Terminology - Service Terminology Context - Basic Terminology and Concepts - Further Reading - Case Study Example - REST Constraints - Goals of the REST Architectural Style					9
<b>Unit-2 SERVICE CONTRACTS AND SERVICE-ORIENTATION WITH REST</b>					
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
<b>Unit-3 SOA METHODOLOGY, ANALYSIS AND SERVICE MODELING AND SERVICE-ORIENTED DESIGN WITH REST</b>					
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
<b>Unit-4 FUNDAMENTAL AND ADVANCED SERVICE COMPOSITION WITH REST WITH CASE STUDY</b>					
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
<b>Unit-5 DESIGN PATTERNS, SERVICE VERSIONING WITH REST AND UNIFORM</b>					

<b>CONTRACT PROFILES</b>	
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
<b>Self-study</b> : NIL	
<b>Site/Industrial Visits</b> : NIL	
<p><b>Course outcomes:</b>            At the end of the course, the student will be able to :</p> <p><b>CO1:</b> Apply SOA-specific methodologies, technologies and standards in REST style.  <b>CO2:</b> Analyze case studies to map it as a "set of services".  <b>CO3:</b> Develop logical models for a given SOA.  <b>CO4:</b> Convert SOA to a buildable specification  <b>CO5:</b> Orchestrate services to create new applications.</p>	
<p><b>Text Books:</b>            T1. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian, "SOA with REST: Principles, Patterns &amp; Constraints for Building Enterprise Solutions with REST", Prentice Hall Service Technology 2012            T2. Arnon Rotem-Gal-Oz, "SOA Patterns, Manning"</p>	
<p><b>Reference Books:</b>            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</p>	
<p><b>Online Resources:</b>            NIL</p>	