CHRIST
(DEEMED TO BE UNIVERSITY)
BANGALORE · INDIA

School of Engineering and Technology

Department of Electronics & Communication Engineering

Syllabus
BTech- Electronics & Communication Engineering
2020-21

January 2020

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

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1. INTRODUCTION

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

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

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

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

VISION
"EXCELLENCE AND SERVICE"

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

MISSION STATEMENT

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

CORE VALUES

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

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

DEPARTMENT VISION

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

DEPARTMENT MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES OF B.TECH IN ECE

PEO1 : Domain Knowledge
Apply the knowledge of Electronics & Communication Engineering to analyse, design and develop solutions for real time engineering problems

PEO2 : Research Oriented
Be competent to pursue higher learning and research
PEO3: Ethics & Teamwork
Assimilate technical skills with professional ethics

PEO4 : Life Long Learning
Be passionate to attain professional excellence through lifelong learning

2. PROGRAM OFFERED

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

3. ELIGIBLITY CRITERIA

❖ **For Undergraduate Programmes**

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

Lateral Entry:

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

- Automobile Engineering (AE)
- B.Tech Civil Engineering (CE)

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

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

❖ **For Postgraduate Programmes**:

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

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

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

4. SELECTION PROCESS

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

OR

2) Christ Selection Process as given below:

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

5. ADMISSION PROCESS

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

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

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

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

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

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

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

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

6. GENERAL RULES

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

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

7. GRADING SCHEME FOR EACH PAPER: Undergraduate Courses

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

8. GRADING SCHEME FOR EACH PAPER: Postgraduate Courses

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

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

09. TEACHING PEDAGOGY

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

10. ASSESSMENT PATTERN - BTECH COURSE 2018 BATCH

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

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

COURSES WITH THEORY AND PRACTICAL

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

DETAIL OF MARK FOR COURSES WITH THOERY AND PRACTICAL

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

Minimum marks required to pass in practical component is 40%.

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

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

- Continuous Internal Assessment (CIA) : 50% (50 marks out of 100 marks)
- End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

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

Mid Semester Examination (MSE) : Theory Papers:

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

End Semester Examination (ESE):

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

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

Question paper pattern is as follows.

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

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

50 % - Medium Level questions

25 % - Simple level questions

25 % - Complex level questions

11. COURSE STRUCTURE

COURSE STRUCTURE – 2020-2024 BATCH

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 – II	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	TE136P	Technical English	1	0	2	100	1	0	1	2
7	ME151	Workshop Practice Lab	0	0	2	50	0	0	1	1
8	HE171	Holistic Education-II	1	0	0	---	1	0	0	1
		Total				**650**				**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	100	2	0	0	2
7	HE271	Holistic Education-II	1	0	0	---	1	0	0	1
		Total				**600**				**21**

COURSE STRUCTURE – 2019-2023 BATCH

III SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	MA331	Mathematics-III	3	0	0	100	3	0	0	3
2	EC332P	Electronic Devices & Circuits	3	0	2	100	3	0	1	4
3	EC333P	Digital Electronics	3	0	2	100	3	0	1	4
4	EC334	Electromagnetic Fields	3	0	0	100	3	0	0	3
5	EC335	Network Analysis & Synthesis	3	0	0	100	2	0	0	3
6		Cyber Security	2	0	0	---	0	0	0	0
7	HE371	Holistic Education-III	1	0	0		1	0	0	1
		Total				**500**				**18**

IV SEMESTER

Sl. No	Course No	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	EC431P	Analog Electronics	3	0	2	100	3	0	0	3
2	EC432	Antennas & Wave Propagation	3	0	0	100	3	0	1	4
3	EC433	Signals & Systems	3	0	0	100	3	0	0	3
4	EC434	Computer Organization & Processors	3	0	0	100	3	0	0	3
5	EC451	Electronic Measurement Lab	0	0	2	50	0	0	1	1
6	HS435	Professional Ethics	2	0	0	100	2	0	0	2
7	MA436	Probability & Queuing Theory	3	0	0	100	3	0	0	3
8	BS451	Engineering Biology Laboratory	0	0	2	50	0	0	2	1
9		Environmental Science	2	0	0	----				
10	HE471	Holistic Education-IV	1	0	0	----	1	0	0	1
		Total				700				**21**

COURSE STRUCTURE – 2018-22 BATCH

SEMESTER V

S 1 No	C o u r s e code	Course Name	Credits (L:T:P)	Total Credits	M	Contact Hours	Category
1	EC531	Control Systems	3:1:0	4	100	5	PC
2	EC532	Discrete Time Signal Processing	2:1:1	4	100	6	PC
3	EC533	Analog Communication	3:0:0	3	100	3	PC
4	EC534	Microcontrollers & Real Time Embedded Systems	3:0:1	4	100	5	PC
5	EC535	Transmission Lines and Waveguides	3:1:0	4	100	5	PC
6	EC536	Elective-I	3:0:0	3	100	3	PE
		TOTAL		22	600	27	

SEMESTER VI

S 1 No	C o u r s e code	Course Name	Credits (L:T:P)	Total Credits	M	Contact Hours	Category
1	EC631	VLSI Design	3:0:1	4	100	5	PC
2	EC632	Information Theory and Coding	3:1:0	4	100	5	PC
3	EC633	Antennas and Wave Propagation	3:1:0	4	100	5	PC
4	EC634	Computer Networks	3:0:0	3	100	3	PC
5	EC635	Digital Communication	2:1:1	4	100	6	PC
6		Elective-II	3:0:0	3	100	3	OE
		TOTAL		22	600	27	

COURSE STRUCTURE – 2017-21 BATCH

SEMESTER VII

S 1 No	C o u r s e code	Course Name	Credits (L:T:P)	Total Credits	M	Contact Hours	Category
1	EC731	Wireless Communication	3:1:0	4	100	5	PC
2	EC732	Digital Image Processing	3:0:0	3	100	3	PC
3	EC733	Optical Fiber Communications	3:1:0	4	100	5	PC
4	EC734	Microwave Engineering	2:1:1	4	100	6	PC
5	EC735	Elective-III	3:0:0	3	100	3	PE
6		Elective-IV	2:0:0	2	100	3	OE
7	EC737	Service Learning – Precision Agriculture	1:0:1	2	100	3	HS
8	EC771	Internship	0:0:2	2	50		PW
		TOTAL		24	750	28	

SEMESTER VIII

S 1 No	C o u r s e code	Course Name	Credits (L:T:P)	Total Credits	M	Contact Hours	Category
1	BTCY01	Cyber Security				2	MC
2	EC831	Wireless Sensor Networks and IoT	3:1:0	4	100	4	PC
3	EC832	Elective-V	3:0:0	3	100	3	PE
4	EC833	Elective-VI	3:0:0	3	100	3	PE
5	IC	Constitution of India					MC
6	EC871	Project Work	0:0:6	6	100	12	PW
7	EC872	Comprehension	0:0:2	2	100	4	PW
		TOTAL		18	500	28	

Electives for 2018-22 Batch

ELECTIVE-III:SIGNAL PROCESSING AND PROGRAMMING SKILLS				
S.NO	**Course Title**	**M**	**C**	**Category**
E1	Biomedical Signal Processing	100	3	PE
E2	Advanced Digital Signal Processing	100	3	PE
E3	Statistical signal Processing	100	3	PE
E4	Speech Processing	100	3	PE
E5	Internet and Java	100	3	PE

ELECTIVE-V:VLSI AND EMBEDDED SYSTEMS				
S.NO	**Course Title**	**M**	**C**	**Category**
E1	Computer Hardware and Interfacing	100	3	PE
E2	Advanced Microprocessor	100	3	PE
E3	Embedded System	100	3	PE
E4	Advanced Electronic system design	100	3	PE
E5	ARM System Architecture	100	3	PE
E6	VLSI Subsystems	100	3	PE
E7	ASIC Design	100	3	PE
E8	Analog VLSI Design	100	3	PE
E9	Robotic System Design	100	3	PE
E10	Process Dynamics and Control	100	3	PE

ELECTIVE-VI:RF &COMMUNICATIONS				
S.NO	**Course Title**	**M**	**C**	**Category**
E1	Telecommunication System Modeling and Simulation	100	3	PE
E2	Satellite Communication	100	3	PE
E3	Radar and Navigational Aids	100	3	PE
E4	Remote Sensing	100	3	PE
E5	Optoelectronic devices	100	3	PE
E6	Electromagnetic Interference and Compatibility	100	3	PE

E7	Microstrip Antennas	100	3	PE
E8	Computational Electromagnetics	100	3	PE
E9	Computer Protocol Engineering	100	3	PE
E10	High Speed Networks	100	3	PE
E11	Soft Computing	100	3	PE
E12	Reliability Of Electronics Systems	100	3	PE

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**

Course objectives: 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

- Have a solid base of understanding elementary linear algebra as required for further undergraduate work in engineering.
- be able to differentiate a function partially with respect to each of its variables in turn
- be able to utilize methods of integration to compute length of arcs, surface area and volume of solids
- be skilled in using integration to compute problems important in physics and engineering
- Learn the meaning and computation of the curl and divergence of a vector field.
- be able to solve first order differential equations that are separable, linear or exact

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 LINEAR ALGEBRA	
Fundamental concepts of Matrix, Rank of a Matrix, Consistency and solution of linear simultaneous equations, Eigen values and Eigen Vectors, Diagonalization	**5**
Unit-2 DIFFERENTIAL CALCULUS – I	
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**
Unit-3 INTEGRAL CALCULUS – I	
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**
Unit-4 DIFFERENTIAL EQUATION – I	
Solution of first order and first degree differential equations: Reducible to Homogeneous, Linear and Exact differential equation, Applications of differential equations. orthogonal trajectories.	**10**
Unit-5 VECTOR CALCULUS – I	

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.	**10**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:

CO1: Checking the consistency of system of linear equations and hence finding solution
CO2: Finding the differentiation of multivariable functions using the concept of total derivatives, Jacobian, Evaluating definite integrals by Leibnitz rule of differentiation under integral sign
CO3: Evaluation of definite integrals as surface area and volume of solid of revolution using reduction formulae
CO4: Solving first order nonlinear differential equations by reducing into homogenous, linear and exact forms
CO5: Finding the velocity and acceleration of a moving particle, vector potential, scalar potential

Text Books:

T1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 39th Edition, Khanna Publishers, July 2005.
T2. H. K. Das & Rajnish Verma, "Higher Engineering Mathematics", S. Chand & Company Ltd., 2011.

Reference Books:

R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons, Inc, 2005
R2. Thomas and Finney, "Calculus", 9th Edition, Pearson Education, 2004
R3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Publication, Canada, 2007
R4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw – Hill, 2009.
R5. Michael Artin, "Algebra", 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2002
R6. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2002
R7. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw – Hill, 2006.
R8. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) & Co. Ltd., India, March 17, 2005.

Online Resources:

NIL

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**

Course objectives: This paper contains five units which are Chemical Energy Sources, Electrochemical Energy Systems, Corrosion Science, Surface Chemistry & 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.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 CHEMICAL ENERGY SOURCES	
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 & 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. **Solar Energy** : Physical and chemical properties of silicon, production of silicon for photovoltaic cell – Mettalurgical 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.	**10**
Unit-2 ELECTROCHEMICAL ENERGY SYSTEMS	
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.	**8**
Unit-3 CORROSION SCIENCE	
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.	**9**

Unit-4 SURFACE CHEMISTRY & CATALYSIS	
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 **Catalysis**: 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	**11**
Unit-5 MATERIAL CHARACTERIZATION & WATER TECHNOLOGY	
Theory and Applications of X-ray Photo electron Spectroscopy(XPS), Powder Xray diffraction (pXRD) **Water Technology:** 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.	**7**
List of Experiments (If any):	**Practical Hours**
PART – A	
1. Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.	**2**
2. Determination of copper by spectrophotometric method.	**2**
3. Conductometric estimation of an acid using standard NaOH solution	**2**
4. Determination of pKa value of a weak acid using pH meter.	**2**
5. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.	**2**
PART – B	
1. Determination of Total Hardness of a sample of water using disodium salt of EDTA.	**2**
2. Determination of percentage of Copper in brass using standard sodium thiosulphate solution.	**2**
3. Determination of Calcium Oxide (CaO) in the given sample of cement by Rapid EDTA method	**2**
4. Determination of Iron in the given sample of Haematite ore solution using potassium dichromate crystals by external indicator method.	**2**
5. Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.	**2**
Self-study : NIL	
Site/Industrial Visits : NIL	

Course outcomes:
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.

Text Books:
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 & Company Ltd. New Delhi, 2009, Reprint- 2016

Reference Books:
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 & M. S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Co., 33rd Ed., Reprint- 2016
R4. Kuriakose J.C. and Rajaram J. " Chemistry in Engineering and Technology" Vol I & 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 & 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",5th Edition
R9. Sunita and Ratan Practical Engineering Chemistry, S.K. Kataria & Sons, 2013.

Online Resources:
NIL

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**

Course objectives: 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.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 BASIC SEMICONDUCTOR AND PN JUNCTION THEORY	
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, Condyctivity.The pn Junction – Biased Junctions – Junction Currents and Voltages.VI Characteristics – Static and Dynamic Resistance.Zener diode characteristics, Zener and Avalanche breakdown.	9
Unit-2 DIODE APPLICATIONS	
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
Unit-3 BIPOLAR JUNCTION TRANSISTOR	
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
Unit-4 INTRODUCTION TO OPERATIONAL AMPLIFIERS	
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, Introduction to Oscillators, the Barkhausen Criterion for Oscillations, Applications of Oscillator	9

Unit-5 DIGITAL ELECTRONICS	
Sampling theorem, Introduction, decimal system, Binary, Octal and Hexadecimal number systems, addition and subtraction, fractional number, Binary Coded Decimal numbers. Boolean algebra, Logic gates, Two Variable and three variable K – maps - Half-adder, Full-adder, Logic Design based on two and three input variables only.	9
List of Experiments (If any):	**Practical Hours**
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
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1**: Describe the basic semiconductor principles , working of p-n junction diode and transistors [L2] [PO1] **CO2**: Demonstrate the operation of diodes in rectifiers, voltage regulator and clipper [L3] [PO1] **CO3**: 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", 3rd 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

Course Name: Computer Programming					
Course Code : CS134P / CS234P					
	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**

Course objectives:

- To provide exposure to problem-solving through programming.
- To provide a basic exposition to the goals of programming
- To enable the student to apply these concepts in applications which involve perception, reasoning and learning.

Units	**Teaching Hours**
Unit-1 ALGORITHMS AND FLOWCHARTS, CONSTANTS, VARIABLES AND DATATYPES, OPERATORS, MANAGING INPUT AND OUTPUT OPERATIONS	
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 associatively. Managing input and output operations: Reading a character, writing a character, Formatted Input, Formatted Output	9
Unit-2 DECISION MAKING AND BRANCHING, LOOPING	
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
Unit-3 ARRAYS, USER DEFINED FUNCTIONS	
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
Unit-4 POINTERS	
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

Unit-5 STRINGS, DERIVED TYPES, FILES	
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
List of Experiments :	**Practical Hours**
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**
Self-study: NA	
Site/Industrial Visits: NA	
Course outcomes: 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)	
Text Books: 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**

Course objectives:

1. To elucidate and critically demonstrate the Energy sources and basic thermodynamic concepts behind energy transfer.
2. To distinguish and elaborate the different types of prime movers.
3. To describe the functioning of refrigeration and air-conditioning.
4. To evaluate and apply the concepts of nano-science in real engineering applications.
5. To demonstrate and apply the process of machining and metal joining in basic applications.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 ENERGY RESOURCES, THERMODYNAMICS AND HEAT TRANSFER	
Energy Resources 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. **Thermodynamics** 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). **Heat Transfer** Modes of Heat transfer and their basic governing equations. Heat exchangers-types. Fins – types and applications.	12
Unit-2 I.C. ENGINE AND TURBINES	
I.C. Engines 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). **Steam Generators** Boilers, fire and water tube boilers (Lancashire and Babcock and Will Cox boiler-working with simple sketches)**.** **Steam turbines** Classifications, Principle of operation of Impulse and reaction turbines. **Gas Turbines** Open cycle and closed cycle gas turbines working principle. **Water Turbines** Classification, working principle of Pelton wheel, Francis turbine and Kaplan turbine**.**	10

Unit-3 REFRIGERATION AND AIR-CONDITIONING	
Refrigeration 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. **Air Conditioning** Definition, types, Room air-conditioning working principle (with sketch), Applications.	6
Unit-4 INTRODUCTION TO NANOTECHNOLOGY	
Introduction to Nanotechnology Introduction to about Nanomaterials, characterization of nanomaterials-SEM, XRD, AFM and Mechanical properties, Advantages, limitations and applications of Nanomaterials.	7
Unit-5 MACHINE TOOLS AND METAL JOINING PROCESSES	
Machine tools 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) **Metal joining** 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).	10
Self-study: 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.	
Site/Industrial Visits: 1. Heat Transfer Lab. 2. Fluid mechanics and Machinery Lab. 3. Metal Cutting Lab. 4. I.C. Engine Lab.	
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
O2. http://www.nptel.ac.in/downloads/112108148.

Course Name: Technical English					
Course Code : TE136P / TE236P					
	L	**T**	**P**	Category	**HSMC**
Contact Hrs./Week	**1**	**0**	**2**	CIA Marks	**25**
Contact Hrs./Sem.	**15**	**0**	**30**	ESE Marks	**25**
Credits.	**1**	**0**	**1**	Exam Hours	**2**

Course objectives: 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.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 VOCABULARY BUILDING	
Concept of word formation, synonyms , antonyms, homophones, prefixes and suffixes, Misused and confused words.	8
Unit-2 BASIC WRITING SKILLS	
Sentence structure, parts of speech, Fragments, Run-on errors, Phrases and clauses, Misplaced and Dangling modifiers, Structure of paragraphs Techniques of writing precisely.	8
Unit-3 IDENTIFYING COMMON ERRORS IN WRITING	
Subject verb agreement(concord), articles, prepositions, Tenses, Redundancies, cliché's , Misused and confused words	9
Unit-4 ESSAY WRITING (LANG. LAB)	
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
Unit-5 ORAL COMMUNICATION	
(Interactive practical sessions in lang. lab), listening comprehensions, pronunciation, intonation, stress and rhythm, interview and formal presentation skills.	10

Self-study: NA

Site/Industrial Visits: NA

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 Heasly. 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**

Course objectives: To provide the students with the hands on experience on different trades of engineering like fitting, welding, carpentary & sheet metal.

Units	**Teaching Hours**
List of Experiments (If any):	**Practical Hours**
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

Self-study: NA

Site/Industrial Visits: NA

Course outcomes:

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**

Course objectives: 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

- be introduced to the tools of integration of multivariate functions over areas and volumes.
- 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.
- be able to solve higher order homogenous/ non-homogenous linear differential equations with constant coefficients
- be able to solve Cauchy's and Legendre's equations.
- 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.
- be able to perform operations with Laplace and inverse Laplace transforms to solve higher order differential equations

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 DIFFERENTIAL CALCULUS – II	
Polar curves and angle between Polar curves. Pedal equations of polar curves, Radius of curvature – Cartesian, parametric, polar and pedal forms.	**8**
Unit-2 INTEGRAL CALCULUS – II	
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**
Unit-3 DIFFERENTIAL EQUATIONS – II	
Linear differential equations of second and higher order with constant coefficients. Method of variation of parameters. Legendre'a and Cauchy's homogeneous differential equations.	**10**
Unit-4 LAPLACE TRANSFORMS	

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

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**

Course objectives: 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.

At the end of the course, the students would be able to

- Identify the fundamental aspects of modern physics and quantum mechanics.
- Compare classical and quantum free electron theory.
- Outline the salient properties of elastic and dielectric materials.
- Apply the concepts learnt in Laser, Fiber optics in the field of Engineering.
- Apply optical phenomenon in technology.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 MODERN PHYSICS	
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**
Unit-2 QUANTUM MECHANICS	
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**
Unit-3 ELECTRICAL AND THERMAL CONDUCTIVITIES OF METALS	
Classical free-electron theory. Introduction, assumptions and limitation of classical free-electron theory. Thermal Conductivity. Wiedemann - Franz law, calculation of Lorentz number. **Quantum free-electron theory** – Postulates of quantum fee 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.	**10**
Unit-4 MATERIALS SCIENCE	

Elasticity : Introduction - Bending of beams – Single Cantilever – Application of Cantilever in AFM, Young's modulus-Non uniform bending. Problems. **Dielectrics :** 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.	**09**
Unit-5 APPLIED OPTICS	
Lasers: 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. **Optical Fibers:** 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.	**08**
List of Experiments (If any):	**Practical Hours**
PART – A	
1. Basic Measuring Instruments • Vernier Callipers • Screw Gauge • Travelling Microscope	**02**
2. Verification of Stefan's law	**01**
3. Planck's Constant (Determination of Planck's constant using LED or using the principle of photoelectric effect)	**01**
4. Determination of Fermi energy.	**01**
5. Young's modulus – Non-uniform bending.	**01**
6. Measurement of Dielectric Constant (Charging & discharging of capacitor).	**02**
7. Ultrasonic Interferometer.	**01**
8. Interference at a wedge.	**02**
9. Laser Diffraction (Determination of grating constant and number of rulings per inch using diffraction grating).	**01**
10. Frequency determination – Melde's apparatus	**02**
11. Photo Multiplier Tube – Demonstration only	**01**

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

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**

Course objectives: 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.

Prerequisites: NA

Units	**Teaching Hours**
Unit-1 : DC CIRCUITS	
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
Unit-2: AC CIRCUITS	
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
Unit-3: POWER SYSTEM COMPONENTS	
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
Unit-4: POWER CONVERTERS AND RENEWABLE ENERGY	
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
Unit-5: SMART GRID AND ELECTRIC VEHICLES	

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
List of Experiments:	**Practical Hours**
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**
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: 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	
Text Books: 1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 2. V K. Mehta, Vivek Mehta, "Principles of Power System", S. Chand, 2005, reprint 2015. 3. D. P. Kothari and K C.Singal, "Renewable Energy Sources and Emerging Technologies", PHI, 2011. 4. James Larminie, John Lowry, 'Electric Vehicle Technology Explained', Wiley , 2015.	
Reference Books: 1. Weedy, Cory, Ekanayake, ' Electric Power Systems', John Wiley & Sons; 5th edition, 2012. 2. Hina Fathima (Editor), 'Hybrid-Renewable Energy Systems in Microgrids: Integration, Developments and Control', Woodhead Publishing Series in Energy, 2018. 3. Nikos Hatziargyriou, 'Microgrids: Architectures and Control', Wiley, 2014 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**

Course objectives:

- The students will understand the basics of civil engineering and Engineering Mechanics
- The students will understand the basic principles and laws of forces of nature, measurements, calculations and SI units.
- 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.
- The students will understand the basic concepts of forces in the member, centroid, moment of inertia and Kinetics of bodies.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1	
Introduction To Civil Engineering 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. **Introduction to Engineering Mechanics** 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 Transmissibilty of forces, Moment, Couple and its characteristics. Composition and resolution of forces, Paralleologram Law of forces, Polygon law. Resultant of coplanar concurrent force systems.	9
Unit-2	
Composition of Coplanar Concurrent and Non Concurrent Force System. Resultant of coplanar concurrent force systems. Varignon's Theorem, Resultant of coplanar non concurrent force systems. **Equilibrium of force systems** Free body Diagram, Lami's Theorem ,Equations of Equilibrium, Equilibrium of coplanar concurrent forces.	9
Unit-3	

Support Reactions 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
Unit-4	
Centroid and Moment of inertia 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
Unit-5	
Kinematics 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
List of Experiments (If any):	**Practical Hours**
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 Apparatus.	2
12. To determine the center of gravity Using Parallel Force Apparatus.	2
Self-study: NA	
Site/Industrial Visits : Nil	

Course outcomes: After a successful completion of the course, the student will be able to:
CO1: Understand basics of Civil Engineering, its scope of study and materials of construction. (L1)(PO1)(PSO1)
CO2: Comprehend the action of Forces, Moments and other loads on systems of rigid bodies.(L2) (PO1,PO2)(PSO2)
CO3: Compute the reactive forces and the effects that develop as a result of the external loads. (L3)(PO1)(PSO2)
CO4: Compute Centroid and Moment of Inertia of regular and built up sections.(L3)(PO1) (PSO1)
CO5: Express the relationship between the motion of bodies and equipped to pursue studies in allied courses in Mechanics. (L3) (PO1,PO2) (PSO1)

Text Books:
T1. Bhavikatti S.S. *Elements of Civil Engineering*, 4th Edition and *Engineering Mechanics* ,2nd edition, New Delhi, Vikas Publishing House Pvt. Ltd, 2008.
T2. Shesh Prakash and Mogaveer, Elements *of Civil Engineering and Engineering Mechanics*, 1st edition, New Delhi , PHI learning Private Limited,2009.
T3. Jagadeesh T.R. and Jay Ram, *Elements of Civil Engineering and Engineering Mechanics*, 2nd edition, Bangalore, Sapana Book House, 2008.

Reference Books:
R1. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
R2. Meriam J. L, and Kraige, L. G, Engineering Mechanics, 5/E, Volume I, Wiley India Edition, India, Feburary 2018
R3. Irvingh H Shames, Engineering Mechanics, 4/E, PHI learning Private Limited, New Delhi, 2008
R4. Ferdinand P. Beer and E. Russel Johnston Jr., Mechanics for Engineers: Statics, McGraw-Hill Book Company, New Delhi. International Edition 2013
R5. Bansal R. K, Engineering Mechanics, Laxmi Publications (P) Ltd, New Delhi, 2015
Goyal and Raghuvanshi, Engineering Mechanics, New Edition, PHI learning Private Limited, New Delhi. 2011
R6. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.
R6. Kukreja C.B., Kishore K.Ravi Chawla., Material Testing Laboratory Manual, Standard Publishers & Distributors 1996.
R7. Gambhir M.L., Concrete Manual, Dhanpat Rai & Sons, New Delhi, 2014
Duggal S.K., Surveying, Vol-I, Tata McGraw Hill - Publishing Co. Ltd. New Delhi.
R8. Punmia. B.C., Surveying Vol–1, Laxmi Publications, New Delhi.

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**

Course objectives:

- To create an awareness and emphasise the need for Engineering Graphics.
- To teach basic drawing standards and conventions.
- To develop skills in three-dimensional visualization of engineering components.
- To develop an understanding of 2D and 3D drawings using the Solidworks software

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO ENGINEERING DRAWING& ORTHOGRAPHIC PROJECTIONS	
Introduction to Engineering Drawing Principles of Engineering Graphics and their significance, usage of Drawing instruments, BIS conventions, lettering, Scales – Plain, Diagonal and Vernier Scales. **Orthographic Projections (First Angle Projection Only)** 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**
Unit-2 INTRODUCTION OF COMPUTER AIDED ENGINEERING DRAWing	
Introduction of Computer Aided Engineering Drawing (CAED) 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**
Unit-3 PROJECTIONS OF REGULAR SOLIDS &SECTIONS OF SOLIDS	
Projections of Regular Solids Projection of solids inclined to both the Planes, draw simple annotation, dimensioning and scale (both manual and CAD software).**Sections of solids** Sections and sectional views of right angular solids - Prism, Cylinder, Pyramid, Cone– Auxiliary Views; (both manual and CAD software)	**20**
Unit-4 DEVELOPMENT OF SURFACES & ISOMETRIC PROJECTIONS	

Development of surfaces Development of surfaces of right regular solids - prism, pyramid, cylinder and cone; draw the sectional orthographic views of geometrical solids. **Isometric Projections** 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.	**20**
Unit-5 OVERVIEW OF COMPUTER GRAPHICS & INTRODUCTION TO MODELING AND ASSEMBLY	
Overview of Computer Graphics 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. **Introduction to Modeling and Assembly** 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.	**20**
Self-study: Three Modeling of Simple Machine Parts	
Site/Industrial Visits : Nil	
Course outcomes: 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}	
Text Books: T1. Bhatt N.D., Panchal V.M. & 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. & Rana B.C. (2009), Engineering Drawing and Computer Graphics, Pearson Education T4. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication	
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", 15th Edition, Subash Publishers Bangalore	
Online Resources: Nil	

COURSE NAME: BIOLOGY FOR ENGINEERS					
Course Code : BS136 / BS236					
	L	**T**	**P**	**S**	Course Code
Contact Hrs./Week	**3**	**0**	**0**		CIA Marks
Contact Hrs./Sem.	**45**	**0**	**0**		ESE Marks
Total Contact Hrs.	**45**	**0**	**0**		Exam Hours
Credits.	**3**	**0**	**0**		

Course objectives:

Prerequisites:

Units	**Teaching Hours**
Unit-1 HUMAN PHYSIOLOGY	
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	9
Unit-2 BIOSENSORS	
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	10
Unit-3 MODERN IMAGING SYSTEMS	
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.	8
Unit-4 BIOMECHANICS	
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	10
Unit-5 MATERIALS FOR ORGANS AND DEVICES	

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
Self-study:	
Site/Industrial Visits:	
Course outcomes: 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.	
Text Books: 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 & Sons, 2009 T5. Duane Knudson, "Fundamentals of Biomechanics", Springer Science & 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.	
Reference Books: R1. Bansi Dhar Malhotra, Anthony Turner, "Advances in Biosensors: Perspectives in Biosensors", Volume 5 of Advances in Biosensors, Elsevier, 2003	
Online Resources: NIL	

Course Name: Mathematics-III					
Course Code : MA331					
	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 hrs

Course objectives: This course develops the conceptual understanding of the learners and improves their ability to solve boundary value problems and application of different transformation techniques in the field of electronics and engineering

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 COORDINATE SYSTEMS	
Curvilinear Coordinate System, Gradient, divergent, curl and Laplacian in cylindrical and Spherical Coordinate system, Cylindrical Coordinates, Spherical Coordinates, Transformation between systems	9
Unit-2 PARTIAL DIFFERENTIAL EQUATION	
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients	9
Unit-3 FOURIER SERIES& FOURIER TRANSFORM	
Fourier series – Odd and even functions – Half range Fourier sine and cosine series – Complex form of Fourier series – Harmonic Analysis. Discrete Fourier Sine and Cosine transform, Complex Fourier transform – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity. Solution of equations using Fourier transform, Limitation of Fourier series and Fourier transform and need for Wavelet	9
Unit-4 BOUNDARY VALUE PROBLEMS	
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Two dimensional Laplace equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.	9
Unit-5 Z – TRANSFORM AND DIFFERENCE EQUATIONS	
Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.	9
Self-study : NIL	
Site/Industrial Visits : NIL	

Course outcomes:
At the end of the course, the student will be able to :
CO1: Transform the Cartesian coordinate system into spherical and cylindrical forms by applying vector operators
CO2: Find Fourier series and Fourier transforms of periodic and non-periodic functions, harmonic analysis of the given data
CO3: Form the partial differential equations and solve it by methods of variable separable.
CO4: Solve the boundary value problems by applying Fourier series.
CO5: Solve difference equations using Z – transform.

Text Books:
T1. Grewal, B.S., "Higher Engineering Mathematics", Forty Third Edition , Khanna Publishers, Delhi, 2014
T2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III",Forth Edition,S. Chand & Company ltd., New Delhi, 2010.

Reference Books:
R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons,Inc. 2011
R2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students",Volumes II and III, Fourth Edition, Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2007.
R3. Ramana B.V " Higher Engineering Mathematics", Tata McGraw – Hill Publishing Company.New Delhi, 2009.
R4. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore
R5. T.Veera Rajan, "Engineering Mathematics [For Semester III]. Third Edition. Tata McGraw-Hill Publishing Company. New Delhi, 2007
R6. S. L. Loney, "Plane Trigonometry", Cambridge: University Press
R7. H. K. Das & Rajnish Verma, "Higher Engineering Mathematics", S. Chand & Company Ltd., 2011

Online Resources:
NIL

Course Name: Electronic Devices & Circuits					
Course Code : EC332P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: The aim of this course is to familiarize the student with the principle of operation, capabilities and limitation of various electron devices so that he or she will be able to use these devices effectively.

Prerequisites: Basic Electronics

Units	**Teaching Hours**
Unit-1 PN DIODES AND POWER CONTROL DEVICES	
Semiconductor diodes: Theory of PN junction diode – Diode current equation – Diode resistance – Transition or space charge capacitance – Diffusion capacitance – Effect of temperature on PN junction diodes – Junction diode switching characteristics – Breakdown in PN junction diodes Power control devices: PNPN diode (Shockley diode) SCR characteristics – LASCR (Light Activated SCR) – TRIAC – DIAC – Structure & Characteristics. Characteristics and equivalent circuit of UJT - intrinsic stand-off ratio	9
Unit-2 BJT – BIASING AND SMALL SIGNAL ANALYSIS	
DC Biasing - BJTs : Operating Point, Transistor Biasing circuits (Fixed Bias, Emitter Bias, Voltage Divider Bias, DC Bias with voltage feedback. Transistor as a switch. 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. (gain, input and output impedance).	9
Unit-3 FET – BIASING AND AMPLIFIERS	
JFET: Construction, Operation, Characteristic, Schockley's Equation, Transfer Characteristics and Applications ,MOSFET :Enhancement type MOSFET and Depletion MOSFET – Construction, Operation and Characteristics, Handling precautions for MOSFET FET Biasing: Fixed Bias Configuration, Self – Bias Configuration, Voltage Divider Biasing. Depletion Type MOSFETs, Enhancement Type MOSFETs, FET Amplifiers: FET Small Signal Model	9
Unit-4 FREQUENCY RESPONSE AND HIGH FREQUENCY ANALYSIS	
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. Hybrid – pi equivalent circuit of BJTs. High frequency analysis of BJT amplifiers to obtain upper cut off frequency	9
Unit-5 FEEDBACK AMPLIFIERS	
Feedback Amplifiers: Negative and positive feedback. Properties of negative feedback, basic feedback configurations, analysis of current series and voltage shunt feedback. Multistage amplifiers gain and frequency response.	9

List of Experiments (If any):	**Practical Hours**
1. Input and Output Characteristics of common Emitter Transistor Configuration	2
2. Input and output Characteristics of common base transistor Configuration	2
3. Characteristics of JFET	2
4. Characteristics of UJT	2
5. Determination of Stability factor (Fixed bias, Collector to Base bias & Self bias)	2
6. CE amplifier – Frequency Response	4
7. Common source FET amplifier – Frequency Response	4
8. Characteristics of SCR	4
9. Current series feedback amplifier: determination of frequency response with and without feedback	4
SIMULATION USING PSPICE/MULTISIM	
1. Voltage divider bias	2
2. Shunt feedback amplifiers –frequency response and gain	2
Self-study : Bias Stabilization, Thermal runaway. Transistor as a switch -Unit 3	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1**: Demonstrate the basics of electron motion in electric field and mechanisms of current flow in semi-conductors. **CO2:** Define the structure of Diodes and apply the concepts of diode for real life applications. **CO3:** Define and understand the structure of BJT, FET Transistors and analyze their input output characteristics. **CO4:** Estimate design parameters required for stable basing circuits using diodes and transistors **CO5:** Construct switching and amplifier circuits for real life applications using diodes and transistors. **CO6:** Analyze the frequency response of amplifiers	
Text Books: T1. Jacob Millman & Christos C.Halkias, "Electronic Devices and Circuits", Tata McGraw-Hill Education Pvt. Ltd., 2010. T2. Millman J. and Halkias .C. " Integrated Electronics ", Tata McGraw-Hill Publishing, 2000. T3. Robert L. Boylestead & Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th edition ,Pearson Education,2009. T4. Sedra and Smith." Microelectronic Circuits", 6/e, Oxford University Press,2010.	
Reference Books: R1. Donald A Neamen, "Electronic Circuit Analysis and Design", 3/e, TMH. R2. Ben G. Streetman and Sanjay Banerjee, "Solid State Electronic Devices",Sixth edition, Pearson Education 2006. R3. S.M. Sze, "Semiconductor Devices – Physics and Technology", 2nd Edn. John Wiley, 2002. R4. David A. Bell, "Electronic Devices and Circuits", 4th Edition, Prentice Hall of India, 2007. R5. Nandita Das Gupta and Amitava Das Gupta, "Semiconductor Devices – Modelling and Technology", Prentice Hall of India, 2004.	

Online Resources:
NIL

Course Name: Digital Electronics					
Course Code : EC333P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: To study the basics of digital circuits and learn methods and fundamental concepts used in the design of digital systems.

Prerequisites: Basic Electronics

Units	**Teaching Hours**
Unit-1 COMBINATIONAL CIRCUITS – I	
Design procedure – Simplification of Boolean Functions using theorems and postulates, Four variable Karnaugh Maps, Adders-Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor- Carry look ahead adder- BCD adder, Magnitude Comparator.	9
Unit-2 COMBINATIONAL CIRCUITS – II	
Multiplexer/ Demultiplexer,Encoder / decoder, parity checker, Code converters. Implementation of combinational logic using MUX, ROM, PAL and PLA- Introduction of HDL for combinational Circuits.	9
Unit-3 SEQUENTIAL CIRCUITS	
Classification of sequential circuits, Moore and Mealy -Design of Synchronous counters: state diagram- State table –State minimization –State assignment- ASM- Excitation table and maps-Circuit implementation - Universal shift register – Shift counters – Ring counters, Introduction of HDL for sequential Circuits	9
Unit-4 ASYNCHRONOUS SEQUENTIAL CIRCUITS	
Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles – Races, Hazards: Static –Dynamic –Essential –Hazards elimination.	9
Unit-5 DIGITAL INTEGRATED CIRCUITS	
Introduction – Special Characteristics – Bipolar Transistor Characteristics – RTL and DTL circuits – Transistor-Transistor Logic (TTL) Emitter Coupled Logic (ECL) – Metal Oxide Semiconductor (MOS) – Complementary MOS (CMOS) – CMOS Transmission Gate circuits	9
List of Experiments (If any):	**Practical Hours**
1. Design and implementation of Adders and Subtractors using logic gates.	2
2. Design and implementation of code converters using logic gates.	2
3. BCD to excess-3 code and vice versa	4
4. Binary to Gray and vice-versa	4

5. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC 7483.	2
6. Design and implementation of 2Bit Magnitude Comparator using logic gates 8 Bit Magnitude Comparator using IC 7485	2
7. Design and implementation of 16 bit odd/even parity checker generator using IC74180	2
8. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC74150 and IC 74154	2
9. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147	2
10. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters	2
11. Design and implementation of 3-bit synchronous up/down counter	2
12. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops	2
13. VHDL Circuit Design-Practices	2
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Understand the concepts of data paths, control units, and micro-operations and building blocks of digital systems **CO2:** Apply the principles of Boolean algebra to manipulate and minimize logic expressions, use of K-map to minimize and optimizes the logic functions **CO3:** Design combinational circuits using decoder, multiplexers, PLDs **CO4:** Analyze the operation of sequential circuits built with various flip-flops and design of counters, registers **CO5:** Use state machine diagrams to design finite state machines using various types of flip-flops and combinational circuits with prescribed functionality.	
Text Books: T1. M. Morris Mano, Michael D. Ciletti, "Digital Design" 5thEdition, Prentice Hall of India Pvt. Ltd., New Delhi, 2015/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.	
Reference Books: R1. John .M Yarbrough," Digital Logic Applications and Design", Thomson- Vikas Publishing house, New Delhi, 2006. R2. J. Bhasker, "VHDL Primer",3rd Edition, Addison Wesley Longman Publications, 2001. R3. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 5th ed., Vikas Publishing House Pvt. Ltd, New Delhi, 2016. R4. Charles H.Roth, " Fundamentals of Logic Design", Thomson Publication Company, 2012. R5. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications",6th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.	
Online Resources: NIL	

Course Name: Electromagnetic Fields					
Course Code : EC334					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3 hrs

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

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 STATIC ELECTRIC FIELDS	
Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Coordinate System – Introduction to line, Surface and Volume Integrals – Flux and circulation- Definition of Curl, Divergence and Gradient – Meaning of Strokes theorem and Divergence theorem. Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Principle of Superposition – Electric Flux Density – Gauss Law – Proof of Gauss Law – Applications. Charge distributions-line, surface, volume Electric Scalar Potential – Relationship between potential and electric field - Potential due to electrical dipole - Poisson's and Laplace's equation – Electrostatic energy and energy density - Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current	9
Unit-2 STATIC MAGNETIC FIELD	
The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite current carrying wire – Magnetic field intensity on the axis of a circular and rectangular current carrying loop – Ampere's circuital law and simple applications. Current distributions –line, surface and volume. Magnetic flux density – The Lorentz force equation for a moving charge and applications – Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential-Energy density in magnetic fields – Nature of magnetic materials – magnetization and permeability - magnetic boundary conditions.	9
Unit-3 TIME VARYING ELECTRIC AND MAGNETIC FIELDS	
Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law –Equation expressed in point form. Displacement current – Ampere's circuital law in integral form – Modified form of Ampere's circuital law as Maxwell's first equation in integral form – Equation expressed in point form. Maxwell's four equations in integral form and differential form	9
Unit-4 ELECTROMAGNETIC WAVES	

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

Course Name: Network Analysis & Synthesis					
Course Code : EC335					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: The course aims at

- Analyse a particular circuit energized with independent, dependent sources, using Node, Mesh analysis and network theorems like Superposition, Thevenins Theorem, Nortons Theorem and Maximum Power Transfer Theorem.
- Analyse dynamic circuits energized with ac source using Node, Mesh analysis and network theorems like Superposition , Thevenins and Nortons Theorem
- Analyse circuits using Laplace Transform
- Design various filters using the T and pi network.
- Describe the characterization of two port networks.
- Realize network functions in Foster/ Cauer forms

Prerequisites: Basics of Electrical Engineering

Units	**Teaching Hours**
Unit-1 ANALYSIS OF MEMORYLESS CIRCUITS	
Reference directions for two terminal elements - Kirchhoff's Laws - Independent and Dependent Sources – Resistance Networks: Node and Mesh analysis of resistance networks containing both voltage and current independent and dependent sources - Source Transformations. Superposition, Thevenin, Norton and Maximum Power Transfer Theorems applied to resistance networks with dependent and independent current, voltage sources.	9
Unit-2 SINUSOIDAL STEADY STATE IN DYNAMIC CIRCUITS	
Capacitors and Inductors – Current - voltage relationships – Coupled coils – Mutual Inductance – Dot Convention. Sinusoidal Steady State Analysis: Review of complex numbers – Rectangular and Polar forms – Phasors and the sinusoidal steady state response - Phasor relationships for R, L and C – Impedance and Admittance – Node and Mesh analysis, Superposition, Source transformation, Thevenin and Norton's theorems applied to Phasor circuits – Sinusoidal Steady State power – Average Power – Maximum power transfer theorem	9
Unit-3 ANALYSIS OF DYNAMIC CIRCUITS USING LAPLACE TRANSFORMS	
Laplace Transform as a tool to analyse Circuits – Transformation of a circuit into s domain – Transformed equivalent of resistance, capacitance, inductance and mutual inductance – Impedance and Admittance in the transform domain – Node and Mesh analysis of the transformed circuit - Excitation by sources and initial conditions – Complete response with switched dc sources - Network theorems applied to the transformed circuit – Network Functions: Driving point and Transfer functions - Poles and zeros	9
Unit-4 FREQUENCY RESPONSE AND FILTERS	

Frequency Response: Network functions in the sinusoidal steady state with s = jω - Magnitude and Phase response - Magnitude and Phase response of First order Low pass and High pass RC/ RL circuits. Filtering: Frequency domain characteristics of ideal filters –– Non - ideal filters –Approximating functions: Butterworth, Chebyshev and elliptic filters (Magnitude response only). Design of analog filters (Butterworth and Chebyshev). Transformations in the analog domain. Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T section, π section, terminating half section. Pass bands and stop bands. Design of constant-K, m-derived filters. Composite filters	9
Unit-5 TWO PORT NETWORKS AND SYNTHESIS	
Two Port Networks: Characterization of two port networks, Z, Y, ABCD and h-parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & ıı Representation. Network Synthesis: Realizability, Positive real function, definition and properties; Hurwitz Polynomial, Properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:**Analyse memoryless circuits using Mesh Analysis, Node Analysis and Network Theorems **CO2:** Analyse dynamic circuits using Mesh Analysis, Node Analysis and Network Theorems **CO3:**Analyze electric circuits using Laplace Transform **CO4:**Design analog filters using Butterworth, Chebyshev approximations and realize them using T and pi networks **CO5:**Analyse port networks using h parameters, Z parameters, Y parameters, and transmission parameters **CO6:**Synthesize one port networks using Foster and Cauer Forms	
Text Books: T1. Van Valkenburg: "Network Analysis", Third Edition, Pearson Education,2015 T2. Suresh Kumar K. S, "Electric Circuits and Networks", First Edition , Pearson Education, 2008 T3. Wai-Kai Chen, "Passive and Active Filters-- Theory and Implementations", John Wiley & Sons, 2009 T4. W H. Hayt, Kemmerly and S M Durbin, "Engineering Circuit Analysis", Eighth Edition, Tata Mc.Graw Hill, 2013	
Reference Books: R1. Franklin F. Kuo: "Network Analysis and Synthesis", Second Edition, Wiley India, 2010 R2. M.E. Van Valkenburg, "Design of Analog Filters", Saunder's College Publishing, 2008 R3. V. K. Aatre: "Network Theory and Filter Design", Second Edition, Wiley Eastern,2014	
Online Resources: NIL	

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

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

Prerequisites: NIL

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

Self-study : NIL

Site/Industrial Visits : NIL

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

Reference Books:
R1. Matt Bishop, "Introduction to Computer Security", Pearson, 6th impression, ISBN: 978-81-7758-425-7.
R2. Thomas R, Justin Peltier, John, "Information Security Fundamentals", Auerbach Publications.
R3. AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill.2003
R4. Nina Godbole, SunitBelapure, "Cyber Security", Wiley India 1st Edition 2011
R5. Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, "Cyber Security Policy Guidebook", Wiley; 1 edition , 2012
R6. Dan Shoemaker and Wm. Arthur Conklin, "Cyber security: The Essential Body Of Knowledge", Delmar Cengage Learning; 1 edition, 2011
R7. Stallings, "Cryptography & Network Security - Principles & Practice", Prentice Hall, 6th Edition 2014

Online Resources:
NIL

Course Name: Analog Electronics					
Course Code : EC431P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3 hrs

Course objectives: The aim of this course is to familiarize the student with the analysis and design of feedback amplifiers, oscillators, tuned amplifiers, wave shaping circuits, multivibrators and blocking oscillators using BJT and Op-Amps

Prerequisites: Basic Electronics, Electronic Devices & Circuits

Units	**Teaching Hours**
Unit-1 OSCILLATORS AND TRANSISTOR SWITCHING CIRCUITS	
Mechanism for start of oscillation and stabilization of amplitude: Tank Circuit. Positive Feedback: Barkhausen Criterion. RC phase shift Oscillator. Wien bridge Oscillator. Analysis of LC Oscillators, Colpitts, Hartley, Clapp oscillators. Frequency range of RC and LC Oscillators. Quartz Crystal Construction. Electrical equivalent circuit of Crystal. Pierce crystal Oscillator circuit. Transistor switching times. (Delay, rise, storage and fall time). Analysis of collector coupled Astable, Monostable and Bistable multivibrators. UJT Relaxation Oscillator.	9
Unit-2 LARGE SIGNAL AMPLIFIERS AND TUNED AMPLIFIERS	
Power Amplifier: Definition and amplifier types – efficiency – classification. Transformer coupled Class A amplifier – Transformer coupled class – B and class – AB amplifiers – Complementary Symmetry – Push pull amplifier. Calculation of efficiency, power output and dissipation. Amplifier Distortion – Cross over distortion. Power of a signal having distortion. Power Transistor heat sinking. Tuned Amplifiers: Basic principle – Concept of resonance – coil loses, unloaded and loaded Q of tank circuits. Basic tuned amplifier using BJT – Q factor – Selectivity – instability of tuned amplifier – Stabilization techniques – Class C tuned Amplifiers and their applications. Efficiency of class C tuned amplifier.	9
Unit-3 OPAMP BASICS	
Operational Amplifier: Simplified Internal Circuit of 741 – opamp. Opamp parameters: Input bias current, Input Offset Current, Input Offset Voltage, Thermal drift, Voltage Gain, Input and Output Impedance, CMRR, Slewrate. Low frequency and High Frequency equivalent model of opamp Inverting and Non Inverting Amplifier: Analysis, Frequency response of inverting and non-inverting amplifier.[Analysis to show the effect of frequency on the voltage gain] Summing Amplifier [Adder], Difference Amplifier [Subtractor].	9
Unit-4 OPAMP APPLICATIONS AND FILTERS	

Instrumentation amplifiers, V to I and I to V converters and their applications, Logarithmic Amplifier, Antilogarithmic Amplifier, Comparators, Schmitt Trigger, Square and triangular waveform generator First order Low pass, High pass Filters, Frequency Response. Second Order Low Pass and High Pass Filters, - Bandpass and band elimination filters, Notch Filter, All Pass filters.	9
Unit-5 ADC/DAC CONVERTERS AND SPECIAL FUNCTION ICS	
D/A converters: DAC characteristics- resolution, output input equations, weighted resistor, R-2R network. A/D converter: ADC characteristics, Types - Dual slope, Counter ramp, Successive approximation, flash ADC, oversampling and delta sigma ADC. Waveform generators – grounded capacitor VCO and emitter coupled VCO. Basic PLL topology and principle, transient response of PLL, Linear model of PLL, Major building blocks of PLL – analog and digital phase detector, VCO, filter. Applications of PLL. Monolithic PLL - IC LM565. 555 Timer Astable Multivibrator and Monostable Multi vibrator using 555 IC	9
List of Experiments (If any):	**Practical Hours**
1. Design of BJT RC Phase shift oscillator – measurement of amplitude and frequency of oscillation	2
2. Design of BJT Colpitts Oscillator - measurement of amplitude and frequency of oscillation	2
3. Design of UJT oscillator – measurement of amplitude and time period of waveforms	2
4. Design of transistor Astable multivibrator -measurement of amplitude and frequency of oscillation of asymmetrical square waveform	2
5. Current series feedback amplifier: determination of frequency response with and without feedback (using BJT).	2
6. Non Inverting and Inverting Amplifiers using ICs	2
7. Adders and Subtractors functionality using ICs	2
8. Schmitt Trigger using ICs	2
9. Low Pass and High Pass Filters using ICs	2
10. Astable and monostable Multivibrator using 555	2
SIMULATION USING PSPICE	
1. Monostable multivibrator: pulse generation on application of a trigger pulse	1
2. RC Integrator and Differentiator circuit	1
3. Monostable multivibrator: pulse generation on application of a trigger pulse	2
4. Voltage shunt feedback amplifier : frequency response with and without feedback	2

5. Wein Bridge Oscillator	2
6. R/2R Ladder DAC	2

Self-study : Bias Stabilization, Thermal runaway. Transistor as a switch -Unit 3

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Analyze the RC, LC and crystal oscillator circuits and generation of sinusoidal signals over various frequency bands.
CO2: Describe the timing circuits designed with BJT transistors.
CO3: Design and demonstrate large signal and tuned amplifiers for various power applications and resonant frequency applications.
CO4: Understand the elements inside an opamp and design basic adders and subtractors
CO5: Design various application circuits using operational amplifiers like integrators, differentiators, wave form generators
CO6: Design filters using operational amplifiers and plot its frequency response.
CO7: Understand the principle of ADC and DAC and design DAC - R/2R DAC, binary weighted DAC
CO8: Design various application circuits using the timer IC 555

Text Books:
T1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, OUP, 2008.
T2. Millman J. and Halkias .C. " Integrated Electronics ", Tata McGraw-Hill Publishing, 2000.
T3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3ed, Tata Mc.Graw Hill, 2002.
T4. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4ed, Prentice Hall of India, 2002.

Reference Books:
R1. Donald A Neamen, "Electronic Circuit Analysis and Design", 3/e, TMH.
R2. Behzad Razavi," Design of Analog CMOS IC", 2nd Edition, Tata McGraw Hill, 2003.
R3. David A. Bell, "Operational Amplifiers and Linear ICs", 3rd Edition, OUP, 2011.
R4. David A. Johns, Ken Martin, "Analog Integrated Circuit Design", 2nd Edition, Wiley India, 2008.

Online Resources:
NIL

Course Name: Antennas & Wave Propagation					
Course Code : EC432					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives: The course aims at providing an in-depth understanding of modern antenna concepts, practical antenna design for various applications explaining the theory of different types of antennas used in communication systems. This course also provides a study for the analysis and design of arrays, wave propagation and antenna measurements.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 ANTENNA BASICS & WIRE ANTENNAS	
Basics of antenna Parameters: Radiation intensity, Directivity, Power gain, Beam Width, Band Width, polarization, Input impedance, Efficiency, Effective length and Effective area, Antenna Temperature, Reciprocity principle, Friss Transmission equation, Radiation mechanism, Current distribution on thin wire antenna, Retarded vector potential, Fields associated with oscillating dipole. Power radiated and radiation resistance of current element, Radiation resistance of half-wave dipole and quarter-wave monopole, Loop Antennas, Radiation from small loop and its radiation resistance.	9
Unit-2 ANTENNA ARRAYS	
Array of point sources: Expression for electric field for two point sources of equal amplitude and phase ,equal amplitude and opposite phase and unequal amplitude and any phase, Linear array of N isotropic point sources. Broad side array, End fire array, Method of pattern multiplication. Non-uniform Distribution - Binomial array, Dolph -Chebyshev array, Planar and Circular Arrays.	9
Unit-3 SPECIAL ANTENNAS	
Travelling Wave Antenna, Rhombic Antenna, Yagi Uda Antenna, Log periodic antenna, Helical antenna, Horn Antenna, Lens Antenna, Dish antenna, microstrip antenna, dielectric resonator antenna.	9
Unit-4 WAVE PROPAGATION	
Ground wave propagation: Attenuation characteristics for ground wave propagation, Calculation of field strength at a distance. Space wave propagation: Reflection from ground for vertically and horizontally polarized waves, Reflection characteristics of earth, Resultant of direct and reflected ray at the receiver, Duct propagation. Sky wave propagation: Structure of the ionosphere. Effective dielectric constant of ionized region, Mechanism of refraction, Refractive index, Critical frequency, Skip distance, Energy loss in the ionosphere due to collisions, Maximum usable frequency, Fading and Diversity reception.	9

Unit-5 ANTENNA MEASUREMENTS & APPLICATIONS	
Measurement Ranges, Absorbing materials, anechoic chamber, Compact antenna test ranges, Pattern Measurement Arrangement, Impedance Measurement, Phase & Gain measurements, VSWR measurements. Application of Antennas (Overview): Antennas for Mobile communication, Satellite Communication (LEO, MEO, GEO Satellite Antennas, Cubesats), Antennas for Biomedical, Mammography and Microwave Imaging applications, Implantable antennas.	9
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: At the end of the course, the student will be able to : **CO1:** Explain the fundamentals and radiation principles of various antenna **CO2:** Analyze the various antenna arrays **CO3:** Design the special antennas for suitable applications **CO4:** Discuss the various types of wave propagations **CO5:** Measure the antenna parameters **CO6:** Paraphrase the selection of antennas for appropriate applications	
Text Books: T1. J. D. Kraus and R.Marhefka, "Antennas", 2nd edition, Tata McGraw-Hill, 2003. T2. C. A. Balanis, "Antenna Theory", 4th edition, John Wiley & Sons, 2016.	
Reference Books: R1. R. E. Collins, "Antennas and Radio Propagation ", 2nd edition, McGraw-Hill, 2003 R2. K. D. Prasad, "Antennas and Wave Propagation", 3rd Edition, Tech Publications, 2001 R3. E. C. Jordan and K. G. Balmain, "Electro Magnetic Waves and Radiating System", 2nd edition , PHI, New Delhi, 2015	
Online Resources: NIL	

Course Name: Signals & Systems					
Course Code : EC433					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

Course objectives:

- Demonstrate a knowledge and understanding of the fundamental concepts and principles of signals and systems.
- Demonstrate spectral analysis of CT periodic and aperiodic signals using CT Fourier and Laplace methods.
- Analyse and characterization of total response, impulse response and frequency response of LTI CT systems.
- Interpret discrete time signal by Discrete Time Fourier transforms and Z transform.
- Analyse and Characterization of total response, impulse response and frequency response of LTI DT systems.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 CLASSIFICATION OF SIGNALS AND SYSTEMS	
Continuous Time signals (CT signals), Discrete Time signals (DT signals) - Step, Ramp, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, Energy and power, even and odd, Deterministic and Random signals, Transformation on Independent variables -CT systems and DT systems, Properties of Systems – Linearity, Causality, Time Invariance, Stability, Invertibility and LTI Systems.	9
Unit-2 ANALYSIS OF CT SIGNALS	
Fourier Series Analysis, Spectrum of CT Signals, Continuous Time Fourier Transform and Laplace Transform in Signal Analysis, Properties of Fourier Transform, Laplace Transform-Properties-ROC, Parseval's Theorem, Sampling Theorem and Aliasing.	9
Unit-3 LTI-CT SYSTEMS	
Differential equations-Total Response- Fourier Transform & Laplace Transform, Impulse response, Convolution Integral, Frequency response.	9
Unit-4 ANALYSIS OF DT SIGNALS	
Spectrum of DT Signals, Discrete Time Fourier Transform (DTFT), Z-Transform in signal analysis, Z-transform-Properties-ROC and Inverse Z Transform-Partial Fraction-Long Division.	9
Unit-5 LTI-DT SYSTEMS	
Difference equations, Total Response-Z- Transform, Impulse response, Convolution sum, Frequency response.	9
Self-study : Real Life Applications	
Site/Industrial Visits : Alstom Transport India Limited, Bharat Electronics Limited and other relevant organization.	

Course outcomes:
At the end of the course, the student will be able to :
CO1: Categorize the properties and representation of discrete and continuous time signals and systems
CO2: Analyze the continuous time signal using Fourier and Laplace transform
CO3: Determine total response, impulse response and frequency response of LTI-CT system
CO4: Analyze the discrete time signals using Discrete Time Fourier Transforms and Z transform
CO5: Determine total response, impulse response and frequency response of LTI-DT systems

Text Books:
T1 Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, 2nd edn., Pearson Education, 2015
T2. M. J. Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH 2003.

Reference Books:
R1. Lathi B. P, Signals Systems and Communication, B S Publications, Hyderabad, 2011.
R2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley, 2009
R3. K. Lindner, “Signals and Systems”, McGraw Hill International, 2009
R4. Michael J Roberts, "Fundamentals of Signals and systems" Tata McGraw Hill, 2007.

Online Resources:
O1. https://www.sciencedirect.com/book/9780123948120/signals-and-systems-using-matlab
O2. https://nptel.ac.in/downloads/117101055/
O3. https://www.iitg.ac.in/cseweb/vlab/signals-and-systems-laboratory/

Course Name: Computer Organization & Processors					
Course Code : EC434					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3hrs

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

Prerequisites: NIL

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

Course outcomes:
At the end of the course, the student will be able to :
CO1: Summarize the architectural features of a computer
CO2: Discover the basic functional units in ALU and perform various arithmetic operations of ALU
CO3: Demonstrate the dataflow and program execution process in Computer
CO4: Summarize various memory architectures and their data storage behaviour
CO5: Interpret unique architectural features of 8086 and Pentium processors.

Text Books:
T1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 7th Edition "Computer Organization", McGraw-Hill, 2011
T2. Douglous V. Hall "Microprocessor and Interfacing" 3rd edition ,Tata McGraw Hill,2015.
T3. James L. Antonakos , " The Pentium Microprocessor '' Pearson Education, 2007

Reference Books:
R1. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10h Edition, Pearson Education, 2015.
R2. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 3rd Edition, Morgan Kaufmann, 2008
R3. John P.Hayes, "Computer Architecture and Organization", 4th Edition, McGrawHill, 2003.

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

Course Name: Electronic Measurement Lab					
Course Code : EC451					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	0	0	2	CIA Marks	50
Contact Hrs./Sem.	0	0	30	ESE Marks	50
Credits.	0	0	1	Exam Hours	3 hrs

Course objectives: The aim of this course is to familiarize the student with the calibration, measurement, testing and characterization of various sensors and transducers devices and test instruments so that he or she will be able to carry out measurements effectively.

Prerequisites: Basic Electronics

List of Experiments :	**Practical Hours**
1. Study of strain gauge & Load cell characteristics	2
2. Calibration of LDR and Opto coupler characteristics	2
3. Study of Photo electric & Hall effect transducers	2
4. LVDT and Tacho generator characteristics	2
5. RTD, Thermocouple and Thermistor characteristics	2
6. Measurement of PH and water conductivity	2
7. Characteristics of stepper motor and servo motor	2
8. IC temperature sensor (AD 590)	2
9. Measurement of Speed-contact and Non-contact Types	2
10. Design and testing of Instrumentation amplifier	2
11. Design and testing of a temperature controller	2
12. Design of RC lead, lag, lead - lag compensator	2
13. Measurement of RF signals using Spectrum Analyzer	3
14. Measurement of frequency stability of oscillators using Frequency Counter	3

Self-study :

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Demonstrate the use of test instruments for signal measurements and characterize common sensors and transducers.
CO2: Estimate the long term stability of oscillators using frequency counters and compare stability factors of various oscillators with different Q factors.
CO3: Calibrate and study the characteristics of pressure, temperature, speed, transducers
CO4: Analyze the spectral characteristics of RF signals

Text Books:
T1. Albert D.Helfrick and William D.Cooper – Modern Electronic Instrumentation and Measurement Techniques, Pearson / Prentice Hall of India, 2007.

Reference Books: R1. David A. Bell, Electronic Instrumentation and measurements, Prentice Hall of India Pvt Ltd, 2003
Online Resources: NIL

Course Name: Professional Ethics					
Course Code : HS435					
	L	**T**	**P**	**Category**	HSMC
Contact Hrs./Week	2	0	0	**CIA Marks**	50
Contact Hrs./Sem.	30	0	0	**ESE Marks**	50
Credits.	2	0	0	**Exam Hours**	3

Course objectives: The objectives of the course are to expose students to ethics and various stakeholders involved in civil engineering professional practice. The course also gives an insight to related laws of labour and arbitration.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1	
Professional Ethics : Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.	6
Unit-2	
Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC) (formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)	8
Unit-3	
Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017	8
Unit-4	

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – add act meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.	8
Self-study : Nil	
Site/Industrial Visits : Nil	
Course outcomes: The students will be able to **CO1:** Explain the roles of stakeholders in civil engineering profession.{L2}{PO6,PO8} **CO2:** Describe engineering ethics, responsibility, honesty, integrity, reliability, risk and safety factors. {L2}{PO6,PO8} **CO3:** Describe the role of labour, arbitration and conciliation in civil engineering. {L2}{PO6,PO8}	
Text Books: T1. R. Subramanian, *Professional Ethics,* Second edition, 2017, Oxford University Press. T2. R.S. Naagarazan, *A Textbook on Professional Ethics and Human Values*, First edition, 2007, New age.	
Reference Books: R1. *National Building Code of India*, Volume I and II, Bureau of Indian Standards, 2016. R2. The Arbitration and Conciliation Act, 1996.	
Online Resources: W1. https://bis.gov.in/ W2. https://rera.goa.gov.in/reraApp/ W3. https://labour.gov.in/childlabour/child-labour-acts-and-rules	

Course Name: Probability & Queuing Theory					
Course Code : MA436					
	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 hrs

Course objectives: The objective of this course is to describe the fundamentals and advanced concepts of probability theory, random process, queuing theory to support the graduate coursework and research in electrical and electronics engineering

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 PROBABILITY AND RANDOM VARIABLE	
Axioms of probability - Conditional probability, Random variable - Probability mass function - Probability density function - Properties. Mathematical Expectation and Moments. Relation between central and Non-central moments	9
Unit-2 STANDARD DISTRIBUTIONS	
Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable. Moments - Moment generating functions and their properties.	9
Unit-3 TWO DIMENSIONAL RANDOM VARIABLES	
Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem	9
Unit-4 RANDOM PROCESSES AND MARKOV CHAINS	
Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains - Transition probabilities - Limiting distributions. Transition Diagram.	9
Unit-5 QUEUING THEORY	
Markovian models – M/M/1, M/M/C , finite and infinite capacity - M/ M/∞ queues - Finite source model - M/G/1 queue (steady state solutions only) – Pollaczek – Khintchine formula – Special cases. Single and Multiple Server System.	9

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Understand the basic probability concepts
CO2: Describe standard distributions which can describe real life phenomena
CO3: Solve problems involving more than one random variable and functions of random variables.
CO4: understand and characterize phenomena which evolve with respect to time in a probabilistic manner.
CO5: Explain queuing system and queuing models.

Text Books:
T1. Ross, S., "A first course in probability", Ninth Edition, Pearson Education, Delhi, 2013
T2. Medhi J., "Stochastic Processes", 3rd Edition,New Age Publishers, New Delhi, 2009.
T3. .Veerarajan, "Probability, Statistics and Random process", Third Edition, Tata McGraw Hill, New Delhi, 2009.

Reference Books:
R1**.** Allen., A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi
R2. Taha, H. A., "Operations Research-An Introduction", Eighth Edition, Pearson Education Edition Asia, Delhi, 2015.
R3. Gross, D. and Harris, C.M., "Fundamentals of Queuing theory", John Wiley and Sons, Third Edition, New York, 2008.

Online Resources:
NIL

SEMESTER V SYLLABUS

CONTROL SYSTEMS

Sub Code: EC531	**L: T: P**	**Total Lecture Hrs: 45**
Exam Marks: 100	**3: 1: 0**	**Exam Hours:03Credits: 4**

COURSE OBJECTIVE:
To provide sound knowledge in the basic concepts of linear control theory, modern control theory and design of control system.

SYLLABUS:

UNIT I SYSTEMS AND THEIR REPRESENTATION 9+3hrs
Basic elements in control systems – Open and closed loop systems – Transfer function. Mathematical Modelling of Systems: Electrical Systems, Mechanical Systems[Translational and Rotational Mechanical Systems], Electro Mechanical Systems. Thermal 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

UNIT II TIME RESPONSE 9+3hrs
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.

UNIT III STABILITY OF CONTROL SYSTEM 9+3hrs
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.

UNIT IV FREQUENCY RESPONSE 9+3hrs
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. Constant M an N circles – Nichols chart – Determination of closed loop response from open loop response. Compensation - Lead, Lag, Lead Lag Compensation.

UNIT V INTRODUCTION TO MODERN CONTROL THEORY 9+3hrs
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 Gilbert's Test

COURSE LEARNING OUTCOMES
After completion of the course students will be able to:

- 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.
- 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.
- 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.

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

TEXT BOOKS

1. K. Ogata, 'Modern Control Engineering', 5th edition, Pearson Education, NewDelhi, 2010 / PHI.
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', 4th edition,New Age International Publishers, 2007.

REFERENCE BOOKS

1. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd.,9th edition, New Delhi, 2002.
2. M. Gopal, 'Control Systems, Principles & Design',4th edition, Tata McGraw Hill, New Delhi, 2012.
3. M.N. Bandyopadhyay, 'Control Engineering Theory and Practice',1st edition,Prentice Hall of India, 2003.

DISCRETE TIME SIGNAL PROCESSING

Sub Code: EC532	**L: T: P**	**Total Lecture Hrs: 45**
Exam Marks: 100	**2: 1: 1**	**Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE:

This course will introduce the basic concepts and techniques for processing signals on a computer. Aim of this course is to make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors. The course emphasizes intuitive understanding and practical implementations of the theoretical concepts**.**

SYLLABUS:

UNIT – I DISCRETE FOURIER TRANSFORM **6+6hrs**

DFT from DTFT – DFT Symmetry Relations – Properties – Linearity – Circular Shift – Frequency Shift - Duality – Modulation - Circular Convolution – Parseval's Theorem. Linear Convolution Using DFT – System Response

Fast Fourier Transform : Radix -2 FFT Algorithm, Decimation in Time (DIT) and Decimation in frequency (DIF) Algorithms. IDFT using FFT.

UNIT – II LTI DISCRETE SYSTEMS IN THE TRANSFORM DOMAIN **6+6hrs**

Transfer function Classification based on – Magnitude and Phase Characteristics. FIR and IIR filters - Types of Linear Phase FIR Filters – Type – I, Type – II, Type – III, and Type – IV. Zero Locations of Linear Phase FIR Filters. Simple FIR and IIR Digital Filters.

UNIT – III DESIGN OF FIR FILTERS **6+6hrs**

Design using Hamming, Hanning and Blackmann Windows - Frequency sampling method, Parks-McClellan Method.

Realization of FIR filters: Transversal, Linear phase and Polyphase structures. FIR Cascaded Lattice Structures

UNIT – IV DESIGN OF IIR FILTERS **6+6hrs**

Review of Analog filter Design (Already covered in III Semester Network Analysis and Synthesis). Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform - pre warping

Realization: Direct, cascade and parallel forms. All Pass Filter Realization. Lattice Ladder Structure.

UNIT – V FINITE WORD LENGTH EFFECTS **6+6hrs**

Quantization noise –quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error – co-efficient quantization error - limit cycle

Multirate Signal Processing Fundamentals: Introduction, Decimation, Interpolation, Fractional Sampling rate conversion, Multistage Implementation and design of Sampling Rate Conversion, Computational Efficiency – Polyphase decomposition.

COURSE LEARNING OUTCOME:

On completion of this course, the students can

- Examine the methods of Fourier Transform Analysis.
- Analyze discrete-time signals and systems in Transform Domain.
- Design digital Finite Impulse Response (FIR) filters using Windows and Frequency Sampling methods.

- Design digital Infinite impulse response (IIR) filters using Bilinear Transformation and Impulse Invariant Transformation.
- Examine the effects of Finite Word Length in digital filters.
- Explain Sampling Rate Conversion and examine its effects.

TEXT BOOKS:

1. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Fourth Edition, Mc. Graw Hill,2013.

REFERENCES:

1. John G. Proakis, Dimitris K Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, PHI,2007.
2. Alan V.Oppenheim, Ronald W. Schafer, "Discrete Time Signal Processing", Second Edition, Pearson Education,1998.

LIST OF EXPERIMENTS **30hrs**

USING TMS320C5X

1. Study of various addressing modes of DSP using simple programming examples
2. Sampling of input signal and display
3. Implementation of FIR filter
4. Calculation of FFT

USING MATLAB

1. Generation of Signals
2. Linear and circular convolution of two sequences
3. Sampling and effect of aliasing
4. Design of FIR filters
5. Design of IIR filters
6. Calculation of FFT of a signal

ANALOG COMMUNICATION

Sub Code: EC533 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0E** **xam Hours: 03Credits: 3**

COURSE OBJECTIVE:
To study the various analog communication fundamentals e.g., Amplitude modulation and demodulation, Angle modulation and demodulation, noise performance of various receivers and information theory with source coding theorem.

SYLLABUS:

UNIT I RANDOM PROCESS **9hrs**
Introduction, Mathematical definition of a Random Process, Stationary Processes, Mean, Correlation and Covariance Functions, Ergodic Processes, Transmission of a Random Process through a Linear Time Invariant filter, Power Spectral Density, Gaussian Process.

UNIT II AMPLITUDE MODULATION **9hrs**
Generation and demodulation of conventional AM, DSB-SC-AM, SSB-SC-AM, VSB Signals, Filtering of sidebands, Comparison of various Amplitude modulation systems, Frequency translation, Frequency Division Multiplexing, AM transmitters – Super heterodyne receiver and AM receiver.

UNIT III ANGLE MODULATION **9hrs**
Angle modulation, frequency modulation, Narrowband and wideband FM, transmission bandwidth of FM signals, Generation of FM signal – Direct FM – indirect FM, Demodulation of FM signals, FM stereo multiplexing, PLL – Non-linear model and linear model of PLL, Non-linear effects in FM systems, FM Broadcast receivers, FM stereo receivers.

UNIT IV NOISE **9hrs** Noise –
Shot noise, thermal noise, White noise, Noise equivalent Bandwidth, Narrowband noise, Representation of Narrowband noise in terms of envelope and phase components, Sine wave plus Narrowband Noise, Receiver model.

UNIT V NOISE PERFORMANCE OF AM AND FM RECEIVERS **9hrs**
Noise in AM (conventional AM, DSB-SC-AM, SSB-SC-AM) receivers, threshold effect, Noise in FM receivers capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and de-emphasis in FM, Comparison of performance of AM and FM systems.

COURSE LEARNING OUTCOME:

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

- Explain the basic concepts of analog modulation schemes.
- Discriminate analog modulated waveforms in time /frequency domain and also find modulation index
- Compare and contrast the different analog system based on energy and bandwidth requirement
- Analyze energy and power spectral density of the signal
- Describe different types of noise and predict its effect on various analog communication systems
- Develop understanding about performance of analog communication systems

TEXT BOOK
1. Simon Haykin,"Communication Systems", John Wiley & sons, NY, 4th Edition, 2006.

REFERENCES

1. J.G. Proakis, "Communication Systems", 5th edition ,Tata McGraw Hills,2008.
2. Roddy and Coolen, Electronic communication, PHI, New Delhi, 4th Edition, 2003.
3. Taub and Schilling, Principles of communication systems, 3rd edition TMH, New Delhi, 2007.
4. Bruce Carlson et al, Communication systems, McGraw-Hill Int., 5th Edition, 2009.

MICROCONTROLLERS &REAL TIME EMBEDDED SYSTEMS

Sub Code: EC534 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 1** **Exam Hours: 03Credits: 4**

COURSE OBJECTIVE:
To learn the architecture programming and interfacing of Microcontroller and INTELCore DesktopMicroprocessors.

SYLLABUS:

UNIT I 8051 ARCHITECTURE **9 + 3**
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.

UNIT II 8051 PROGRAMMING **9 + 3**
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.

UNIT III SYSTEM DESIGN USING 8051 **9 + 3**
Interfacing LCD Display – Matrix Keypad Interfacing – ADC Interfacing –DAC Interfacing –Sensor Interfacing –Interfacing with 8255 Controlling AC appliances – Stepper Motor Control – DC Motor Interfacing.

UNIT IV HIGH PERFORMANCE RISC ARCHITECTURE: ARM **9 + 3**
The ARM architecture– Bus Architecture-ARM organization and implementation – Addressing Modes-The ARM instruction set - The thumb instruction set– ARM assembly language program-ARM Interfacing.

UNIT V EMBEDDED SYSTEM AND RTOS **9 + 3**

Overview of 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.

COURSE LEARNING OUTCOME:

At the end of the course, the students will be able to:
- Summarize the architectural features of 8051 microcontroller.
- Apply the knowledge of ALP, Embedded C to solve an embedded software concepts.
- Examine and demonstrate the working of I/O devices.
- Relate the advance features of ARM processors for efficient embedded system.
- Interpret unique architectural features of advance processors.

TEXT BOOKS/ REFERENCE BOOKS

1. Gibson, "Microprocessor and Interfacing" Tata McGraw Hill,II edition.
2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' 8051 Microcontroller and Embedded Systems using Assembly and C ' ,2nd edition,Prentice Hall of India,2008
3. Myke Predko, "Programming and customizing the 8051 microcontroller", Tata McGraw Hill 2001.

4. Steve Furber , '' ARM System On –Chip architecture "Addision Wesley , 2nd edition,2000.
5. Raj Kamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003

LIST OF EXPERIMENTS **30hrs**

1. Programs for 8/16 bit Arithmetic operations (Using Processors).
2. Programs for Sorting and Searching (Using Processors).
3. Programs for String manipulation operations (Using Processors).
4. Programs for Digital clock and Stop watch (Using Processors).
5. Interfacing ADC and DAC.
6. Parallel Communication between two MP Kits using 8255.
7. Serial Communication between two MP Kits using 8251.
8. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051microcontroller.
9. Programming and verifying Timer and UART operations of 8051 microcontroller.
10. Programming and verifying Interrupt operations of 8051 microcontroller.
11. Communication between 8051 Microcontroller kit and PC.
12. Interfacing and Programming of Stepper Motor and DC Motor Speed control using 8051.

TRANSMISSION LINES AND WAVEGUIDES

Sub Code: EC535 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 1: 0** **Exam Hours: 03Credits: 4**

COURSE OBJECTIVE:
To become familiar with propagation of signals through lines, understand signal propagation at radio frequencies; understand radio propagation in guided systems and to become familiar with resonators

SYLLABUS:

UNIT I TRANSMISSION LINE THEORY **9 + 3hrs**
Different types of transmission lines – Definition of Characteristic impedance – The transmission line as a cascade of T-Sections - Definition of Propagation Constant. General Solution of the transmission line – The two standard forms for voltage and current of a line terminated by an impedance – physical significance of the equation and the infinite line – The two standard forms for the input impedance of a transmission line terminated by an impedance – meaning of reflection coefficient – wavelength and velocity of propagation. Waveform distortion – distortion less transmission line – The telephone cable – Inductance loading of telephone cables. Input impedance of lossless lines – reflection on a line not terminated by Zo - Transfer impedance – reflection factor and reflection loss – T and ∏ Section equivalent to lines**.**

UNIT II THE LINE AT RADIO FREQUENCIES **9 + 3hrs**
Standing waves and standing wave ratio on a line – One eighth wave line – The quarter wave line and impedance matching – the half wave line. The circle diagram for the dissipationless line – The Smith Chart – Application of the Smith Chart – Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and viceversa – Input impedance of a lossless line terminated by an impedance – single stub matching and double stub matching.

UNIT III GUIDED WAVES **9+3hrs** Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation – component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.

UNIT IV RECTANGULAR WAVEGUIDES **9 + 3hrs**
Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes in rectangular waveguides – Wave impedances – characteristic impedance – Excitation of modes.

UNIT V CIRCULAR WAVE GUIDES AND RESONATORS **9 + 3hrs**
Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristic impedance – Dominant mode in circular waveguide – excitation of modes – Microwave cavities, Rectangular cavity resonators, circular cavity resonator, semicircular cavity resonator, Q factor of a cavity resonator for TE101 mode.

COURSE LEARNING OUTCOME:

At the end of this course, students would be able to

- Compute the Guided Wave solutions -TE,TM, and TEM
- Analyze and design waveguides and understand the propagation of electromagnetic waves.
- Discuss the concepts of Resonators and the associated modal field.

- Analyze the transmission lines and their parameters using the Smith Chart.

TEXT BOOKS

1. J.D.Ryder ―Networks, Lines and Fields‖,3rd edition, PHI, New Delhi, 2003. (Unit I & II)
2. E.C. Jordan and K.G.Balmain ―Electro Magnetic Waves and Radiating System, PHI, New Delhi, 2003. (Unit III, IV & V)

REFERENCES

1. Ramo, Whineery and Van Duzer: Fields and Waves in Communication Electronics‖ John Wiley, 2003.
2. David M.Pozar: Microwave Engineering – 4th Edition – John Wiley.
3. David K.Cheng,Field and Waves in Electromagnetism,2nd Edition , Pearson Education, 1989.

SEMESTER VI SYLLABUS

VLSI DESIGN

Sub Code: EC631 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 1** **Exam Hours: 03Credits: 4**

COURSE OBJECTIVE
To introduce the technology, design concepts of Very Large Scale Integrated Circuits.

SYLLABUS

UNIT I: MOS TRANSISTORS **9hrs**
Fundamentals of Enhancement Mode MOSFETs, Depletion Mode MOSFETs, CMOS transistor Theory, Long Channel I-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics.

UNIT II : CMOS PROCESSING TECHNOLOGY: **9hrs**
Overview of IC industry, CMOS Technologies (Nwell, Pwell, Twin-Tub, SOI, BiCMOS), Layout Design Rules, Stick Diagrams, Euler's Rule for Physical Design.

UNIT III: CMOS CHIP DESIGN: **9hrs**
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.

UNIT IV: VLSI CIRCUIT DESIGN: **9hrs**
Precharge-Evaluate logic, Static and Dynamic CMOS logic circuits, Combinational Circuit Design, Sequential Circuit Design, Circuit Design of Latches and Flip-Flops.

UNIT V: VERILOG HDL: **9hrs**
Basic Concepts: VLSI Design flow, identifiers, gate primitives, value set, ports, gate delays, structural gate level and switch level modeling, Design hierarchies, Behavioral and RTL modeling: Operators, timing controls, Procedural assignments conditional statements, Data flow modeling and RTL. Structural gate level description of combinational and sequential circuits.

COURSE LEARNING OUTCOME:

After completing students would be able to
- Comprehend the basics of CMOS circuits.
- Describe CMOS process technology.
- Identify the techniques of chip design using programmable devices
- Strategy for designing the CMOS circuits
- Design VLSI subsystems and modeling a digital system using Hardware Description Language.

TEXT BOOKS:

1. CMOS VLSI Design : A Circuits and Systems Perspective (English) 4th Edition Ayan Banerjee , Neil H. E. Weste , David Harris,2010.
2. Weste-Eshraghian - Principles of CMOS VLSI Design,2nd Edition,1994.
3. Verilog HDL: Samir Palnitkar,2 edition,Pearson Education,2003.

4. M.J.S.Smith : Application Specific integrated circuits, Pearson Education, 1997.

REFERENCE:

1. Puchnell DA & Eshraghian K, Basic VLSI Design , PHI
2. John P. Uyemura , Introduction to VLSr circuits and systems, John Wiley.
3. Peter.J.Ashenden, Digital Design : An Embedded Systems Approach Using Verilog, Elesvier 2010

LIST OF EXPERIMENTS **30hrs**

1) Design Entry and Simulation of Combinational Logic circuits
   a) Basic logic gates
   b) Half adder and full adder
   c) Half Sub tractor and full sub tractor
   d) 8 bit adder
   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) Deisgn entry and simulation of parallel and serieal adder using FSM Techniques.
4) Synthesis, P&R and Post P&R simulation for all the blocks/codes developed in Expt.No. 1 and No. 2
5) Design Entry and Simulation of traffic signal controller using Xilinx ISE Design suite and implementing the same on Spartan FPGA.
6) Schematic and Layout of a simple CMOS inverter, parasitic extraction and simulation.
7) Design and simulation of pipelined serial and parallel adder to add/ subract 8 number of size, 12 bits each in 2's complement
8) Design and Implement a 4 digit seven segment display.

INFORMATION THEORY AND CODING

Sub Code:EC632 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 1:** **0Exam Hours: 03Credits: 4**

COURSE OBJECTIVE:
The course aims at providing students a foundation in information theory – the theory that provides quantitative measures of information and allows us to analyze and characterize the fundamental limits of communication systems.

SYLLABUS:

UNITI INFORMATIONTHEORY **9+3hrs**
Information–Entropy, Informationrate, classificationofcodes, KraftMcMillanInequality, Sourcecodingtheorem,Shannon-Fanocoding, Huffmancoding, ExtendedHuffman coding-Jointandconditionalentropies,Mutualinformation- Discretememoryless channels–BSC,BEC – Channel capacity,Shannonlimit.

UNITII SOURCECODING:TEXT,AUDIOANDSPEECH **9+3hrs**
Text: AdaptiveHuffmanCoding,ArithmeticCoding, LZWalgorithm –Audio:Perceptual coding,Maskingtechniques,Psychoacousticmodel,MEGAudiolayersI,II,III,DolbyAC3Speech:ChannelVocoder, Linear PredictiveCoding

UNITIII SOURCECODING: IMAGEAND VIDEO **9+3hrs**
ImageandVideoFormats–GIF,TIFF,SIF,CIF,QCIF–Imagecompression:READ,JPEG–VideoCompression:Principles-I,B,Pframes,Motionestimation,Motion compensation,H.261,MPEGstandard

UNITIV ERROR CONTROLCODING:BLOCKCODES **9+3hrs**
DefinitionsandPrinciples:Hammingweight,Hammingdistance,Minimum distance decoding-Singleparitycodes,Hammingcodes,Repetitioncodes- Linearblockcodes, Cycliccodes-Syndromecalculation,Encoderanddecoder - CRC

UNITV ERROR CONTROLCODING:CONVOLUTIONALCODES **9+3hrs**
Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential searchandViterbi algorithm–PrincipleofTurbocoding

COURSE LEARNING OUTCOME:

After completion of the course students would be able to :

- Identify, list and describe terms related to information measurement.
- Compute and develop efficient codes using encoding schemes to improve efficiency of information communication.
- Analyze and develop solutions to problems associated with information handling. Interpret and justify the solutions adopted for a specific information handling problem.
- Differentiate among Lossy and lossless compression schemes, differentiate among block codes and convolutional codes and effectively utilize them to address the challenges associated with information technology.

TEXTBOOK

1. R Bose,"InformationTheory,CodingandCrptography",TMH 2008.
2. FredHalsall,"MultidediaCommunications:Applications,Networks,ProtocolsandStandards",PerasonEducationAsia,2002.

REFERENCES

1. K Sayood, "Introduction to Data Compression" 4/e, Elsevier 2008.
2. S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007.
3. Amitabha Bhattacharya, "Digital Communication", TMH 2006.

ANTENNAS AND WAVE PROPAGATION

Sub Code: EC633 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 1: 0** **Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE:
The objective of this Course is to introduce the students with the antenna fundamentals, design aspects, arrays, special antennas, different propagation mechanism, measurement and their practical applications.

SYLLABUS:

UNIT I ANTENNA BASICS & WIRE ANTENNAS 9 + 3
Basics of antenna- Parameters (Definition): Radiation intensity, Directivity, Power gain, Beam Width, Band Width, polarization, Input impedance, Efficeincy, Effective length and Effective area, Antenna Temperature. Reciprocity principle,Friss Transmission equation, Radiation mechanism, Current distribution on thin wire antenna, Retarded vector potential, Fields associated with oscillating dipole. Power radiated and radiation resistance of current element, Radiation resistance of half-wave dipole and quarter-wave monopole, Loop Antennas- Radiation from small loop and its radiation resistance.

UNIT II ANTENNA ARRAYS 9 + 3
Introduction - Array of point sources: Expression for electric field for two point sources of equal amplitude and phase ,equal amplitude and opposite phase and unequal amplitude and any phase, Linear array of N isotropic point sources. Broad side array, End fire array, Method of pattern multiplication. Non-uniform Distribution - Binomial array,Dolph -Tchebyshev array, Planar and Circular Arrays.

UNIT III SPECIAL ANTENNAS 9 + 3
Travelling Wave Antennas- Radiation from a traveling wave on a wire, Rhombic Antennas-Design and Analysis of Rhombic antenna, Yagi Uda Antennas -Three element Yagi antennas. Log periodic antenna – Types and Design of LPDA, Helical antenna-Design, Normal mode and axial mode operation, Horn Antenna - Field on the axis of an E-Plane and H-Plane sectoral Horn, Radiation from an elemental area of a plane wave (Huygens's Source),Lens Antenna- Dielectric lens and metal plane lens antennas, Dish antennas- Reflector type of antennas.

UNIT IV WAVE PROPAGATION. 9 + 3
Ground wave propagation: Attenuation characteristics for ground wave propagation, Calculation of field strength at a distance. Space wave propagation: Reflection from ground for vertically and horizontally polarized waves, Reflection characteristics of earth, Resultant of direct and reflected ray at the receiver, Duct propagation. Sky wave propagation: Structure of the ionosphere. Effective dielectric constant of ionized region, Mechanism of refraction, Refractive index, Critical frequency, Skip distance, Energy loss in the ionosphere due to collisions, Maximum usable frequency, Fading and Diversity reception.

UNIT V ANTENNA MEASUREMENTS & APPLICATIONS 9 + 3
Antenna Measurements: Introduction, Measurement Ranges, Absorbing materials, anechoic chamber, Compact antenna test ranges, Pattern Measurement Arrangement, Impedance Measurement, Phase & Gain measurements, VSWR measurements. Application of Antennas (Overview): Antennas for Mobile communication, Satellite Communication (LEO,MEO,GEO Satellite Antennas , Cubesats), Antennas for Biomedical, Mammography and Microwave Imaging applications, Implantable antennas.

COURSE LEARNING OUTCOME:
On completion of this course the students will be able to
- Explain the fundamentals and radiation principles of various antenna.
- Analyze the various antenna arrays.
- Design the special antennas for suitable applications.
- Discuss the various types of wave propagations.

- Measure the antenna parameters.
- Paraphrase the selection of antennas for appropriate applications.

TEXTBOOK

1. John D.Kraus and RonalatoryMarhefka, "Antennas", 2nd edition,Tata McGraw-Hill Book Company, 2003.(Unit I.II.III.IV)
2. Balanis, "Antenna Theory", John Wiley & Sons, 4th edition, 2016. (Unit III,V)

REFERENCES

1. R.E.Collins, 'Antennas and Radio Propagation ",2nd edition, McGraw-Hill, 2003.
2. K.D.Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech Publications, 3rd Edition, 2001.
3. E.C.Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2003.

COMPUTER NETWORKS

Sub Code: EC634 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To introduce the concepts, terminologies, and technologies used in modern data communication and computer networking.

SYLLABUS:

UNIT I DATA COMMUNICATIONS 9hrs
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.

UNIT II DATA LINK LAYER 9hrs
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.

UNIT III NETWORK LAYER 9hrs
Internetworks - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV TRANSPORT LAYER 9hrs
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services

UNIT V WIRELESS LAN – MAC & NETWORK LAYER 9hrs
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

COURSE LEARNING OUTCOME:

After completion students would be able to :

- Explain the OSI reference model and TCP/IP model for a data communication system.
- Describe the data link layer services including error control and flow control techniques and distinguish between the data link layers of IEEE 802.3 and IEEE 802.4.
- Use IP addressing and apply routing algorithms for finding the path for network layer packet delivery for a given topology.
- Describe the essential principles of transport layer including reliable data transfer, congestion control and quality of service.
- Interpret the MAC layer functions of Wireless LAN from IEEE 802.11 draft standard.

TEXT BOOKS

1. Behrouz A. Foruzan, “Data communication and Networking”,5th edition , Tata McGraw-Hill, 2012.

REFERENCES

1. James .F. Kurouse & W. Rouse, “Computer Networking: A Topdown Approach Featuring”, 7th edition,Pearson Education,2016.
2. Larry L.Peterson & Peter S. Davie, “COMPUTER NETWORKS”, Harcourt Asia Pvt. Ltd., 5th Edition,2011.

3. Andrew S. Tannenbaum, "Computer Networks", PHI, 5th Edition, 2016.
4. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2013.
5. Azzedine Boukerche "Algorithms and Protocols for Wireless, Mobile AdHoc Networks", Wiley-IEEE Press, 2008.

DIGITAL COMMUNICATION

Sub Code: EC635 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **2: 1:1** **Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE:
To introduce the basic concepts of Digital Communication modulation to baseband, passband modulation and to give an exposure to error control coding and finally to discuss about the spread spectrum modulation schemes.

SYLLABUS:

UNIT I PULSE MODULATION 6+6hrs
Sampling process –PAM- other forms of pulse modulation –Bandwidth –Noise trade off – Quantization –PCM- Noise considerations in PCM Systems, Limitation and modification of PCM-Delta modulation –Linear prediction –differential pulse code modulation – Adaptive Delta Modulation, Time Division Multiplexing.

UNIT- II BASEBAND PULSE TRANSMISSION 6+6hrs
Matched Filter- Error Rate due to noise –Inter-symbol Interference- Nyquist criterion for Distortion-less Baseband Binary Transmission- Correlative level coding –Baseband M-ary PAM transmission – Adaptive Equalization –Eye patterns.

UNIT - III SIGNAL SPACE ANALYSIS 6+6hrs
Introduction, Geometric Representation of Signals, Continuous AWGN channel as a Vector Channel, Likelihood functions, Coherent detection of signals in noise, Correlation receiver, Probability of error.

UNIT- IV PASSBAND DATA TRANSMISSION 6+6hrs
Introduction – Pass band Transmission model- Generation, Detection, Signal space diagram, bit error probability and Power spectra of BPSK, QPSK, FSK and MSK schemes –Differential phase shift keying – Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.

UNIT V SPREAD SPECTRUM MODULATION 6+6hrs
Pseudo- noise sequences –a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain –Probability of error – Frequency –hop spread spectrum –Maximum length and Gold codes.-Introduction to OFDM.

COURSE LEARNING OUTCOME:
After completion students would be able to:

- Understand the types of pulse modulation techniques and Conversion of analog signal to digital format.
- Illustrate the geometric representation of signals and perform signal space analysis.
- Familiarize error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.
- Compare and contrast the passband data transmission in terms of error probability and power spectra.
- Learn baseband pulse transmission, which deals with the transmission of pulse-amplitude, modulated signals in their baseband form.
- Understand the fundamental concept of spread spectrum modulation

TEXT BOOKS

1. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, 2010.

REFERENCES

1. Sam K.Shanmugam "Analog & Digital Communication" John Wiley.
2. John G.Proakis, "Digital Communication" McGraw Hill ,5th Edition, 2007.
3. Taub & Schilling , "Principles of Digital Communication " Tata McGraw-Hill" 28th reprint, 2003.
4. Bernard Sklar, Pabitra Kumar Ray,"Digital Communications: Fundamentals and Applications" Pearson Education, Second Edition, 2012.
5. www.gnuradio.org

LIST OF EXPERIMENTS **30hrs**

Analog Communication Lab:

1. Characteristics of AM receiver (Selectivity & Sensitivity)Amplitude modulation (Matlab)
2. Characteristics of FM receiver (Selectivity & Sensitivity)Frequency modulation (Matlab)
3. Sampling & time division multiplexing
4. Pulse modulation- PAM / PWM /PPM
5. Pulse code modulation
6. Line coding & Decoding
7. Delta modulation / Differential pulse code modulation
8. Digital modulation –ASK, PSK, QPSK, FSK
9. Noise analysis on Matlab
10. AM in presence of noise (Matlab)
11. AM demodulation in presence of noise (Matlab)
12. FM in presence of noise (Matlab)
13. FM demodulation in presence of noise (Matlab)
14. Analog QAM/QCM using Matlab

Digital Communication Laboratory using LabVIEW and USRP:

1. Modulation and detection
2. Matched filtering and pulse shaping
3. BER performance of BPSK, QPSK, FSK and MSK in AWGN channel.
4. Channel estimation and equalization.
5. Error control coding: Linear Block Codes, Cyclic Codes.

1. SEMESTER VII SYLLABUS

WIRELESS COMMUNICATION

Sub Code: EC731L: T: P Total Lecture Hrs: 45
Exam Marks: 100 3: 1: 0Exam Hours: 03 Credits: 4

COURSE OBJECTIVE:

The aim and objectives are to expose students the concepts of wireless / mobile communication, to make the them understand the various modulation techniques, propagation methods, coding and multiple access techniques used in the mobile communication and to touch upon various wireless network systems and standard.

SYLLABUS:

UNIT I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTAL 9+3hrs

Evolution of mobile communications, Mobile radio systems Around the world, Examples, Comparison of Common Wireless Communication Systems, Trends in cellular radio and personal communications.

Cellular Concept: Frequency reuse, channel assignment, Handoff Strategies, Co-channel & Adjacent Channel Interference, Trunking and grade of service, Improving Coverage and capacity in Cellular systems.

UNIT II MOBILE RADIO PROPAGATION 9+3hrs

Large-Scale Path Loss: Free space propagation model, Three Basic Propagation Mechanisms Reflection- Ground reflection (two-ray) model, Diffraction – knife-edge diffraction model, Scattering – Radar Cross Section Model; Outdoor Propagation models – Okumura & Hata Models; Indoor Propagation Models – partition loss model, log-distance path loss model, Small-Scale Multipath Propagation, Factors influencing Small-Scale fading, Doppler Shift, Types of Small-Scale Fading – frequency selective and small scale fading.

UNIT III MODULATION TECHNIQUES AND EQUALIZATION 9+3hrs

Modulation Techniques: Frequency Vs Amplitude Modulation, Overview of Digital Modulation, Pulse Shaping Techniques, Linear Modulation - QPSK, Non-linear Modulation –QFSK, MSK, GMSK, Combined Linear and Non-Linear Modulation – MPSK, MQAM, MFSK, OFDM, Spread Spectrum Modulation techniques – PN Sequences, DS-SS, FH-SS; Equalization: Fundamentals of Equalization, Survey of Equalization Techniques, Linear Equalization, Non-linear Equalization, Algorithms for Adaptive Equalization, Diversity Techniques, RAKE receiver.

UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES 9+3hrs

Coding: Vocoders, Linear Predictive Coders, Choosing Speech Codecs for Mobile Communication, GSM Codec, USDC Codec, Performance Evaluation of Speech Coders; Multiple Access Techniques: FDMA, TDMA, SSMA-FHMA & CDMA, SDMA, CSMA.

UNIT V WIRELESS SYSTEMS AND STANDARDS 9+3hrs

Modern Wireless Communication Systems: 2G, 2.5G, 3G Wireless Networks, WLL, WLAN Standards, Bluetooth and PAN, Comparison of 0G, 1G, 2G, 3G and 4G Wireless Networks;Wireless Systems and Standards: AMPS and ETACS, USDC (IS-54 and IS-136), GSM, CDMA (IS-95), DECT, PACS, Wireless Cable TV.

COURSE LEARNING OUTCOME:

At the end of the course, the students will be able to

- Describe the evolution and History of Wireless Technology.
- Learn to model radio signal propagation issues and analyse their impact on communication system performance.
- Understand how the various signal processing and coding techniques combat channel uncertainties.
- Understand the techniques of radio spectrum allocation in multi-user systems calculate their impact on networks capacity.
- Explain various wireless systems and standards and their basic operation cases.
- Describe the need for equalization and multiple access technique.

TEXT BOOKS

1. T.S.Rappaport, “Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2014.
2. Andreas F.Molisch,”Wireless Communications”, John Wiley India Pvt Ltd, 2011.
3. David Tse, P.Viswanath,”Fundamentals of Wireless Communications”, Cambridge University Press, 2005.

REFERENCE BOOKS

1. Andrea Goldsmith, ”Wireless Communications”, Cambridge University Press, 2005.
2. T.L. Singhal, “Wireless Communication”, Mc Graw Hill Pub., 2011.
3. V.K. Garg, "Wireless Communications and Networking", Morgan and Kaufmann Pub., 2009.

DIGITAL IMAGE PROCESSING

Sub Code: EC732 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

- Define and describe the fundamentals of digital image processing.
- Give an overview of the applications in image processing, and implement various algorithms on image processing.
- Provide the useful skill base that allows the students to pursue further studies in the area of image processing and its applications.

SYLLABUS:

UNIT I :DIGITAL IMAGE FUNDAMENTALS **9hrs**

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals -RGB,HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II: IMAGE TRANSFORMS AND IMAGE ENHANCEMENT **9hrs**

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet Transform. Enhancement: Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra-harmonic and Yp mean filters, Homomorphic filtering, Color image enhancement.

UNIT III: IMAGE RESTORATION: **9hrs**

Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering -removal of blur caused by uniform linear motion, - Wiener filter - Constrained Least squares restoration - Interactive restoration-Geometric transformations. Pseudo color image processing - intensity slicing, gray level to color transformation.

UNIT IV: IMAGE SEGMENTATION AND RECOGNITION: **9hrs**

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Back Propagation Neural Network, Neural Network applications in Image Processing.

UNIT V : IMAGE COMPRESSION: **9hrs**

Need for data compression, Huffman,. Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. JPEG, MPEG. Standards, Concepts of Context based Compression.

COURSE LEARNING OUTCOME:

On completion of this course:

- Various algorithms on image processing can be implemented.
- Application based on image compression and image enhancement can be implemented.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E.Woods, _Digital Image Processing‘, Pearson Education, Inc., Thirdd Edition, 2016.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Prentice Hall of India, 2002.
3. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2011
4. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, Digital Image Processing using MATLABORATORY‘, Pearson Education, Inc., 2004.
5. William K.Pratt, _ Digital Image Processing‘, John Wiley, NewYork, 2002.

6. Milman Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, III ed., 2013.
7. Sid Ahmed, M.A., _Image Processing Theory, Algorithms and Architectures', McGrawHill, 1994.

OPTICAL FIBER COMMUNICATIONS

Sub Code: EC73 **3L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 1: 0** **Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE

To introduce and explain the various optical fiber modes, configurations and various signal degradation factors associated with an optical fiber. To study about the various optical sources and detectors and identify their use in an optical communication system. Finally, explain and discuss in detail the concepts of digital transmission and their associated parameters on the system performance.

SYLLABUS:

UNIT I INTRODUCTION TO OPTICAL FIBERS 9+3hrs

Optical Spectrum, Spectral band designations used in optical fiber communication, Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Nature of light, , Basic Optical laws and Definitions: Refractive Index, Reflection Refraction, Total Internal Reflection, Polarization components of light, Polarization sensitive materials,

Optical Fiber Modes and Configurations: Fiber Types, Ray Optics Representation, Wave representation in a Dielectric Slab Waveguide, Mode theory for Circular Waveguides: Key Modal concepts, Cutoff Wavelength and V number, Single Mode Fibers: Mode Field Diameter, Propagation Modes in Single-Mode Fibers.

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS 9+3hrs

Attenuation: Attenuation Units, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Dispersion in Fibers: Overview of Dispersion Origins, Modal Delay, Factors Contributing to Dispersion, Material Dispersion, Waveguide Dispersion, Dispersion in Single-Mode Fibers, Polarization-Mode Dispersion,

SM fibers-RI profile and cut-off wavelength.

UNIT III FIBER OPTICAL SOURCES AND COUPLING 9+3hrs

Luminescence: Electroluminescence, Direct and indirect Band gap materials,

LED:LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, Lasers Diodes: Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diode Structures and Radiation Patterns, Temperature effects, Quantum Well laser,

Source to Fiber Power Launching: Source Output Pattern, Power Coupling Calculation

Lensing schemes for Coupling Improvement, Fiber splicing, Fiber Connector Types.

UNIT IV FIBER OPTICAL RECEIVERS 9+3hrs

PIN and APD diodes, Photo detector noise: Noise Sources, SNR and Noise-Equivalent Power and Detectivity, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation: Digital Signal Transmission, Error Sources, Front-End Amplifier, Digital Receiver Performance: Probability of Error, Receiver Sensitivity, Quantum Limit, Introduction to Eye Diagrams.

UNIT V DIGITAL TRANSMISSION SYSTEM 9+3hrs

Point-to-Point links: System considerations, Link Power budget, Rise-time budget, Power Penalties, Operational Principles of WDM, Introduction to passive optical devices: Coupler, Isolator, Circulator and Attenuator, Erbium-doped Amplifiers. Basic on concepts of SONET/SDH Network.

COURSE LEARNING OUTCOME:

On completion of this course, the student will be able to

- Explain the fundamentals of light wave propagation various modes in OFC cables.
- Analyze the limitations of various fiber cables for attenuation and dispersion.

- Design a link budget for a given OFC cable and path distance.
- Discuss the various types of transmitters and receivers used in OFC.
- Interpret the effect of noise on eye patterns.
- Estimate the requirement of optical hardware in a optical link.

TEXT BOOKS

1. Gerd Keiser, "Optical Fiber Communications" Tata McGraw-Hill Education Private Limited, New Delhi, 4th ed., 2010/5th ed. 2013

REFERENCE BOOKS

1. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.
2. Rajiv Ramaswami, Kumar Sivarajan, Galen Sasaki, "Optical Networks: A Practical Perspective", 3rd Edition, Morgan Kaufmann- Harcourt India, 2010.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001

MICROWAVE ENGINEERING

Sub Code: EC734 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **2: 1: 1** **Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE:
To explain the active and passive microwave devices and the associated components used in Microwave Communication Systems.

SYLLABUS:

UNIT-I: MICROWAVE COMPONENTS **6+6hrs**
Microwave Frequencies, Microwave Devices, Microwave Systems, Microwave Units of Measure.Microwave Hybrid Circuits - Waveguide Tees, Magic Tees (Hybrid Trees), Hybrid Rings (Rat-Race Circuits), Waveguide Corners, Bends and Twists
Z & ABCD Parameters- Introduction to S parameters-Directional Couplers, Two-Hole Directional Couplers, , S Matrix of a Directional Coupler, Hybrid Couplers, Circulators and Isolators, Microwave Circulators, Microwave Isolators. Matched and Short Termination

UNIT-II: SOLID STATE MICROWAVE DEVICES **6+6hrs**
BJT – Configurations, Principles of Operation, I-V Characteristics of a transistor, Power Frequency Limitations. JFET – Physical Structure, Principles of Operation, Pinch-off voltage, MESFET – Physical Structure, Principles of Operation, Pinch-off voltage
Introduction, Gunn-effect diodes – GaAs Diodes, RWH Theory, Modes of Operation, LSA Diodes - ATTD Introduction, READ Diode, IMPATT Diode, TRAPATT Diode, BARITT Diode-Introduction to parametric amplifiers - varacter diode, characteristics, advantages and applications

UNIT-III: MICROWAVE TUBES **6+6hrs**
Introduction, Re-entrant Cavities-Two Cavity Klystron–Structure, Mechanism of Oscillation, velocity modulation, transit time in drift space, density modulation, Power output, efficiency, beam loading. Reflex Klystron –Structure, Mechanism of Oscillation, Modes of Oscillation, Power o/p and efficiency, Transit time, Density Modulation and Beam Current, Mode curves TWT—Slow Wave Structure, Structure, operation, Analysis of TWTA, comparison b/w TWTA and Klystron, applications Magnetron Oscillators-Introduction, Cylindrical Magnetron- equations of electron trajectory, cyclotron angular frequency, power output and efficiency, applications, Linear Magnetron-Hull cutoff voltage and Magnetic flux density, Hartree condition, Co-axial Magnetron-structure and operation, Voltage tunable magnetron- structure and operation Applications of Microwave Tubes

UNIT IV: ANALYSIS OF MICROSTRIP LINE COMPONENTS **6+6hrs**
Review of transmission line theory - transmission lines- Coaxial line- Stripline - Microstrip Line-Effective permittivity-Field distribution in transmission lines Even mode and Odd Mode analysis-T-Junction power divider-Wilkinson Power Divider, branchline coupler

UNIT-V: MICROWAVE MEASUREMENTS **6+6hrs**
Introduction, Slotted Line Carriage, VSWR Meter, Power Measurements-Schottky Barrier Diode Sensor, Bolometer sensor, Power Meter, Thermocouple Sensor, High Power Measurements by the Calorimetric Method, Static Calorimeters, Circulating Calorimeters, Insertion loss and Attenuation Measurements, VSWR Measurements-Low VSWR, High VSWR, Return loss measurement by a reflectometer, Impedance Measurement- Slotted Line Method, Impedance measurement by Reactive Discontinuity, Impedance measurement by reflectometer - Network Analyzers, Vector and Scalar-Spectrum Analyzer

COURSE LEARNING OUTCOME:
On completion of this course, students will be able to
- Explain the operation of various passive microwave Components.
- Extrapolate the operation and function of various solid state Microwave devices.
- Illustrate the performance and Operation of various Microwave tubes.

- Analyze the Microstrip Line Components.
- Measure the different parameters associated with Microwave Communication Systems.

TEXT BOOKS

1. Samuel Y.LIAO : Microwave Devices and Circuits – Prentice Hall of India – 3rd Edition (2003)
2. Annapurna Das and Sisir K.Das: Microwave Engineering – Tata McGraw-Hill (2014) (UNIT V)

REFERENCE BOOKS

1. R.E. Collin : Foundations for Microwave Engg. – IEEE Press Second Edition (2002)
2. David M.POZAR : Microwave Engg. – John Wiley & Sons – 4nd Edition (2011)
3. P.A.RIZZI – Microwave Engg. (Passive ckts) – PH1

LIST OF EXPERIMENTS **30hrs**

1. VSWR Measurements – Determination of terminated impedance
2. Determination of guide wavelength, frequency measurement.
3. Radiation Pattern of Horns, Paraboloids.
4. Microwave Power Measurement.
5. Characteristics of Gunn diode Oscillator.
6. Radiation pattern measurement of antenna
7. Characterization of waveguide junctions- Power measurement
8. S-parameter measurement- Scalar network Analyzer - Masurement of amplitude
9. Measurement of Loses in waveguide components
10. Charcterization of Klystron source Optical experiments

SERVICE LEARNING- PRECISION AGRICULTURE

Sub Code: EC737 **L: T: P** **Total Lecture Hrs: 25**
1: 0: 1 **Credits: 2**

UNIT – I **(Theory – 4; Field Work - 0)**

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

UNIT – II **(Theory – 6; Field Work - 5)**

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

Field work

UNIT – III **(Theory – 4; Field Work - 5)**

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.

UNIT – IV **(Theory – 4; Field Work - 0)**

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

UNIT – V **(Theory – 7; Field Work - 10)**

Precision Agriculture system Design: Wireless sensor networks for precision agriculture-Sensor motes: TelosB mote, MicaZ motes-prototype wireless sensor network for precision agriculture-design and deploy a wireless sensor network for precision agriculture-WSN for precision agriculture using WiFi and ZigBee-WSN for precision agriculture using custom protocol.

REFERENCE BOOKS

1. Terry A.Brase, “Precision Agriculture” Thomson/Delmar Learning, 2006
2. Qin Zhang, “ Precision Agriculture Technology for Crop Farming”, CRC Press, 2015
3. Jao, J.; Bo Sun; Kui Wu, "A Prototype Wireless Sensor Network for Precision Agriculture," in *Distributed Computing Systems Workshops (ICDCSW), 2013 IEEE 33rd International Conference on* , vol., no., pp.280-285, 8-11 July 2013
4. Tuan Dinh Le; Dat Ho Tan, "Design and deploy a wireless sensor network for precision agriculture," in *Information and Computer Science (NICS), 2015 2nd National Foundation for Science and Technology Development Conference on* , vol., no., pp.294-299, 16-18 Sept. 2015
5. Maribeth Price, “Mastering ArcGIS”, 6th Edition, McGraw Hill Co., 2103

SEMESTER VIII SYLLABUS

CYBER SECURITY

Sub Code: BTCY01 Credits: MC (Mandatory Course)

COURSE OBJECTIVE:
This 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.

SYLLABUS:
UNIT I:
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.

UNIT II:
Cyber Attack and Cyber Services Computer Virus – Computer Worms – Trojan horse.Vulnerabilities - Phishing - Online Attacks – Pharming - Phoarging – Cyber Attacks - Cyber Threats - Zombie-stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood.

UNIT III:
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.

UNIT-IV:
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.

UNIT V:
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

COURSE LEARNING OUTCOME:
Providing knowledge about different Cyber Crimes, Threats and Laws .Creating awareness about risk management and protection from the cyber threats.

REFERENCE BOOKS

1. Matt Bishop, Introduction to Computer Security, Pearson, 6th impression, ISBN: 978-81-7758-425-7.
2. Thomas R, Justin Peltier, John, Information Security Fundamentals, Auerbach Publications.
3. AtulKahate, Cryptography and Network Security 2nd Edition, Tata McGrawHill.2003
4. Nina Godbole, SunitBelapure, Cyber Security, Wiley India 1st Edition 2011.
5. Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, Cyber Security Policy Guidebook, Wiley; 1 edition , 2012, ISBN-10: 1118027809
6. Dan Shoemaker and Wm. Arthur Conklin, Cybersecurity: The Essential Body Of Knowledge, Delmar Cengage Learning; 1 edition (May 17, 2011) ,ISBN-10: 1435481690

7. Stallings, “Cryptography & Network Security - Principles & Practice”, Prentice Hall, 6th Edition 2014.

WIRELESS SENSOR NETWORKS AND IoT

Sub Code: EC831 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 1: 0** **Exam Hours: 03 Credits: 4**

COURSE OBJECTIVE:
To explain and outline the fundamentals of wireless sensor networks, network architectures, different wireless protocols. To demonstrate the various simulation tools.

SYLLABUS:

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS **9+3hrs**

Challenges for Wireless Sensor Networks, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Introduction to Wisense Sensor network platform.

UNIT II PHYSICAL LAYER ARCHITECTURES **9+3hrs**

Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts, Physical Layer and Transceiver Design Considerations.

UNIT III NETWORKING SENSORS **9+3hrs**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Experiments using Wisense Platform (3 hours).

UNIT IV INTRODUCTION TO IOT **9+3hrs**

Definition of IoT. Applications and Verticals. System Architecture. Typical Process Flows. Technological Enablers. The Open Standard Reference Model. IoT Software Stack. Design Constraints and Considerations. Sensors and Actuators. IoT Security. Analytics for IoT. Experiments using Wisense Platform (3 hours).

UNIT V IOT EMBEDDED PROGRAMMING USING MSP430 **9+3hrs**

Introduction to Microcontrollers. The MSP430 Family. Memory Architecture. Clock and Timer Architecture. Working with Interrupts. Low-power Modes. Best Practices for IoT Device Programming. Introduction to Contiki and TinyOS. Interfacing Sensors. Triggering Actuators. Debugging on Target. UART Interfacing, Experiments using Wisense Platform

COURSE LEARNING OUTCOME:
On completion of this course,
- Different network algorithms and protocols can be analyzed.
- Sensor nodes can be implemented, programmed and simulated.

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

REFERENCE BOOKS:

1.Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. WiSense Documentation. http://wisense.in/api/html/
4.Texas Instruments, "MSP430G2955 Datasheet", March 2013. http://www.ti.com/lit/gpn/msp430g2955
5.Keith Quiring, "MSP430 Software Coding Techniques", August 2006. http://www.ti.com/lit/pdf/slaa294
6.Texas Instruments, "MSP430x2xx Family User's Guide, Revision J", July 2013. http://www.ti.com/lit/pdf/slau144
7. WiSense quick reference on sensors. http://wisense.in/docs/WiSenseSensors.pdf

ELECTIVE-III: SIGNAL PROCESSING AND PROGRAMMING SKILLS SYLLABUS

BIOMEDICAL SIGNAL PROCESSING

Sub Code: EC735E1 **L: T: P** **Total Lecture Hrs: 45**

Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing. Understand how to apply specific mathematical techniques to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum using Fourier Series and calculation of Heart Rate Variability using Fourier Transforms).

SYLLABUS

UNIT I: INTRODUCTION TO BIOMEDICAL SIGNALS **9hrs**

Examples of Biomedical signals - ECG, EEG, EMG etc - Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random & Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments

UNIT II: CONCURRENT, COUPLED AND CORRELATED PROCESSES **9hrs**

Illustration with case studies – Adaptive and optimal filtering - Modeling of Biomedical signals - Detection of biomedical signals in noise -removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Muscle- contraction interference. Event detection - case studies with ECG & EEG - Independent component Analysis - Cocktail party problem applied to EEG signals - Classification of biomedical signals.

UNIT III:CARDIO VASCULAR APPLICATIONS **9hrs**

Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multiscale analysis for ECG parameters estimation - Noise & Artifacts- ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection - Arrhythmia analysis Data

UNIT IV: COMPRESSION **9hrs**

Lossless & Lossy- Heart Rate Variability – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals.

UNIT V: NEUROLOGICAL APPLICATIONS **9hrs**

The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models – Non linear modeling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels.

COURSE LEARNING OUTCOME:
On completion of this course the student can

- Analyze and extend the mathematical and physical foundations of biomedical engineering and how these are reproduced in the design of biomedical instruments, the analysis of biological systems, and the technological advancement

TEXT BOOKS

1. D.C.Reddy ,"Biomedical Signal Processing: Principles and techniques" ,Tata McGraw Hill,New Delhi, 2005
2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall, 1998

REFERENCES BOOKS

1. R. Rangayan, "Biomedical Signal Analysis", Wiley 2002.
2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2007
3. Sörnmo, "Bioelectrical Signal Processing in Cardiac & Neurological Applications", Elsevier (2005)
4. Semmlow, "Bio-signal and Biomedical Image Processing", Marcel Dekker,2014
5. Enderle, "Introduction to Biomedical Engineering," 2/e, Elsevier, 2005

ADVANCED DIGITAL SIGNAL PROCESSING

Sub Code: EC735E2 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

To introduce the student to advanced digital signal processing techniques and introduction to wavelet transforms

SYLLABUS

UNIT I: PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION 9hrs

Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

UNIT II :ADAPTIVE SIGNAL PROCESSING 9hrs

FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

UNIT III :MULTIRATE SIGNAL PROCESSING 9hrs

Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT IV :SPEECH SIGNAL PROCESSING 9hrs

Digital models for speech signal : Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

UNIT V WAVELET TRANSFORMS 9hrs

Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition – Haar Wavelet – Daubechies Wavelet.

COURSE LEARNING OUTCOME:

On completion students will have the knowledge of

- To classify the parametric methods for power spectrum estimation.
- To explain adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- To Illustrate multirate signal processing fundamentals.

[Review of discrete-time signals and systems- DFT and FFT, Z-Transform, Digital Filters is recommended]

TEXTBOOKS

1. John G.Proakis, Dimitris G.Manobakis, Digital Signal Processing, Principles, Algorithms and Applications, Third edition, (2000) PHI.
2. Monson H.Hayes – Statistical Digital Signal Processing and Modeling, Wiley, 2008.

REFERENCES

1. L.R.Rabiner and R.W.Schaber, Digital Processing of Speech Signals, Pearson Education (2003).
2. Roberto Crist, Modern Digital Signal Processing, Thomson Brooks/Cole (2007)
3. Raghuveer. M. Rao, Ajit S.Bopardikar, Wavelet Transforms, Introduction to Theory and applications, Pearson Education, Asia, 2000.

STATISTICAL SIGNAL PROCESSING

Sub Code: EC735E3 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

- To introduce the basics of random signal processing
- Concept wise introduction to estimation and prediction theory
- To know about adaptive filtering and it's applications

SYLLABUS

UNIT I :REVIEW OF RANDOM VARIABLES **9hrs**

Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Schwarz Inequality Orthogonalit principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process, Linear System with random input, Spectral factorization theorem and its importance, innovation process and whitening filter, .Random signal modelling: MA(q), AR(p) , ARMA(p,q) models.

UNIT II:PARAMETER ESTIMATION THEORY **9hrs**

Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Cramer Rao bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties ; Baysean estimation : Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.

UNIT III:ESTIMATION OF SIGNAL IN PRESENCE OF WHITE GAUSSIAN NOISE **9hrs**

Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear Prediction of Signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.

UNIT IV: **ADAPTIVE FILTERING** **9hrs**

FIR adaptive filters – adaptive filter based on steepest descent method- Widrow-Hopf LMS algorithm,Normalized LMS algorithm, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation, RLS adaptive algorithm.

UNIT V: SPECTRAL ANALYSIS **9hrs**

Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Prametric method, AR(p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.

COURSE LEARNING OUTCOME:

On completion students will have

- Solid background on Statistical Signal Processing (estimation theory, detection theory and adaptive filtering) from the theoretical and applied perspectives.
- Ability to design optimal and suboptimal estimators
- Employ the knowledge to solve problems in which the unknown parameter (to estimate) evolves in time according to a dynamic or state model requiring the design of adaptive filters to track its value.

REFERENCES

1. M. Hays: Statistical Digital Signal Processing and Modelling, John Willey and Sons, 12 June 1996.
2. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan: Statistical Signal Processing with Applications, PHI, 1996.

3. Simon Haykin: Adaptive Filter Theory, Prentice Hall, Pearson; 5 edition (June 2, 2013)

4. D.G. Manolakis, V.K. Ingle and S.M. Kogon: Statistical and Adaptive Signal Processing, Artech House Publishers (1 May 2005)
S. M. Kay: Modern Spectral Estimation, Prentice Hall, 1987.

SPEECH PROCESSING

Sub Code: EC735E4 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression

SYLLABUS

UNIT I :NATURE OF SPEECH SIGNAL **9hrs**
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

UNIT II:TIME DOMAIN METHODS FOR SPEECH PROCESSING **9hrs**
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.

UNIT III FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING **9hrs**
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems.

UNIT IV:LINEAR PREDICTIVE CODING OF SPEECH **9hrs**
Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.

UNIT V:HOMOMORPHIC SPEECH ANALYSIS **9hrs**
Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Demonstrate models for speech production
- Explain methods to develop time and frequency domain techniques for estimating speech parameters
- Explain a predictive technique for speech compression
- Understand speech recognition, synthesis and speaker identification.

TEXTBOOK
1. L.R. Rabiner and R.E Schafer : Digital processing of speech signals, Prentice Hall, 1978.

REFERENCES
1. J.L Flanagan : Speech Analysis Synthesis and Perception - 2nd Edition - Sprenger Vertag, 1972.
2. I.H.Witten :Principles of Computer Speech , Academic press, 1983

INTERNET AND JAVA

Sub Code: EC735E5 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE
To learn the basics of Internetworking, Routing, World Wide Web and Java Programming.

DETAILED SYLLABUS

UNIT I INTERNETWORKING WITH TCP / IP: 9hrs
Review of network technologies, Internet addressing, Address resolution protocols (ARP / RARP), Routing IP datagrams, Reliable stream transport service (TCP) TCP / IP over ATM networks, Internet applications - E-mail, Telnet, FTP, NFS.

UNIT II INTERNET ROUTING: 9hrs
Concepts of graph theory, Routing protocols, Distance vector protocols (RIP), Link state protocol (OSPP), Path vector protocols (BGP and IDRP), Routing for high speed multimedia traffic, Multicasting, Resource reservation (RSVP), IP switching.

UNIT III WORLD WIDE WEB: 9hrs
HTTP protocol, Web browsers netscape, Internet explorer, Web site and Web page design, HTML, XML, Dynamic HTML. Internet Security: Security Attacks, Security Services- Firewall, End-To-End Encryption – Overview of Pubic key and Private key encryption-Security certificates.

UNIT IV JAVA PROGRAMMING: 9hrs
Language features- Java Virtual Machine, Basics of Object Orientation. Basic keywords and Syntax. Classes, Object and methods, Subclassing and dynamic binding. Overview of class library. Exception Handling.

UNIT V INTERNET AND JAVA: 9hrs
TCP/IP Socket abstraction –Java net package- TCP Socket class,Server socket, client socket-UDP Socket-connection and Encoding information-Text, Binary Numbers, Framing and Parsing. Multi tasking, Java threads, thread pool. Duplex communication using threads.

COURSE LEARNING OUTCOME

- Summarize the role of protocols in networking and to infer the services and features of the various layers in the protocol stack.
- Develop java application programs(API) as well as java Standard Library
- Use the advanced concepts of java such as servelets & jsp to demonstrate dynamic web pages & add functionality to the WebPages by using XML and HTML.
- Create client and server program using Java and design a good, effective and dynamic website.
- To select the elementary socket system calls, advanced socket system calls and Java Socket API and to point out the basic concepts relating to TCP and UDP based sockets.

REFERENCES

1. Dauglas E.Comer, "Internetworking with TCP/IP", Vol. I: Pearson; 6 edition (May 5, 2013)
2. Eric Ladd and Jim O'Donnell, "Using HTML 4, XML and Java 1.2", Que Platinum edition, Prentice Hall of India, 1999.
3. William Stallings, "High Speed Networks", Prentice Hall Inc., Friday, September 26, 2008
4. Herbert Schildt “Java, the complete reference”,McGraw Hill Education; 9 edition (25 June 2014)

5. Kenneth L Calvert, "KennetTCP/IP Sockets in Java", Morgan Kaufmann, 1 edition (November 2, 2001)

ELECTIVE-V: VLSI AND EMBEDDED SYSTEMSSYLLABUS

COMPUTER HARDWARE AND INTERFACING

Sub Code: EC832E1 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To enable the student to get a detailed knowledge of all the hardware components that make up a computer and to understand the different interfaces required for connecting these hardware devices.

SYLLABUS

UNIT I:CPU AND MEMORY **9hrs**
CPU essentials – processor modes – modern CPU concepts – Architectural performance features – the Intel's CPU – CPU over clocking – over clocking requirements – over clocking the system – over clocking the Intel processors – Essential memory concepts – memory organizations – memory packages – modules – logical memory organizations – memory considerations – memory types – memory techniques – selecting and installing memory.

UNIT II:MOTHERBOARDS **9hrs**
Active motherboards – sockets and slots – Intel D850GB – Pentium4 mother board – expansion slots – form factor – upgrading a mother board – chipsets – north bridge – south bridge – CMOS – CMOS optimization tactics – configuring the standard CMOS setup – motherboard BIOS – POST – BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues – power supplies and power management – concepts of switching regulation – potential power problems – power management.

UNIT III:STORAGE DEVICES **9hrs**
The floppy drive – magnetic storage – magnetic recording principles – data and disk organization – floppy drive – hard drive – data organization and hard drive – sector layout – IDE drive standard and features – Hard drive electronics – CD-ROM drive – construction – CDROM electronics – DVD-ROM – DVD media – DVD drive and decoder.

UNIT IV:I/O PERIPHERALS **9hrs**
Parallel port – signals and timing diagram – IEEE1284 modes – asynchronous communication - serial port signals – video adapters – graphic accelerators – 3D graphics accelerator issues – DirectX – mice – modems – keyboards – sound boards – audio bench marks.

UNIT V:BUS ARCHITECTURE **9hrs**
Buses – Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USB architecture.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Identify issues related to CPU and memory.
- Recognize the components on the motherboard
- Distinguish different storage media
- Describe the features of different I/O peripheral devices and their interfaces.

TEXT BOOK
1. Stephen J.Bigelow, "Trouble Shooting, maintaining and Repairing PCs", Tata McGraw-Hill, New Delhi, 2001.

REFERENCES

1. Craig Zacker & John Rourke, “The complete reference:PC hardware”, Tata McGraw-Hill, New Delhi, 1 edition (23 March 2001)
2. Mike Meyers, “Introduction to PC Hardware and Trouble shooting”, Tata McGraw-Hill, New Delhi, Osborne (1 March 2003)
3. B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, Tata McGraw-Hill, New Delhi, 01-Jan-2002

ADVANCED MICROPROCESSORS

Sub Code: EC832E2 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To learn the architecture and programming of advanced Intel family microprocessors and microcontrollers.

SYLLABUS

UNIT I : ADVANCED MICROPROCESSOR ARCHITECTURE **9hrs**
Internal Microprocessor Architecture-Real mode memory addressing – Protected Mode Memory addressing –Memory paging - Data addressing modes – Program memory addressing modes – Stack memory addressing modes – Data movement instructions – Program control instructions- Arithmetic and Logic Instructions.

UNIT II:MODULAR PROGRAMMING AND ITS CONCEPTS **9hrs**
Modular programming – Procedures – Macro - Interrupts - Interrupt service routines – keyboard and Video display –Data Conversions using assembly languages with C/ C++

UNIT III:PENTIUM& SUPER COMPUTER ARCHITECTURE **9hrs**
Special Pentium registers- Pentium memory management – New Pentium Instructions –Pentium Processor –Basic and additional features of Pentium Pro, Pentium II, Pentium
III, Pentium IV -SUPERCOMPUTES ARCHITECTURE: Elements in the system architecture of a supercomputer, shared memory in multiprocessor- interconnection network - distributed memory cluster - enclosure and cooling infrastructures - cluster management and monitoring software - parallel programming models.

UNIT-IV:16-BIT MICRO CONTROLLER **9hrs**
8096/8097 Architecture-CPU registers –RALU-Internal Program and Data memory Timers-High speed Input and Output –Serial Interface-I/O ports –Interrupts –A/D converter-Watch dog timer – Power down feature –Instruction set- External memory Interfacing –External I/O interfacing.

UNIT V:RISC PROCESSORS AND ARM **9hrs**
The RISC revolution – Characteristics of RISC Architecture – The Berkeley RISC – Register Windows – Windows and parameter passing – Window overflow – RISC architecture and pipelining – Pipeline bubbles – Accessing external memory in RISC systems – Reducing the branch penalties – Branch prediction – The ARM processors – ARM registers – ARM instructions – The ARM built-in shift mechanism – Data movement and memory reference instructions - ARM branch instructions – sequence control –Thumb Instruction set.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Outline the basic architecture of Pentium family of processors.
- Demonstrate concepts in internal programming model of Intel family of microprocessors.
- Describe the programming techniques using MASM, DOS and BIOS function calls.
- Understand the architecture programming and interfacing of 16 bit microcontrollers.
- Distinguish the architecture of RISC processor and ARM.

TEXT BOOK

1. Barry B.Brey, The Intel Microprocessors 8086/8088, 80, 86, 80286, 80386 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Prentice Hall of India Private Limited, New Delhi, Pearson Education; Eighth edition (2012) (UNIT I, II and III)

2. John Peatman, Design with Microcontroller McGraw Hill Publishing Co Ltd, New Delhi. (UNIT IV)Pearson (8 August 1997)
3. Alan Clements, "The principles of computer Hardware", Oxford University Press India; 4 edition (30 January 2013)
4. K. Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 1993
5. Levesque and Williamson, A Guidebook to FORTRAN on Supercomputers, Academic Press (1 January 1989)

REFERENCES

1. Rajkamal, The concepts and feature of micro controllers 68HC11, 8051 and 8096; S Chand Publishers, New Delhi.

EMBEDDED SYSTEMS

Sub Code: EC832E3 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To study the hardware and software used in Embedded Systems.

SYLLABUS

UNIT I:INTRODUCTION TO EMBEDDED SYSTEMS **9hrs**
Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT II:DEVICES AND BUSES FOR DEVICES NETWORK **9hrs**
I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '1²C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III:PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ **9hrs**
Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

UNIT IV :REAL TIME OPERATING SYSTEMS – PART - 1 **9hrs**
Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organisation and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks - INTER PROCESS COMMUNICATION AND SYNCHRONISATION – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs).

UNIT V :REAL TIME OPERATING SYSTEMS – PART - 2 **9hrs**
Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS – Understanding Case Definition – Multiple Tasks and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Describe characteristics of embedded systems and its hardware and software.

- Categorize the devices and buses used for embedded networking.
- Demonstrate the programming concepts and embedded programming in C and C++.
- Examine the concepts of real time operating systems, inter-task communication and an exemplary case of MUCOS – IIRTOS.

TEXTBOOKS

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, Education 2011

REFERENCES

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, Twelfth Indian Reprint 2005.
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufmann; 2 edition (8 July 2008)
4. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley & Sons 2002.

ADVANCED ELECTRONIC SYSTEM DESIGN

Sub Code: EC832E4 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To get knowledge about usage of electronic devices in Communication Engineering and Power supplies.

SYLLABUS

UNIT I :INTRODUCTION TO RF DESIGN **9hrs**
RF behaviour of passive components, Chip components and circuit board considerations, Review of transmission lines, Impedance and admittance transformation, Parallel and series connection of networks, ABCD and scattering parameters, Analysis of amplifier using scattering parameter. RF filter – Basic resonator and filter configurations – Butterworth and Chebyshev filters. Implementation of microstrip filter design. Band pass filter and cascading of band pass filter elements.

UNIT II :RF TRANSISTOR AMPLIFIER DESIGN **9hrs**
Impedance matching using discrete components. Microstrip line matching networks. Amplifier classes of operation and biasing networks – Amplifier power gain, Unilateral design(S_{12} =0) – Simple input and output matching networks – Bilateral design - Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors. Broadband amplifiers, High power amplifiers and multistage amplifiers.

UNIT III :DESIGN OF POWER SUPPLIES **9hrs**
DC power supply design using transistors and SCRs, Design of crowbar and foldback protection circuits, Switched mode power supplies, Forward, flyback, buck and boost converters, Design of transformers and control circuits for SMPS.

UNIT IV :DESIGN OF DATA ACQUISITION SYSTEMS **9hrs**
Amplification of Low level signals, Grounding, Shielding and Guarding techniques, Dual slope, quad slope and high speed A/D converters, Microprocessors Compatible A/D converters, Multiplying A/D converters and Logarithmic A/D converters, Sample and Hold, Design of two and four wire transmitters.

UNIT V:DESIGN OF PRINTED CIRCUIT BOARDS **9hrs**
Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Design RF amplifiers using transistors.
- Outline the performance of modern Power Supplies using SCR and SMPS technology
- Practice signal shielding & grounding techniques and study of A/D and D/A Converters.

TEXT BOOKS
1. Reinhold Luduig and Pavel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education, 2nd edition 2008.
2. Sydney Soclof, "Applications of Analog Integrated Circuits", Prentice Hall of India, Facsimile edition (1 June 1997)
3. Walter C.Bosshart, "Printed circuit Boards – Design and Technology", TATA McGraw-Hill, 16 June 1983.

REFERENCES

1. Keith H.Billings, "Handbook of Switched Mode Supplies" McGraw-Hill Publishing Co., 3 edition 1 October 2010
2. Michael Jaacob, "Applications and Design with Analog Integrated Circuits" Prentice Hall of India, 1 edition (December 26, 1999)
3. Otmar Kigenstein, "Switched Mode Power supplies in Practice", John Wiley and Sons,1 edition (June 1989)
4. Muhammad H.Rashid, Power Electronics – Circuits, Devices and Applications, Prentice Pearson Education India; fourth edition (19 July 2013)

ARM SYSTEMS ARCHITECTURE

Sub Code: EC832E5 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To understand the ARM architecture, memory and programming concepts.

SYLLABUS:

UNIT I: ARM PROCESSOR ARCHITECTURE: 9hrs
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

UNIT II: ARM INSTRUCTIONS SETS AND INTERRUPTS: 9hrs
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

UNIT III: CACHE MECHANISM: 9hrs
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

UNIT IVMEMORY PROTECTION AND MANAGEMENT UNIT: 9hrs
Introduction to protection unit, Protected Regions, and Demonstration of an MPU system. Virtual Memory working principle

UNIT V: EMBEDDED OS AND RTOS: 9hrs
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.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Demonstrate concepts of programming model of ARM processors.
- Describe the programming techniques using ARM processors.
- Understand the Memory organization & management concepts of ARM processors.
- Use concepts of embedded Real-time operating systems.

TEXT BOOKS:

1. "ARM System Developer's Guide Designing and Optimizing" by Andrew N.Sloss Elsevier publication, Morgan Kaufmann, May 2004.
2. "MicroC/OS – II" second edition The Real Time Kernel Jean J. Labrosse Publisher: Viva Books Private Ltd 2nd edition June 2002

REFERENCE BOOK:

1. "Embedded systems" B.Kanta Rao PHI publishers, Eastern Economy Edition, PHI Learning Pvt.Ltd 2011

2. “Embedded Systems Architecture” - Tammy Noergaard, Newness 2nd edition, January 2013
3. “ARM System-on-Chip Architecture” 2nd Edition, Steve Furbe, Pearson Education, Addison Wesley 2nd edition August 2000
4. “Embedded/Real Time Systems” Dr. K.V.K.K PRASAD Dream tech press, 2009

VLSI SUBSYSTEM DESIGN

Sub Code: EC832E6 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To introduce the technology, Subsystem design concepts and testing of Very Large Scale Integrated Circuits.

UNIT I MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY 9hrs
NMOS and PMOS transistors, Threshold voltage- Body effect- Design Equations -Second order effects. MOS models and small signal AC characteristics. Basic CMOS technology.

UNIT II INVERTERS AND LOGIC GATES 9hrs
NMOS and CMOS Inverters, Stick diagram, Inverter ratio, DC and transient characteristics , switching times, Super buffers, CMOS logic structures , Transmission gates, Static CMOS design, dynamic CMOS design.

UNIT III CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION 9hrs
Resistance estimation, Capacitance estimation, Inductance, Inverter switching characteristics – fall time, rise time, propagation delay. CMOS - Gate transistor sizing, power dissipation.

UNIT IV VLSI SYSTEM COMPONENTS CIRCUITS &SYSTEM LEVEL PHYSICAL DESIGN 9hrs
Multiplexers, Decoders, comparators, priority encoders, Shift registers Arithmetic circuits – Ripple carry adders, Carry look ahead adders, High-speed adders, Multipliers. Physical design – Delay modelling, cross talk, floor planning, power distribution. Clock distribution.

UNIT V TESTING AND DESIGN FOR TESTABILITY 9hrs
Need for testing-Fault models- Fault Orient test pattern generation – Fault simulation – Testability improvement – Structural design for testability – Boundary scan test.

COURSE LEARNING OUTCOME
On completion of this course the student can

- Understand the basics of CMOS circuits and CMOS process technology .
- Identify the CMOS inverters and logic gates.
- Strategy for estimating the parameter from the characteristics
- Design VLSI subsystems
- Test the CMOS circuits

TEXT BOOK:
Neil H.E. Weste and Kamran Eshraghian," Principles of CMOS VLSI Design",Pearson Education ASIA, 2 nd edition, 2000.

REFERENCES:
1. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 3 Edition 1995.
2. John P.Uyemura ,"Introduction to VLSI Circuits and Systems", John Wiley & Sons,Inc., 2002.
3. Mark Zwolinski "Digital system Design with VHDL" , Second Edition, Pearson Education Pvt .Ltd, New Delhi-2004.

ASIC DESIGN

Sub Code: EC832E7 **L: T: P** **Total Lecture Hrs: 45**

Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To introduce the types of ASICs and its design flow concepts of VLSI domain.

SYLLABUS
UNIT I INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN 9hrs
Types of ASICs - Design flow - Combinational Logic Cell – Sequential logic cell - Datapath logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort –Library cell design - Library architecture.

UNIT II : PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS 9hrs
Anti fuse -Static RAM - EPROM and EEPROM technology - PREP benchmarks – Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX - DC & AC inputs and outputs – Clock & Power inputs - Xilinx I/O blocks.

UNIT III: PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY 9hrs
Actel ACT - Xilinx LCA - Xilinx EPLD - Altera MAX 5000 Altera FLEX –Design systems - Schematic entry - Low level design language - EDIF- CFI design representation.

UNIT IV LOGIC SYNTHESIS, SIMULATION 9hrs
Logic synthesis -Logic synthesis - Examples for simple combinational logic and sequential logic circuits using VHDL

UNIT V SIMULATION AND FAULT ANALYSIS 9hrs
Types of simulation – Types of faults - Fault models – D-calculus- Fault simulation –LFSR - Signature analysis – Built in self test - Automatic test pattern generation algorithms.

COURSE LEARNING OUTCOME
On completion of this course the student can
- Generalize the basic concepts of CMOS logic cells and its ASIC libraries
- Develop the programmable ASIC
- Demonstrate the synthesis and simulation of ASIC design
- Identify the tools and steps for designing the ASIC design
- Analyze the fault existence in the circuit.

TEXT BOOK:
1. M.J.S .Smith, "Application Specific Integrated Circuits", Addison –Wesley Longman Inc., 1 Edition June 1997.

REFERENCES
1. Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SOCs: A Practical Approach", Prentice Hall PTR, US ed Edition May 2003.
2. Wayne Wolf, "FPGA-Based System Design", Prentice Hall PTR, Pearson Education, 2004
3. R. Rajsuman and Santa Clara, "System-on-a-Chip Design and Test", CA: Artech House Publishers, June 2000.
4. F. Nekoogar, "Timing Verification of Application-Specific Integrated Circuits (ASICs)", Prentice Hall PTR, 1 Edition June 1999.

ANALOG VLSI DESIGN

Sub Code: EC832E8 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE

This course focuses on the design of complex analog circuits like Amplifiers, Oscillators, PLL and switched capacitors etc. This also gives knowledge about behavior and noise analysis of various analog circuits.

SYLLABUS

UNIT I MOS TRANSISTOR AND CIRCUIT MODELLING 9hrs

MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modelling of MOS transistor using SPICE.

MOS Inverter static characteristics: Introduction, CMOS Inverter, Resistive-Load Inverter, Inverter with n-type MOSFET load.

UNIT II AMPLIFIER DESIGN & FEEDBACK 9hrs

Single Stage (CS,CG,CD) configurations, Cascade Stage, frequency response (miller effect) of CG, CS, CD, Types of noise, noise in single stage amplifiers; Circuit Modelling using SPICE. Feedback: properties of feedback, Feedback topologies and effect of loading; Circuit Modelling using SPICE.

UNIT III PASSIVE & ACTIVE CURRENT MIRRORS 9hrs

Basic current mirrors, Cascode current mirror, Active Current Mirrors - large signal analysis, small signal analysis, common mode properties; Circuit Modelling using SPICE. Differential pair: Operation, Basic Differential Pair, differential pair with MOS loads, Frequency response of Cascade & Differential Pair; Circuit Modelling using SPICE.

UNIT IV OP-AMPS, ANALOG MULTIPLIER & PLL 9hrs

Op-Amp topologies, single stage, Two stage, cascade, Gain BW product, Slew rate, Stability & frequency compensation, noise in differential and operational amplifiers; Circuit Modeling using SPICE. Analog multiplier and PLL: Analysis of four quadrant and variable trans-conductance multiplier, Voltage Controlled Oscillator, closed loop analysis of PLL; Circuit Modeling using SPICE.

UNIT V SWITCHED CAPACITOR & INTERCONNECT 9hrs

Sampling Switches, Switched capacitor amplifiers, design techniques for switched capacitor filters; Circuit Modeling using SPICE. Interconnect: Interconnect parameters; Electrical wire models, capacitive parasitic, Resistive parasitic, Inductive parasitic; Crosstalk; Advanced Interconnect Techniques; Circuit Modeling using SPICE.

COURSE OUTCOME

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

- Analyzing concepts of circuit modeling to construct MOS transistors and FET devices.
- Designing models of amplifier circuit using FET and feedback amplifiers.
- Demonstrate the concepts of current mirror and design current mirror loads for amplifier design.
- Applying the methods to design amplifiers using switched capacitors PLL and Mixers for communication transmitter and receivers.
- Analyze the methods to design amplifiers using switched capacitors.

TEXT BOOKS

1.BehzadRazavi, “Design Of Analog CMOS Integrated Circuits”, Tata McGraw Hill,Jan 2016

2. Neil H. E. Weste and David. Harris Ayan Banerjee,, "CMOS VLSI Design" - Pearson Education, March 2010.

REFERENCE BOOKS

1. Jacob Baker, "CMOS Mixed Signal Circuit Design", John Wiley, December 2008
2. Gray & Mayer, Analysis & Design of Analog Integrated Circuits, 5th edition, Wiley, January 2009

ROBOTIC SYSTEM DESIGN

Sub Code: EC832E9 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0:** **0Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- Implementation of robot.

DETAILED SYLLABUS

UNIT I ROBOT KINEMATICS AND DYNAMICS 9hrs

Robot anatomy - Definition, law of robotics. ROBOT KINEMATICS AND DYNAMICS Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations - Transformation Arithmetic - D-H Representation - Forward and inverse Kinematics of Six Degree of Freedom Robot Arm – Robot Arm dynamics

UNIT II ROBOTIC SENSORS & OBSTACLE AVOIDANCE 9hrs

Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

Obstacle avoidance: bug algorithm, histogram, and curvature velocity techniques. Navigation architecture

UNIT III FINITE STATE MACHINES 9hrs

Introduction to Mealey and Moore Machines. State Diagram, State Minimization: Robotic Applications of State Machines. Simulations using SIMULINK.

UNIT IV PROGRAMMING A MICROCONTROLLER 9hrs

Programming of Microcontroller, Interfacing DC motor, Stepper Motor, LEDs, LCDs. ADC, DACs relays etc. with microcontroller. (Using software simulation tools like Proteus and KEIL)

UNIT V {This unit is entirely practical based} **9hrs**

Implementation of a Robot. The concept of the specific robot design has to be discussed.
Eg: Line follower and Grid solving robot/ Robotic Arm/ Balancing Robot etc.

Note: Unit – V will be based on a group project. Each group comprising of maximum 3 members. Any microcontroller can be used in Unit-V.

COURSE LEARNING OUTCOME

On completion of the course, students will be able to,

- Summarize on advanced algebraic tools for description of motion.
- Analyze the path planning for articulated systems.
- Examine and demonstrate the working of control design using state machines.
- Judge the appropriate software tools for analysis of robotic system.
- Design a robotic system in an interactive environment.

TEXT BOOKS

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig , “Introduction to Robotics”, Pearson, 2009.
3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008

REFERENCE BOOKS

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, July 1987

PROCESS DYNAMICS AND CONTROL

Sub Code: EC832E10 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
The aim of this course is to introduce the concepts and fundamentals of process, and the controllers used in process along with advanced control schemes

UNIT I INTRODUCTION TO PROCESS **9hrs**
Process Control System: Need for process control, classification of process variables, Process characteristics: Process equation, degrees of freedom, modeling of simple systems – thermal, gas, liquid systems. Process lag, load disturbance and their effect on processes. Self-regulating processes, interacting and non interacting processes, Regulator and servo control. Piping and Instrumentation diagram- instrument terms and symbols. [Simulations using SIMULINK]

UNIT II CONTROLLERS **9hrs**
Controller modes: Basic control action, two position (ON-OFF), multi-position, floating control modes. Continuous controller modes: Proportional, Integral, Derivative. Composite controller modes: P-I, P-D, P-I-D. response of controllers for different types of test inputs, electronic controllers to realize various control actions, selection of control mode for different processes, Integral wind-up and prevention. Auto/Manual transfer, Bumpless transfer. [Simulations using SIMULINK]

UNIT III TUNING **9hrs**
Optimum Controller Settings: Controller tuning Methods- Process reaction curve method, Ziegler Nichols method, damped oscillation method, ¼ decay ratio. Evaluation criteria - IAE, ISE, ITAE. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow. [Simulations using SIMULINK]

UNIT IV FINAL CONTROL ELEMENTS **9hrs**
Final control elements: I/P and P/I converter, Pneumatic and Electric actuators. Pneumatic control valves, classification, construction details (Globe, butterfly and ball valve types), various plug characteristics. Valve sizing, inherent and installed valve characteristics. Cavitation and flashing in control valves. Valve actuators and positioners. Selection of control valves.

UNIT V ADVANCED CONTROL SCHEMES **9hrs**
Advanced control schemes: Cascade control, ratio control, feed forward control, Adaptive and Inferential control, split range and averaging control. Multivariable process control, interaction of control loops. Case Studies: Steam boiler – control of heat exchangers, drum level control and combustion. Distillation column – Control of top and bottom product compositions – Reflux ratio, control schemes in distillation column. [Simulations using SIMULINK]

TEXT BOOKS

1. D R Coughanowr, Steven E. LeBlanc, "Process Systems Analysis and Control", 3e, McGraw Hill, 2013
2. B. Wayne Bequette, "Process Control, Modelling, Design and Simulation", PHI, 2013
3. George Stephanopoulos: "Chemical Process Control An Introduction to Theory and Practice", PHI, 2013
4. Donald P. Eckman, "Automatic Process Control", Wiley India, 2013

ELECTIVE-VI: RF &COMMUNICATION SYLLABUS

TELECOMMUNICATION SYSTEM MODELING AND SIMULATION

Sub Code: EC833E1 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To model the random variables and random process applied to telecommunication system and to learn the methods of system simulation and performance evaluation.

SYLLABUS

UNIT I: SIMULATION OF RANDOM VARIABLES RANDOM PROCESS 9hrs
Generation of random numbers and sequence, Guassian and uniform random numbers Correlated random sequences, Testing of random numbers generators, Stationary and uncorrelated noise, Goodness of fit test.

UNIT II MODELING OF COMMUNICATION SYSTEMS 9hrs
Radio frequency and optical sources, Analog and Digital signals, Communication channel and models, Free space channels, Multipath channel and discrete channel noise and interference.

UNIT III: ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION 9hrs
Quality of estimator, Estimation of SNR, Probability density function and bit error rate, Monte Carlo method, Importance sampling method, Extreme value theory.

UNIT IV :SIMULATION AND MODELING METHODOLOGY 9hrs
Simulation environment, Modeling considerations, Performance evaluation techniques, error source simulation, Validation.

UNIT V:CASE STUDIES 9hrs
Simulations of QAM digital radio link in environment, Light wave communication link and satellite system.

COURSE LEARNING OUTCOME:
On completion of this course the student can
- Explain the concept of generation and testing of random numbers
- Analyze the tradeoffs of SNR and BER in communication links
- Design the link budget for QAM , satellite and lightwave links
- Discuss the various types of models and simulation methods
- Extrapolate the data for evaluation of performance of communication links
- Classify the various QAM links based on data rate and SNR levels.

TEXTBOOK
1. MC.Jeruchim, P.Balaban and Sam K Shanmugam, "Simulation of communication Systems: Modeling, Methodology and Techniques ", Plenum press, New York, 2001.

REFERENCES
1. Averill.M.Law and W.David Kelton,"Simulation Modeling and Analysis", McGraw-Hill Inc., 2000.
2. Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2nd Edition, 2015.
3. W.Turin, "Performance Analysis of Digital Communication Systems", Computer Science Press, New York, 1990.

4. Jerry banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall of India, fourth edition 2012.

SATELLITE COMMUNICATION

Sub Code: EC833E2 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE
To enable the student to become familiar with satellites and satellite services.

DETAILED SYLLABUS

UNIT I OVERVIEW OF SATELLITE SYSTEMS, ORBITS AND LAUNCHING METHODS 9hrs

Introduction – Frequency Allocations for Satellite Services – Intelsat – U.S.Domsats – Polar Orbiting Satellites – Problems – Kepler's First Law – Kepler's Second Law – Kepler's Third Law – Definitions of Terms for Earth-orbiting Satellites – Orbital Elements – Apogee and Perigee Heights – Orbital Perturbations – Effects of a Non spherical Earth – Atmospheric Drag – Inclined Orbits – Calendars – Universal Time – Julian Dates – Sidereal Time – The Orbital Plane – The Geocentric-Equatorial Coordinate System – Earth Station Referred to the IJK Frame – The Top centric-Horizon Co-ordinate System – The Sub-satellite Point – Predicting Satellite Position.

UNIT II GEOSTATIONARY ORBIT & SPACE SEGMENT 9hrs

Introduction – Antenna Look Angels – The Polar Mount Antenna – Limits of Visibility – Near Geostationary Orbits – Earth Eclipse of Satellite – Sun Transit Outage – Launching Orbits – Problems – Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders – Wideband Receiver – Input Demultiplexer – Power Amplifier – Antenna Subsystem – Morelos – Anik-E – Advanced Tiros-N Spacecraft

UNIT III EARTH SEGMENT & SPACE LINK 9hrs

Introduction – Receive-Only Home TV Systems – Outdoor Unit – Indoor Unit for Analog (FM) TV – Master Antenna TV System – Community Antenna TV System – Transmit-Receive Earth Stations – Problems – Equivalent Isotropic Radiated Power – Transmission Losses – Free-Space Transmission – Feeder Losses – Antenna Misalignment Losses – Fixed Atmospheric and Ionospheric Losses – Link Power Budget Equation – System Noise – Antenna Noise – Amplifier Noise Temperature – Amplifiers in Cascade – Noise Factor – Noise Temperature of Absorptive Networks – Overall System Noise Temperature – Carrier-to-Noise Ratio – Uplink – Saturation Flux Density – Input Back Off – The Earth Station HPA – Downlink – Output Back off – Satellite TWTA Output – Effects of Rain – Uplink rain-fade margin – Downlink rain-fade margin – Combined Uplink and Downlink C/N Ratio – Intermodulation Noise.

UNIT IV SATELLITE ACCESS 9hrs

Single Access – Preassigned FDMA, Demand-Assigned FDMA, SPADE System. Bandwidth-limited a Power-limited TWT amplifier operation, FDMA downlink analysis.
TDMA: Reference Burst; Preamble and Postamble, Carrier recovery, Network synchronization, unique word detection, Traffic Date, Frame Efficiency and Channel capacity, preassigned TDMA, Demand assigned TDMA, Speech Interpolation and Prediction, Downlink analysis for Digital transmission.
Companion of uplink Power requirements for FDMA & TDMA. On-board signal processing for TDMA / FDMA operation, Satellite switched TDMA.
Code-Division Multiple Access – Direct-Sequence spread spectrum – code signal c(t) – autocorrelation function for c(t) – Acquisition and trackling – Spectrum spreading and dispreading – CDMA throughput – Problems – Network Layers – TCP Link – Satellite Links and TCP – Enhancing TCP Over Satellite Channels Using Standard Mechanisms (RFC-2488) – Requests for comments – Split TCP connections – Asymmetric Channels – Proposed Systems.

UNIT V SERVICES AND APPLICATIONS 9hrs

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing– Mobile satellite service: GSM, GPS-Orbcomm & Iridium Satellite systems, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity

COURSE LEARNING OUTCOMES:

At the end of the course the students will

1. To recognize the fundamentals on satellite systems orbits & launching methods
2. To explain about geostationary orbit & space segment
3. To analyze the earth segment and space link
4. To interpret various satellite access techniques
5. To paraphrase the satellite services & its applications

TEXT BOOK

1. Dennis Roddy, Satellite Communications, McGraw-Hill Publication Third edition 2008

REFERENCES

1. Timothy Pratt – Charles Bostian & Jeremy Allmuti, Satellite Communications, John Willy& Sons (Asia) Pvt. Ltd. 2006
2. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson, Satellite Communication Systems Engineering, Pearson Education Ltd., Second edition 2003.
3. M.Richharia : Satellite Communication Systems (Design Principles Macmillan Press Ltd. Second Edition 2003.

RADAR AND NAVIGATIONAL AIDS

Sub Code: EC833E3 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To make the student understand the principles of Radar and its use in military and civilian environment. Also to make the student familiar with navigational aids available for navigation of aircrafts and ships.

SYLLABUS

UNIT I: INTRODUCTION TO RADAR **9hrs**

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies – Applications of Radar – The Origins of Radar

The Radar Equation

Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters-System losses – Other Radar Equation Considerations

UNIT II: MTI AND PULSE DOPPLER RADAR **9hrs**

Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics -Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

UNIT III: DETECTION OF SIGNALS IN NOISE **9hrs**

Introduction – Matched –Filter Receiver –Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters - Frequency-Scan Arrays

Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter.

Radar Receivers - The Radar Receiver - Receiver noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV: INTRODUCTION **9hrs**

Introduction - Four methods of Navigation .

Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders

Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments.

Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System

UNIT V: DME AND TACAN **9hrs**

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment

Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS)

Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.
Inertial Navigation - Principles of Operation - Navigation Over the Earth - Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems.
Satellite Navigation System - The Transit System - Navstar Global Positioning System (GPS)

COURSE LEARNING OUTCOME:
On completion of the course, student will be able to

- Explain the radar equation and principle of detection of objects using radio waves
- Analyze the significance of radar cross section and ranging
- Design the link budget for detecting target objects
- Discuss the various types of radar systems
- Extrapolate the magnitude of signal received amidst background noise
- Estimate the radar system for a particular application

TEXTBOOK

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003

REFERENCES

1. Peyton Z. Peebles:, "Radar Principles", Johnwiley, 2007
2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2010

REMOTE SENSING

Sub Code: EC833E4 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits:**

COURSE OBJECTIVE:
To provide the students with an understanding of geographic information systems from the software engineering, data handling and management point of views.

SYLLABUS

UNIT I:REMOTE SENSING **9hrs**
Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.

UNIT II:EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS **9hrs**
Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface:Imaging spectrometry and spectral characteristics.

UNIT III:OPTICAL AND MICROWAVE REMOTE SENSING **9hrs**
Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle - Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

UNIT IV:GEOGRAPHIC INFORMATION SYSTEM **9hrs**
GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotter

UNIT V:MISCELLANEOUS TOPICS **9hrs**
Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications- Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems. Global positioning system – an introduction.

COURSE LEARNING OUTCOME:
Students will understand latest development of ubiquitous positioning, and develop critical mind on designing application by integrating positioning technologies with GIS and computer programming techniques.

TEXT BOOKS

1. M.G. Srinivas (Edited by), Remote Sensing Applications, Narosa Publishing House, 2001. (Units 1 & 2).
2. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2012(Units 3, 4 & 5).

REFERENCES

1. Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000.
2. Kang-Tsung Chang,"Introduction to Geograhic Information Systems", TMH, 2002
3. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, Inc, New York, 2015.
4. Janza.F.J., Blue, H.M., and Johnston, J.E., "Manual of Remote Sensing"Vol. I., American Society of Photogrammetry, Virginia, U.S.A, 1975.
5. Burrough P A, "Principle of GIS for land resource assessment", Oxford
6. Mischael Hord, "Remote Sensing Methods and Applications", John Wiley & Sons, New York, 1988.
7. Singal, "Remote Sening", Tata McGraw-Hill, New Delhi, 1990.
8. Floyd F. Sabins, Remote sensing, "Principles and interpretation", W H Freeman and Company 2007.
9. IEEE Transactions on Geo-science and Remote sensing.
10. Manual of Remote Sensing – American society of photogrammetry & remote sensing, 2013.

OPTO ELECTRONIC DEVICES

Sub Code: EC833E5 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits:**

COURSE OBJECTIVE:
To learn different types of optical emission, detection, modulation and opto electronic integrated circuits and their applications.

SYLLABUS

UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS **9hrs**
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT II DISPLAY DEVICES AND LASERS **9hrs**
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

UNIT III OPTICAL DETECTION DEVICES **9hrs**
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT IV OPTOELECTRONIC MODULATOR **9hrs**
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS **9hrs**
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

COURSE LEARNING OUTCOME:
On completion of this course, student will be able to

- Utilize fundamental knowledge of the basic physics and semiconductor behind optoelectronic devices.
- Design semiconductor optical sources (including light emitting diodes and laser diodes) for a variety of applications.
- Describe impacts of semiconductor material properties into the fabrications of semiconductor optoelectronic devices.
- Examine various premises, approaches procedures and results related to optoelectronic systems.
- Develop the knowledge of optoelectronic devices and fiber optics in order to be able to relate present and future technologies for applications in optical communications, sensor/imaging techniques, as well as energy conversion that has found renewed interest recently due to world-wide demands of energy saving and new energy production.

TEXTBOOK

J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

REFERENCES

1. Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 1997.
2. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998.

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

Sub Code: EC833E6 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

- To tutor the basics of EMI, EMC
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques
- To impart comprehensive insight about the current EMC standards and about various measurement techniques

SYLLABUS

UNIT I:BASIC CONCEPTS **9hrs**

Definition of EMI and EMC with examples, Classification of EMI/EMC - CE, RE, CS, RS, Units of Parameters, Sources of EMI, EMI coupling modes - CM and DM, ESD Phenomena and effects, Transient phenomena and suppression.

UNIT II:EMC STANDARD AND REGULATIONS **9hrs**

National and Intentional standardizing organizations- FCC, CISPR, ANSI, DOD, IEC, CENEEC, FCC CE and RE standards, CISPR, CE and RE Standards, IEC/EN, CS standards, Frequency assignment - spectrum conversation.

UNIT III:EMI CONTROL METHODS AND FIXES **9hrs**

Shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, opto isolator.

UNIT IV:EMC DESIGN AND INTERCONNECTION TECHNIQUES **9hrs**

Cable routing and connection, Component selection and mounting, PCB design- Trace routing, Impedance control, decoupling, Zoning and grounding

UNIT V:EMI MEASUREMENTS **9hrs**

Basic principles of RE, CE, RS and CS measurements, EMI measuring instruments- Antennas, LISN, Feed through capacitor, current probe, EMC analyzer and detection t6echnique open area site, shielded anechoic chamber, TEM cell, MIL -STD test methods, Civilian STD test methods.

COURSE LEARNING OUTCOME:

On completion of the course, students will be able to:

- Explain the basic concepts of Electromagnetic Interference and Compatibility in the system level design.
- Paraphrase the standards and Regulations of Electromagnetic Interference and Compatibility .
- Analyze the electromagnetic interference control techniques.
- Design the Cable routing and the Interconnection Techniques.
- Interpret the electronics instruments as per EMI standards .

TEXT BOOKS

1. Prasad Kodali.V – Engineering Electromagnetic Compatibility – S.Chand&Co – New Delhi – 2000

Clayton R.Paul – Introduction to Electromagnetic compatibility – Wiley & Sons – 2006

REFERENCES

1. Keiser – Principles of Electromagnetic Compatibility – Artech House – 3/e 1998

2. Donwhite Consultant Incorporate – Handbook of EMI / EMC – Vol I – 1985

MICROSTRIP ANTENNAS

Sub Code: EC833E7 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

The aim of this course is to introduce the concepts and fundamentals of microstrip antennas and design aspects

SYLLABUS

UNIT I BASICS OF MICROSTRIP ANTENNAS **9hrs**

Origin of Microstrip radiators, microstrip antenna analysis methods, microstrip antenna advantages, disadvantages and applications; materials used for microstrip antennas, feed, ground and substrates and their properties, Common Feed methods, Characteristics of Resonance Frequency, Bandwidth, % BW, Return loss, VSWR, 50 Ohms Characteristic impedance, Axial ratio, Efficiency, Gain, Directivity, Rectangular & Polar Radiation Patterns,Experiment on the design of simple feeds

UNIT II RECANGULAR MICROSTRIP ANTENNA MODELS AND CHARACTERISTICS 9hrs

Rectangular microstrip antennas- common feed methods, transmission line model, cavity model, TM10 and TM01 modes, return loss, radiation pattern, quarterwave rectangular microstrip antenna, single feed and dual fed circular polarized rectangular microwave antenna design, impedance and axial ratio bandwidth, efficiency, experiment to understand the MSA mode characteristics and various other characteristics of microstrip antenna

UNIT III DESIGN GUIDELINES OF MICROSTRIP ANTENNAS **9hrs**

Design guidelines for a linearly polarized rectangular microstrip antenna, Design guidelines for a circularly polarized rectangular microstrip antenna, electromagnetically coupled rectangular microstrip antenna, ultra-wideband rectangular microstrip antenna, experiment on the design of SMSA, RMSA, UWB

UNIT IV CIRCULAR MICROSTRIP ANTENNAS **9hrs**

Circular microstrip antenna properties, directivity, input impedance bandwidth, gain, radiation pattern and efficiency, radiation modesTM11 bipolar mode, TM21 quadrapolar mode, TM02 unipolar mode, cross polarization, annular microstrip antenna, experiment on the design of CMSA and EMSA

UNIT V BROADBAND MICROSTRIP ANTENNA, ARRAYS AND PRINTED ANTENNAS 9hrs

Broadband microstrip antennas, broadbanding, microstrip antenna matching with capacitive slot, microstrip arrays- planar array theory, array feeding methods – corporate fed and series fed; overview of printed antennas –omnidirectional microstrip antenna, stripline fed tapered slot antenna, Vivaldi antenna, meanderline antenna(ESA) geometry and radiation patterns, PIFA antenna, experiment on the design of BB-MSA and Array

COURSE LEARNING OUTCOME:

At the end of the course the students will be able to

- Explain the concepts of microstrip antennas feeds & fundamentals .
- Discuss the construction characteristics of rectangular Microstrip antennas.
- Create the Rectangular Microstrip antennas.

- Design the circular microstrip antennas.
- Analyze the broadband microstrip antenna arrays & printed antennas.
- Generate research paper using the design knowledge gained.

TEXT BOOK

1. Randy Bancraft, "Microstrip and Printed Antenna Design", Prentice-Hall of India, 2006
2. Ramesh Garg, Prakash Bhartia, Inder Baul and Apisak Ittipiboon, "Microstrip Antenna Design Handbook", Artech House, 2001

REFERENCE

1. Bahl, I.J., Bhartia, P., " Microstrip Antennas", ArTech House, 1997.
2. Rod Waterhouse "Microstrip Patch Antennas: A designer's Guide", Springer, Kluwer, 2003.

Note: Experiments are informal lab sessions based on the purchase of simulation software

COMPUTATIONAL ELECTROMAGNETICS

Sub Code: EC833E8 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:

To get a basic idea of numerical techniques used to make it possible to solve many electromagnetics design problems by computations rather than the traditional way by building and testing prototypes. The course introduces three largely used numerical techniques in solving electromagnetic problems involving complex structures. To have a general idea about implementing the algorithms an overview on the Krylov subspace is also included

SYLLABUS

UNIT I: BASICS OF COMPUTATIONAL ELECTROMAGNETICS **9hrs**

Fields and Potentials - Review of Maxwell's equations - boundary conditions- Wave equation- Analytical methods-Separation of variables in rectangular coordinates on Laplace equation and wave equation- Orthogonal functions and its applications-Challenges in solving the wave equations. Overview of numerical methods used in electromagnetics - Method of Curvilinear Squares, Method of Moments, Finite Element Method. Finite Difference Method, Monte Carlo Method.

UNIT II: METHOD OF MOMENTS **9hrs**

Introduction- Green's function- Free space and domain with conducting boundaries. Integral equations. Integral formulation of electrostatics and Maxwell's equations. Application to capacitance calculation and electromagnetic scattering from a thin wire.

UNIT III: FINITE DIFFERENCE METHOD **9hrs**

Finite difference methods, Central/forward/backward differences, solving Poisson equations on a rectangular domain

Finite difference time domain methods, stability analysis, dispersion analysis, simple first order absorbing boundary condition-Simple solution of wave equation with absorbing boundary conditions- Yee's Finite Difference Algorithm

UNIT IV: FINITE ELEMENT METHOD **9hrs**

Finite element methods, bary-centric coordinate systems, Lagrange interpolation polynomials, applying FEM to solve Poisson equations. Solution of the wave equation

Introduction to monte carlo methods- General concept

UNIT V : LINEAR ALGEBRA FOR ALGORITHMIC IMPLEMENTATION **9hrs**

Applied linear algebra for solving matrix equations Ax=b, singular value decomposition (SVD) algorithm, graph theory for direct factorization and sparse direct matrix solvers. Introduction to optimization - Least square optimization method

COURSE LEARNING OUTCOME:

Student will be able to:

- Making an appropriate choice of solution type for solving an electromagnetic problem.
- Formulate and implement a basic computational algorithm in Electromagnetics with the finite-difference scheme, the finite-element method and the method of moments.
- Investigations on hybrid models to provide solutions to Electromagnetic problems that may lead to research.
- Apply the knowledge of mathematics, science and engineering to solve complex electromagnetic problems .

TEXTBOOKS

1. Mathew N. O. Sadiku, Numerical Techniques in Electromagnetics, Second Edition, 2001
2. Anderson Bondeson, Thomas Raylander, Par Ingelstom, Computational Electromagnetics, 2005
3. D.S. Watkins (2004), Fundamentals of Matrix computations

REFERENCES

1. Karl E. Lonngren,Sava V.Savov, Randy J. Jost,Fundamentals of Electromagnetics with MATLAB, 2e SciTech Publishing, Inc., 2007.
2. A F. Peterson, S L Ray and R Mittra, Computational Methods for electromagnetics, IEEE Press 2001

COMMUNICATION PROTOCOL ENGINEERING

Sub Code: EC833E9 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

UNIT I NETWORK REFERENCE MODEL 9hrs
Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model ,TCP/IP protocol suite

UNIT II PROTOCOL SPECIFICATIONS 9hrs
Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol- other protocol specification languages

UNIT III PROTOCOL VERIFICATION/VALIDATION 9hrs
Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation

UNIT IV PROTOCOL CONFORMANCE/PERFORMANCE TESTING 9hrs Conformance testing methodology and frame work, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controlLaboratoryle interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, ScaLaboratoryility testing

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9hrs
Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering

REFERENCES

1. Pallapa Venkataram and Sunilkumar S.Manvi, “Communication protocol Engineering”, Eastern Economy edition, 2004
2. Richard Lai and Jirachiefpattana, “Communication Protocol Specification and Verification”, Kluwer Publishers, Boston, 2013.
3. Tarnay, K., “Protocol Specification and Testing”, Plenum, New York, 2012.
4. Mohamed G. Gouda, “Elements of Network Protocol Design”, John Wiley & Sons, Inc. New York, USA, 2008
5. V.Ahuja, “Design and Analysis of Computer Communication networks”, McGraw-Hill, London, 2000.
6. G.J.Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York, 2005.

HIGH SPEED NETWORKS

Sub Code: EC833E10 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To highlight the features of different technologies involved in High Speed Networking and their performance.

SYLLABUS

UNIT I HIGH SPEED NETWORKS 9hrs
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

UNIT II CONGESTION AND TRAFFIC MANAGEMENT 9hrs
Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III TCP AND ATM CONGESTION CONTROL 9hrs
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM.
Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES 9hrs
Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

UNIT V PROTOCOLS FOR QOS SUPPORT 9hrs
RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

COURSE LEARNING OUTCOME:
On completion of this course, students will be able to

- Get an introduction about ATM and Frame relay and be able to extend the ideas relevantly.
- Have an updated survey of developments in High Speed Networks.
- Explain techniques involved to support real-time traffic and congestion control.
  Distinguish different levels of quality of service (QoS) to different applications.

TEXT BOOK

1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.

REFERENCES

1. Warland & Pravin Varaiya, "HIGH PERFORMANCE COMMUNICATION NETWORKS", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003

SOFT COMPUTING

Sub Code: EC833E11 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **3: 0: 0** **Exam Hours: 03 Credits: 3**

COURSE OBJECTIVE:
To introduce the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

SYLLABUS

UNIT I FUZZY SET THEORY 9hrs
Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT II OPTIMIZATION 9hrs
Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT III NEURAL NETWORKS 9hrs
Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT IV NEURO FUZZY MODELING 9hrs
Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE 9hrs
Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

COURSE LEARNING OUTCOME:
On completion of this course, students will be able to

- Describe the basics mathematical elements of fuzzy set and compare fuzzy set with classical set theories.
- Distinguish and develop systems based on ANN algorithms and optimized the system using modern tools.
- Design and analyze fuzzy inference applications in the area of control system, Clustering, Pattern Recognition, Processing, and Fuzzy Databases.
- Identify, classify and analyze the real time problems that are amendable to solution by Nero-Fuzzy modeling.

TEXT BOOK

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

REFERENCES

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 2010.

2. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996.

RELIABILITY OF ELECTRONICS SYSTEMS

Sub Code: EC833E12 **L: T: P** **Total Lecture Hrs: 45**
Exam Marks: 100 **Credits: 3: 0: 0** **Exam Hours: 03**

COURSE OBJECTIVE

The aim of the course is to introduce the essence of reliability engineering to the students

UNIT I INTRODUCTION TO RELIABILITY ENGINEERING

9hrs Reliability standards and specifications, objectives and need for reliability engineering, reasons of failure of engineering items, bathtub curve and pattern of failures with time for non-repairable and repairable items, part failures and types, reliability engg. as a design discipline, deterministic versus probabilistic considerations, definitions and terminologies of reliability engg., statistical distributions used in reliability models, development of reliability engg., reliability as an effectiveness parameter, reliability program activities, reliability economics and management

UNIT II PART SELECTION SPECIFICATION AND CONTROL 9hrs

Introduction, details of part selection consideration, Component reliability- mean time between failures(MTBF), failure rate, meantime to failure (MTTF), availability and unavailability, relationship between failure rate and MTBF, component values and tolerances, custom device and VLSI microcircuit considerations, critical parts, custom LSI/VLSI devices, part quality grades, Arrhenius reaction rate model, microcircuit package considerations, screening of microcircuits, derating, stress reliability prediction, derating guidelines, placement and mounting of parts, example problems.

UNIT III FAILURES AND ANALYSIS 9hrs

Component failure data: Variation of failure data with time, types of failure, factors affecting the failure rate, effect of temperature and failure rate, estimating internal temperature rise, effect of voltage stress, environmental factors, problem of measuring failure rates, confidence limits and levels, evaluating test results; FMEA - design, process and service FMEAs, FMECA, example problems.

UNIT IV RELIABILITY TESTING 9hrs

Introduction to testing, planning and development of test programme – test categories, durability and environments, test documents and specifications, different types of testing – sequential, vibration, temperature, EMI and Beta, accelerated testing, VLSI reliability issues – process monitoring, IC fabrication, CAD of VLSI and testing, reliability of CAD/CAM electronic components, circuits and equipment and manufacturing issues.

UNIT V ANALYSIS AND DEISGN FOR RELIABILITY 9hrs

Circuit analysis methods and techniques: Analog circuit design for reliability, circuit analysis and reliability, circuit tolerance analysis methods, sneak analysis, overview of redundancy, fail-safe circuits, vibration and environmental considerations, Aspects of EMI/EMC/ESD, Electrostatic Discharge(ESD): nature of static electricity, ESD related damage, failure modes and mechanisms, device and equipment susceptibility, ESD design precautions and protective materials

COURSE LEARNING OUTCOMES:

The syllabus is framed in such a way that at the end of the course, the students will be able to

1. Understand the concept of reliability engineering, its importance and how it is developed

2. Know about military and other standards, the specifications and how parts of circuits are selected and controlled
3. Learn how failures are happening and how to analyze and mitigate them
4. Exposed to the methods which are used for testing reliability of electronic systems
5. Realize how the systems are analyzed and designed for high reliability

TEXT BOOKS

1. Norman B. Fuqua, "Reliability Engineering for Electronic Design"Marcel Dekker Inc., 1987.
2. Patrick D.T. O'Connor, David Newton and Richard Bromley, "Electronic system Reliability: Practical Reliability Engg., John Wiley & Sons Ltd., 5/e, 2012.
3. J.C. Cluley, "Electronics Equipment Reliability", The Macmillan Press Ltd., 2/e 1981

REFERENCE BOOKS

1. J. Swingler, "Reliability characterization of electrical and electronic system: Elsevier Pub. 1/e, 2015 (Edited Research papers)
2. D.H. Stamatis, "failure Mode and Effect Analysis: FMEA from theory to execution", Productivity Press India Pvt. Ltd., 2/e 2003.
3. MIL-STD-1629A, 1980, Military Standard – procedures for performing failure mode, effects and criticality analysis
4. Titu Bajenescu and Marius Bazu,: Reliability of Electronic component: A practical guide to electronic system manufacturing, Springer, 2012.
5. MIL –HDBK -338B, 1991, Militray Standard - Electronic reliability design handbook, Dept. of defense USA.
6. White paper: Prajwal Kini A, "Reliability Estimation for Electronic Design", 2009.
7. Milton Ohring and Lucian Kasprzak "Reliability and Failure of Electronic Materials and Devices, Academic Press, 2014