DIT UNIVERSITY

Dehradun

Fully Flexible Choice Based Credit System

for

Bachelor of Technology

In

Electronics and Communication Engineering (2022-26)

Approved by 20th Meeting of Academic Council-DIT University

Introduction

The Ministry of Human Resource Development (MHRD), Govt. of India, has initiated development of a New Education Policy (NEP) to bring out comprehensive reforms in the Indian education system.

The University Grants Commission (UGC) has subsequently initiated several steps to foster academic excellence through introduction of paradigm shift in learning and teaching pedagogy, innovation and improvement in course curricula, examination and education system.

While a majority of education institutions have started following the semester-based system of education, it has been observed that this new system is still producing graduates who lack knowledge, values, and skills and are not job ready professional. The reason for this lacking could be attributed to the rigidity of our program structures and lack of flexibility to have choices among core subject education, liberal arts, ability enhancement, skill development, etc., that is fundamental to overall development and employability of these graduates. To make this possible, a fully flexible choice-based credit system (FFCBCS), a well-established internationally known system, is proposed. This fully flexible choice-based credit system allows students the flexibility to learn at their own pace, and register for both core subjects and a variety of courses from other areas, leading to holistic development of an individual. The FFCBCS will facilitate us to bench mark our programs with best international liberal arts based academic programs.

Advantages of the FFCBCS structure:

- Shift in focus from the teacher-centric to student-centric education. Student can curve out their program structure by choosing minimum number of credits from well-defined baskets.
- Student may undertake as many credits as they can cope with.
- FFCBCS allows students to choose courses from various baskets of inter-disciplinary, intra-disciplinary, skill oriented, ability enhancing, and from other disciplines.

Features unique to DIT University FFCBCS structure

1. A minimum of 150-160 credits has to be earned by a student to be eligible for an Under Graduate degree in Engineering. Each department will decide their total credits for each program, and it can vary across disciplines.

2. Courses are categorized into 11 baskets, and a student will have the option to choose courses in most baskets and earn ***minimum number of credits*** required in each basket for the award of his/her degree. For each basket, Engineering departments have the flexibility to identify course(s) which will be a core requirement for their program.

3. In certain disciplines, students may choose a ***Specialization*** by earning 18 credits of Discipline Elective courses towards a particular area of that discipline (interdisciplinary). In addition to this, brighter students will have the option to receive (a) a ***Certificate*** by earning *additional* 9 credits towards a particular area either inside or outside their discipline, or (b) ***Minor*** by earning additional 18 credits towards a particular area outside their discipline. Certificates and Minors can be earned through either University courses, or with MOOCs from providers as identified by the University. Each department will design the structures and eligibility conditions for registration to its certificates or minor program, which may be reviewed annually, to keep the ***Certificates*** and ***Minors*** contemporary and relevant to latest changes.

4. An FFCBCS council may be formed comprising all HoDs and one representative each from respective departments. FFCBCS council will meet at the end of every semester after the completion of Board of Examination meeting to discuss and finalize course offerings by respective departments in the upcoming semester. FFCBCS council will be chaired by the Dean Academic Affairs.

5. To provide sufficient flexibility and room during the program for additional ***Certificates***, ***Specializations, and Minors***, 8-week summer semesters (Summer 1, Summer 2, and Summer 3) may have to run. Summer semesters

are critical for implementing a fully flexible system. Each department will decide *a priori* which courses to offer in the summer semester and get them finalized at the FFCBCS council meeting.

6. Project based learning has to be incorporated as a core component of evaluation in each course, and depending on the level and type of the course, the project can be of several types - Study Oriented Project, Lab Oriented Project, Design Oriented Project, Computer Oriented Project, Projects of Organizational Aspects, Research Projects, or Entrepreneurship and Start Up Projects. A Capstone Project has been introduced in the 8th semester for all Bachelor of Technology students.

7. Courses under each basket may be updated on an annual basis.

8. Each student will be advised by a faculty advisor of his/her department for registration of courses from each basket in the beginning of semester, depending upon the availability of seats. A student advising centre may be formed where students will have access to department faculty advisers. Faculty advisers should have complete access to view individual student's academic transcript for advising purposes.

9. A student getting an F grade in a core course (departmental or otherwise) at the end of the semester will have to earn those credits by registering for the same course whenever it is offered in subsequent semesters. If the course is not a core course, the student may choose to register for any other course next semester in that basket as advised by the department faculty adviser. Additional fees for those number of credits may apply.

10. Students may opt for summer training/internships/industrial tours as advised by the department. However, these activities will not have credits.

Baskets of FFCBCS

11 baskets of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These baskets are as follows:

1. **Language and Literature:** These include courses related to English or other popular languages worldwide, communication skills, and literature. These courses are of 3 credits each.
2. **Core Science:** These courses include science courses from the disciplines of Physics and Chemistry. These courses are of 5 credits each.
3. **Core Mathematics:** This basket includes courses from Mathematics department, crafted for engineering students. These courses are of 4 credits each.
4. **Engineering Sciences:** This basket includes introductory courses from various disciplines of Engineering designed to provide the student solid foundation to the domain of engineering. These courses are of 4 credits each.
5. **Discipline Core:** This basket includes compulsory courses in the discipline in which the student is admitted to the University. These courses are of 4 credits each.
6. **Discipline Elective:** This basket provides students courses other than discipline core, and are normally in certain specialized areas. These courses are of 3 credits each.
7. **Humanities and Liberal Arts:** This basket includes liberal arts courses in various disciplines like psychology, management, economics, etc., and are of 3 credits each.
8. **Skill Enhancement:** Courses in this basket are primarily hands-on and aims to allow students acquire skills required in certain disciplines that are currently in high demand in the job market. These courses are of 2 credits each.
9. **Ability Enhancement:** These courses aim to enhance knowledge and ability of an individual in certain required areas related to national and societal interest. Courses in this basket are of 2 credits each.
10. **Free Electives:** Student can register for any three courses outside their department of his/her choice. These courses can also be taken from MOOCs, and Courses in this basket are of 3 credits each.
11. **Capstone Project:** Capstone project is a semester long multifaceted experimental/research assignment that serves as a culminating academic and intellectual experience for students, taken in the last semester of study. It is of 12 credits and may be done groups of not more than three students, and in three modes as follows:
    - **Mode A**: Project with a department faculty.
    - **Mode B**: Project as part of Industry Internship arranged only by the career and placement service of the University. Students securing this assignment on their own will not be allowed, unless the project is secured at a well-known industry, and duly approved by the department. The department's decision in all such cases will be final.
    - **Mode C**: Semester long project in an academic institute/lab of National/International Importance, secured by students on their own. The department's decision to allow in all such cases will be final.

    A separate rule booklet will be released for implementation of Capstone Project.

ECE-DIT University FFCBCS credits

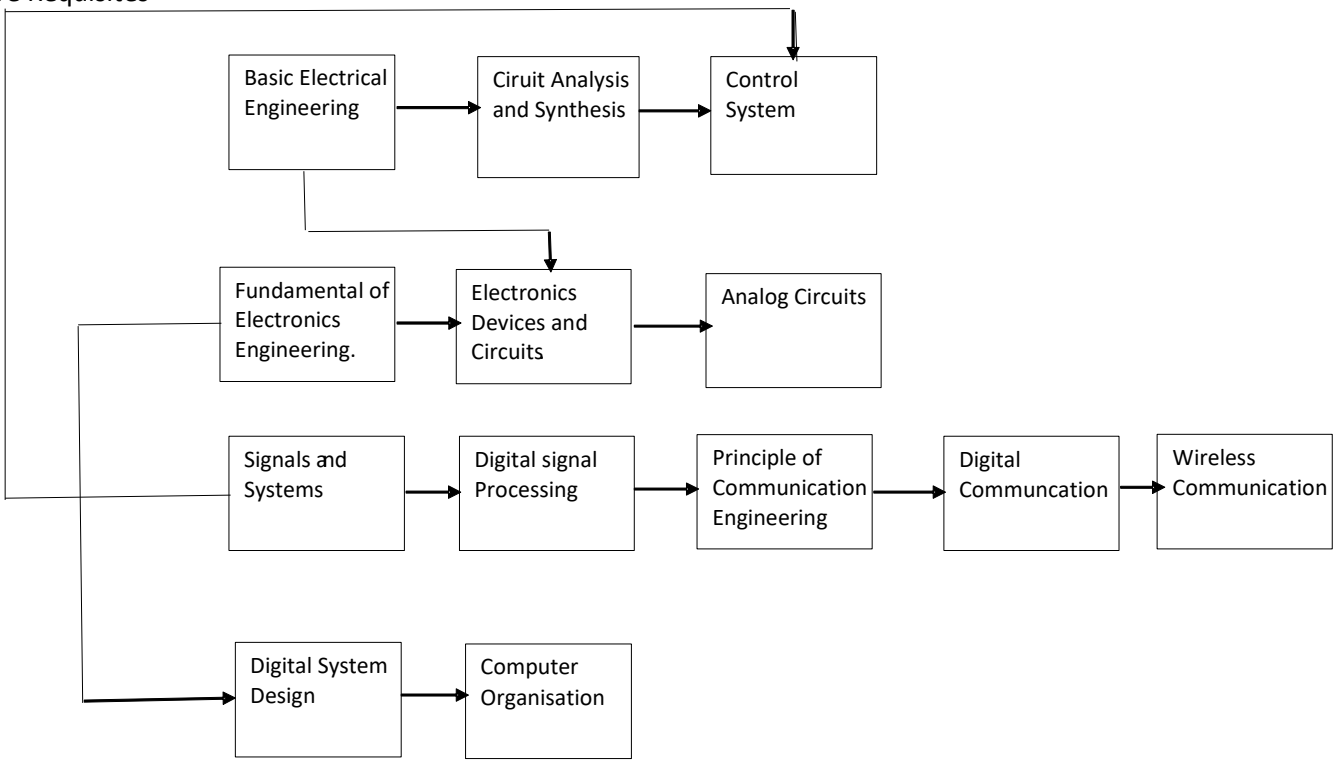
Basket/Area	ECE-DITU Credits
Language and Literature (LL)	6
Core Sciences (CAS)	10
Core Mathematics (CM)	12
Engineering Sciences (ES)	20
Discipline Core (DC)	48
Discipline Elective (DE)	24
Humanities and Social Sciences (HSS)	6
Skill Enhancement Courses (SEC)	8
Ability Enhancement Courses (AEC)	8
Free Electives (FE)	6
Projects (PRJ)	12
Total	**160**

Structure of the Undergraduate program in Electronics and Communication Engineering

Basket/Area	Min Credits To be taken	Credit per course	Courses
Language and Literature (LL) Core: Professional Communication Elective: Choose any 1 more LL course	6	3	2
Core Sciences (CS) Core: Wave & Optics and Introduction to Quantum Mechanics Elective: Choose any one elective from CAS basket	10	5	2
Core Mathematics (CM) Core: Maths 1, Maths2, and Maths 4 Elective: None	12	4	3
Engineering Sciences (ES) Core: Programming for problem solving, Fundamental of Electronics Engineering, Data structures and Basic Electrical Engineering Elective: Choose any 1 more ES Course	20	4	5
Discipline Core (DC) Core: CAS, SS, EDC, DSD, Analog Circuits, EM & WP, CO, DSP, Control System, POC, Digital Communication, and Wireless Communication Elective: None	48	4	12
Discipline Elective (DE) Core: None Elective: Choose any 8 courses as per your Specialization,	24	3	8

Humanities and Social Sciences (HSS) Core: Principles of Management Elective: Choose any 1 more HSS Courses	6	3	2
Skill Enhancement Courses (SEC) Core: None Elective: Choose any 4 SEC Course	8	2	4
Ability Enhancement Courses (AEC) Elective: Choose any 4 AEC Course	8	2	4
Free Electives (FE) Core: None Elective: Choose any 3 courses across University course offerings	6	3	2
Thesis Project (TP) Mode A: Project with a department faculty Mode B: Project as part of Industry Internship Mode C: Project in an academic institute/lab of National Importance. All Modes must be semester long	12	12	1
Total Credits	160		

Pre Requisites



Course Baskets: University FFCBCS Baskets for B.Tech (ECE)Programs. A * against a course means it is a core course for all B.Tech students.

Course Code	FFCBCS Baskets (other than DC/DE)				
	Language and Literature (min 6 credits to be taken)	**Credits**			
	Name of Courses	L	T	P	C
LAF181	Professional Communication*	2	0	2	3
LAF182	Indian English Literature	3	0	0	3
LAF183	English Language Teaching	3	0	0	3
	Core Sciences (min 10 credits to be taken)				
	Name of Courses	L	T	P	C
CHF101	Engineering Chemistry (For CS/IT/EE/ECE)	3	1	2	5
CHF102	Applied Engineering Chemistry (for ME/CE/PE/ECE/EE)*	3	1	2	5
PYF101	Wave & Optics and Introduction to Quantum Mechanics	3	1	2	5
PYF102	Introduction to Mechanics	3	1	2	5
PYF103	Electricity & Magnetism	3	1	2	5
PYF105	Engineering Physics* (Since 2022)	3	1	2	5
	Core Mathematics (min 12 credits to be taken)				
	Name of Courses	L	T	P	C
MAF101	Engineering Mathematics I*	3	1	0	4
MAF102	Engineering Mathematics II*	3	1	0	4
MAF201	Engineering Mathematics III (EE, ME, CE)	3	1	0	4
MAF202	Probability and Statistics (CSE, IT, ECE, PE)	3	1	0	4
	Engineering Sciences (min 20 credits to be taken)				
	Name of Courses	L	T	P	C
ECF101	Fundamental of Electronics Engineering*	3	0	2	4
EEF101	Basic Electrical Engineering *	3	0	2	4
EEF143	Electrical and Electronics Engineering Practice (non EE/EECE)	3	0	2	4
MEF101	Thermodynamics	3	1	0	4
MEF201	Mechanical Engineering Materials	3	1	0	4
CSF101	Programming for Problem Solving*	3	0	2	4
CSF102	Data Structures*	3	0	2	4
MEF102	Engineering Graphics	2	0	4	4
MEF103	Engineering Mechanics	2	1	2	4
MEF201	Engineering Materials	3	0	2	4
PEF204	Fluid Mechanics	3	0	2	4
EEF141	Electrical Engineering Material	3	1	0	4
ECF142	Fundamental of Semiconductor Electronics	3	1	0	4
ECF144	Digital Electronics and Applications (non-EE/ECE, 2022-23 onwards)	3	0	2	4

	Skill Enhancement (min 8 credits to be taken)				
	Name of Courses	L	T	P	C
ECFXXX	Technical Training 1	0	0	4	2
ECFXXX	Technical Training 2	0	0	4	2
ECFXXX	Value Added Training 1	0	0	4	2
ECFXXX	Value Added Training 2	0	0	4	2
SWAYXXX	MOOCS Courses (as advised by the departments)	2	0	0	0
	Ability Enhancement (min 8 credits to be taken)				
	Name of Courses	L	T	P	C
CHF201	Environmental Science*	2	0	0	2
LAF285	Indian Constitution*	2	0	0	2
MEF483	Entrepreneurship and Start-ups*	0	0	4	2
UCF201	Aptitude and Soft Skills*	2	0	0	2
	Humanities and Liberal Arts (min 6 credits to be taken)				
	Name of Courses	L	T	P	C
LAF281	Introduction to Psychology	3	0	0	3
LAF381	Positive Psychology & Living	3	0	0	3
LAF481	Application of Psychology	3	0	0	3
LAF282	Human Values	3	0	0	3
LAF283	Literature, Language & Society	3	0	0	3
LAF284	Principles of Management	3	0	0	3
LAF482	Intellectual Property Rights	3	0	0	3
LAF382	Engineering Economics	3	0	0	3
	Free Electives (min 6 credits to be taken)				
	Name of Courses	L	T	P	C
ECF481	Analog Electronics (ECE)	2	0	2	3
ECF482	Cellular Communication Network (ECE)	2	0	2	3
ECF381	Microcontroller (ECE)	2	0	2	3
ECF382	Bio Medical Instrumentation (ECE)	2	0	2	3
ECF483	Digital Image processing (ECE)	2	0	2	3
CSF381	Software Project Management	3	0	0	3
CSF345	Introduction to Data Science	3	0	0	3
CSF482	Introduction to Cybersecurity	3	0	0	3
MEF381	Composites materials	3	0	0	3
MEF481	Total Quality Management	3	0	0	3
MEF482	Renewable Energy Sources	3	0	0	3
PEF 381	Carbon Capture and Sequestration	3	0	0	3
PEF 491	Polymer Technology	3	0	0	3
PEF 492	Health, Safety and Environment in Industry	3	0	0	3
CEF281	Properties of Materials	3	0	0	3
CEF382	Disaster Preparedness Planning & Management	3	0	0	3
CEF481	Environmental Management & Sustainability	3	0	0	3
CEF482	Natural Dynamics	3	0	0	3
CEF483	GIS	3	0	0	3
CEF484	Resource Dynamics and Economic Implications	3	0	0	3

	Project (12 credits)					
UCF439	Capstone Project		0	0	24	12
	Discipline Core (48 credits)					
	Name of courses	**Prerequisite**				
EEF201	Circuit Analysis and Synthesis	None	3	0	2	4
ECF202	Signals and systems	None	3	1	0	4
ECF203	Electronics Devices and Circuits	None	3	0	2	4
ECF204	Digital System Design	None	3	0	2	4
ECF205	EM and WP	None	3	1	0	4
ECF211	Analog Circuits	None	3	0	2	4
ECF213	Computer Organisation	None	3	1	0	4
ECF214	Digital Signal processing	None	3	0	2	4
EEF302	Control System	None	3	0	2	4
ECF302	Principles of Communication	None	3	0	2	4
ECF311	Digital Communication	Principles of Communication	3	0	2	4
ECF401	Wireless Communication	None	3	1	0	4
	Discipline Electives (24 credits)					
	Name of courses	**Prerequisite**				
ECF341	Digital Design Using Verilog	Digital System Design	2	0	2	3
ECF342	Filter Design	Analog Circuits	2	0	2	3
ECF343	VLSI Technology	None	3	0	0	3
ECF441	Data Communication and Networks	None	3	0	0	3
ECF344	Advanced Antennas	None	2	0	2	3
ECF442	Digital Image Processing	Digital Signal Processing	2	0	2	3
ECF443	Design of Communications	Principle of Communication	3	0	0	3
ECF444	Optical Fibre Communication	None	2	0	2	3
ECF345	MATLAB for Engineers	None	2	0	2	3
ECF445	Satellite Communication	None	3	0	0	3
ECF446	Optical Network	None	3	0	0	3
ECF447	Photonics	Fundamental of Electronics Engineering	3	0	0	3
ECF448	Spread Spectrum systems	Digital communication	3	0	0	3
ECF346	VLSI Design	Electronics Devices and Circuits	2	0	2	3
ECF449	Microwave Devices	EM &WP	2	0	2	3
ECF348	Biomedical Instrumentation	None	2	0	2	3
ECF451	ANN & Fuzzy logic	None	2	0	2	3
ECF452	Latest Trends in Communication	None	3	0	0	3
ECF453	PLC,DCS and SCADA	None	3	0	0	3
ECF454	Transducer and Instrumentation	None	2	0	2	3
ECF 347	Microprocessor	Digital system Design	2	0	2	3
ECF 349	Microcontroller	Microprocessor	2	0	2	3
ECF 351	Principles of Antenna and Microwave	None	2	0	2	3

Flow of Actions for implementing FFCBCS every semester

After release of Final Exam results, FFCBCS council meets to decide & finalize course offerings in each basket

Courses are created in ERP and in LMS with required number of seats

Registrar announces the date for Registration

Students get advised and registers for courses in the Student Advising Centre

List of students gets added in LMS

Class Starts

SAMPLE PLAN OF STUDY

A Sample ECE Cohort Structure for 4 Years is mentioned below:

Semester 1			
S. NO.	**Course Code**	**Name of Course**	**Credits**
1	CS 1-PYF105	Engineering Physics	5
2	CM1-MAF101	Engineering Maths 1	4
3	LL1-LAF181	Professional Communication	3
4	ES1- CSF101	Programming for Problem Solving	4
5	ES2-EEF101	Basic Electrical Engineering	4
		Total Credits	**20**

Semester 2			
S NO	**Course Code**	**Name of Course**	**Credits**
1	CS2-CHF102	Applied Engineering Chemistry	5
2	CM2-MAF102	Engineering Maths 2	4
3	LL2-LAF182	Indian English Literature	3
4	ES3-CSF102	Data Structures	4
5	ES4-ECF101	Fundamental of Electronics Engineering	4
6	ES5-ECF142	Fundamental of Semiconductor Electronics	4
		Total Credits	**24**

Semester 3			
S NO	**Course Code**	**Name of Course**	**Credit**
1	EEF201	Circuit Analysis and Synthesis	4
2	ECF202	Signals and systems	4
3	ECF203	Electronics Devices and Circuits	4
4	ECF204	Digital System Design	4
5	ECF205	EM &WP	4
6	AEC1	One course from Ability Enhancement	2
		Total Credits	**22**

Semester 4			
S NO	**Course Code**	**Name of Course**	**Credit**
1	ECF 211	Analog Circuits	4
2	DE1	Discipline Elective	3
3	ECF213	Computer Organisation	4
4	ECF214	DSP	4
5	AEC2	One course from Ability Enhancement (Entrepreneurship and Start-ups)-MEF483	2
6	CM3 MAF202	Probability and Statistics	4
		Total Credits	**21**

Semester 5			
S NO	**Course Code**	**Name of Course**	**Credits**
1	EEF302	Control System	4
2	ECF302	Principles of Communication	4
3	DE2	Discipline Elective	3
4	DE3	Discipline Elective	3
5	SEC1	Skill Enhancement Course (Technical Training 1)	2
6	SEC2	Skill Enhancement Course(VAT 1)	2
7	HSS1	One course from Humanities and Liberal Arts	3
8	AEC3	One course from Ability Enhancement	2
		Total Credits	**23**

Semester 6			
S NO	**Course Code**	**Name of Course**	**Credits**
1	ECF311	Digital Communication	4
2	DE4	Discipline Elective	3
3	DE5	Discipline Elective	3
4	AEC4	One course from Ability Enhancement	2
5	FE1	Free Elective	3
6	SEC3	Skill Enhancement Course (Technical Training 2)	2
7	SEC4	Skill Enhancement Course(VAT 2)	2
		Total Credits	**19**

Semester 7			
S NO	**Course Code**	**Name of Course**	**Credit**
1	ECF401	Wireless Communication	4
2	DE6	Discipline Elective	3
3	DE7	Discipline Elective	3
4	DE8	Discipline Elective	3
5	HSS2	One course from Humanities and Liberal Arts	3
6	FE2	Free Elective	3
		Total Credits	**19**

Semester 8			
S NO	**Course Code**	**Name of Course**	**Credit**
1	UCF439	Project	12

Total Credits
160

Undergraduate Course Description Document

Semester: **First/Second Semester** **Year:** **First**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF101**
3.	**Course Title**	**Fundamental of Electronics Engineering**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Science**

8. Course Summary

This course is designed to serve as a first course in an undergraduate Electrical and Electronics & Communication Engineering (EECE) curriculum. The course introduces the fundamentals of electronics engineering. Topics covered include: Semiconductor theory; devices based on semiconductor materials like diodes, transistors; BJT and FET; Basics of Op-amp. Design and lab exercises are also significant components of the course.

9. Course Objectives

After successfully studying this course, students will be able to understand the basic electronics engineering principles and abstractions on which the design of electronic systems is based. These include diodes and transistors models and operational amplifiers. Student will be able to use these engineering abstractions to analyse and design simple electronic circuits. Student will be able to formulate and solve the problems of electronic circuits and analyse their behaviour.

10. Course Outcomes

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

1. Analyse circuits made up of linear and nonlinear elements. Specifically, analyse circuits containing resistors diodes and transistors such as rectifiers, clampers and clippers.
2. Determine the output produced by a circuit for a given set of inputs using diode, op-amp and transistors
3. Analyse the difference between bipolar and unipolar semiconductor devices and distinguish the designing difference and their parameters.
4. Study the digital logic and their operations in various applications.

11. Curriculum Content

Unit 1: Semiconductor Diodes:

Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes, p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Diode small signal model, Zener diode and applications, Rectifier Circuits

Unit 2: Bipolar Junction Transistors (BJTs):

Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, DC load line and operating point Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes

Unit 3: Field Effect Transistor (FET):
Junction Field-Effect Transistor (JFET). current-voltage characteristics, Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, Depletion-type MOSFET, D.C. operation of MOSFET circuits, Transfer characteristics, Shockley equation.

Unit 4: Operation Amplifier (Op-amps):
Ideal Op-amp, Differential amplifier: differential and common mode operation, common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted, summer, integrator, differentiator.

Unit-5: Digital Logic
Binary, octal, Hexadecimal and Decimal Number systems, Boolean algebra, Basic Logic gates, Universal Logic gates and their implementation and K-map up to 4 variables only

List of Experiments

1. To identify and Study of the various component and Devices of electronics with their specification (CRO, Function Generator, Multimeter, Power Supply, resistor, capacitor, inductor, ICs, LED, potentiometer etc.)
2. To study the V-I characteristics of PN diode
3. To study the V-I characteristics Zener diode.
4. To find the efficiency of rectifiers and ripple factor of capacitive and non-capacitive half wave and full wave rectifier.
5. To Study and verify clipper and clamper with biased circuits.
6. To find the characteristics of CB and CE amplifiers.
7. Determine the characteristics of FET.
8. Verifications of all logics gates.

Textbook(s)

1. Millman J., Halkias C.C., Jit S., “Electronic Devices and Circuits”, Tata McGraw-Hill, 2nd 2007.
2. Boylstead R.L., Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson, 10th 2009 Edition.

Reference Books

1. S.Shalivahanan, Electronics Devices & Circuits, Vikas Publication, 2nd Edition.2018
2. Ramakant A. Gayakwad, Op-Amp and Linear Integrated Circuits, Pearson Publications, 6th Edition.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **First/second Semester** **Year:** **First**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF101**
3.	**Course Title**	**Basic Electrical Engineering**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	
7.	**Course Basket**	**Engineering Science**

8. Course Summary

To provide comprehensive idea about AC and DC circuit analysis, working principles and applications of basic machines in electrical engineering.

9. Course Objectives

- To provide working knowledge for analysis of basic DC & AC circuits used in electrical & electronic devices.
- To impart a basic knowledge of electrical quantities such as current, voltage, phasor diagram, power factor, power, energy and frequency.
- To provide basic idea of power system, single phase and three phase systems.
- To give an introductory idea about 1-phase transformers.
- To explain working principle, construction, applications of DC and AC machines.

10. Course Outcomes

- To understand and analyses AC & DC circuits.
- To understand the behavior of circuit elements for single-phase circuits.
- To understand the generation of three-phase power and operation of three-phase circuits.
- To understand the construction and operation of transformers, DC generators and motors, induction motors, and synchronous generators.

11 Curriculum Content

Unit 1: D.C. Network Theory

Review of basic circuit theory concepts, Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star – delta transformation, Magnetic Circuits.

Unit 2: A.C. Circuits

Single Phase A.C.: Phasor representation of voltage and current, A.C. circuit behavior of resistance, inductance, capacitance & their combination in series and parallel, Power triangle, Power factor, Concept of series & parallel resonance.

Three Phase A.C.: Star – delta connections, Relation between line and phase quantities, three phase power and its measurement, What is 3 phase 4 wire and 3 phase 3 wire system.

Unit 3: Power System & Transformers

Single line diagram of simple power system.

Single phase Transformer: Principle of operation, Types of construction, Phasor diagram, Equivalent circuit, Efficiency and voltage regulation, O.C. and S.C. tests.

Unit 4: D.C. & Synchronous Machines

D.C. Machines: Construction and working principle of d.c. generator and d.c. motor, Types of d.c. machines, E.M.F. equation, Torque equation, characteristics, Losses and efficiency, Need of starter in d.c. motors.

Synchronous Machines: Construction and Principle of operation of Alternator and Synchronous Motor.

Unit- 5: Induction Motors

Three Phase Induction Motors: Principle of operation of 3-Ø induction motor, Types of 3-Ø induction motor, Need of starters in 3-Ø induction motors, Slip – torque characteristics

Single Phase Induction Motor: Principle of operation of single phase induction motor by double revolving field theory, Methods of starting of single phase induction motor.

Textbook(s)

1. V. Del Toro. “Principles of electrical Engineering”, Prentice hall International.
2. J. Nagrath, “Basic Electrical Engineering”, Tata Mc Graw Hill.

Reference Books

1. W.H. Hayt & J.E. Kemmerly, “Engineering circuit Analysis”, Mc Graw Hill.
2. H. Cotton, “Advanced Electrical Technology” Wheeler Publishing.

List of Experiments

1. Verification of Network Theorems.
2. Study of diode characteristics. Study of phenomenon of resonance in RLC series circuit.
3. Measurement of power in a three phase circuit by two wattmeter method.
4. Measurement of efficiency of a single phase transformer by load test.
5. Determination of parameters and losses in a single phase transformer by OC and SC test.
6. Study of characteristic of DC Motor.
7. Study of characteristic of AC Motor.
8. DC generator characteristics.
9. Speed control of dc shunt motor.
10. Study running and reversing of a three phase induction motor.
11. Study of a single phase energy meter.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **First/Second Semester** **Year:** **First**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF143**
3.	**Course Title**	**Electrical and Electronics Engineering Practice**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**none**
7.	**Course Basket**	**Engineering Science**

8. Course Summary

The course introduces the fundamentals of electronics and electrical engineering. In this syllabus the fundamentals of Circuits,semiconductors,Electronics devices and electrical machines would be studied by the students.The fundamental concepts of digital logic have been also included.

9. Course Objectives

- To acknowledge students about charge, current, voltage and various circuit laws involved in analysis.
- To provide students with the basic knowledge of operation and working different types of electrical machines and their application
- To get acquaints student with fundamental knowledge of semiconductor devices their characteristics and modelling in different applications.
- To provide students with the basic knowledge of digital logic.

10. Course Outcomes

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

1. Fundamental knowledge about charge, current, voltage and various basic electric circuit laws.
2. DC circuit analysis and methods.
3. Basics of AC circuits elements and various methods involved.
4. Functioning of DC machines and its characteristics.
5. Fundamental theory of semiconductor devices, fermi level and concept of doping.
6. Basics of different types of transistor configuration, modelling and their application.
7. Basics of logics circuits.

11. Curriculum Content

UNIT 1 – DC NETWORK THEOREM

Review of basic circuit theory concepts, Mesh and Nodal analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star – Delta transformation

UNIT 2 – AC CIRCUIT'S AND FUNDAMENTALS OF SEMICONDUCTORS

Single Phase AC: Phasor representation of voltage and current, AC circuit behaviour of Resistive, Inductive and Capacitive Load and their combination in series, Power triangle, Power factor

Introduction to three phase AC

Fundamentals of semiconductors: Energy bands in semiconductors, Intrinsic and extrinsic semiconductors, Fermi level.

UNIT 3: DIODE AND TRANSISTOR FUNDAMENTAL:

Diode circuits: Construction, Junction diode characteristics, Half and full wave rectifiers - Expression for efficiency, Zener Diode Characteristics and its application as voltage regulator.

Transistor circuits: Construction and characteristics of a transistor in CB, CE and CC modes - Relative merits, Construction and characteristics of JFET and MOSFET.

UNIT IV: DIGITAL LOGIC:
Binary and Decimal Number systems, Boolean algebra, Basic Logic gates, Universal Logic gates and K-map upto 4 variables only.

UNIT V – ELECTRICAL MACHINES
Transformers: Principle of Operation and EMF equation DC Machines: Construction, working principle & characteristics Induction & synchronous Machines: Principle of operation of 3 φ and 1 φ Induction Motor and synchronous machine.

List of Experiments:
1. Verification of Network Theorems.
2. Measurement of efficiency of a single phase transformer by load test.
3. Determination of parameters and losses in a single phase transformer by OC and SC test.
4. Perform the polarity test on Transformer.
5. Study of characteristic of AC Motor.
6. Study of DC shunt and series generator characteristics.
7. Study the Speed control of dc shunt motor.
8. Study running and reversing of a three phase induction motor.
9. To identify and Study of the various component and Devices of electronics with their specification (CRO, Function Generator, Multimeter, Power Supply, resistor, capacitor, inductor, ICs, LED, potentiometer etc.)
10. To study the V-I characteristics of PN diode and Zener diode.
11. To find the efficiency of rectifiers and ripple factor of capacitive and non-capacitive half wave and full wave rectifier.
12. To Study and verify clipper and clamper with biased circuits.
13. To find the characteristics of CB and CE amplifiers.
14. Determine the characteristics of FET.
15. Verifications of all logics gates.

Textbook(s)

1. Vincent Del Toro, “Principles of Electrical Engineering”, Prentice Hall Publication.
2. Electronics Devices and Circuits, Millman and Halkias, Tata McGraw Hill, 4t h ed.

Reference Book

1. I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill Publication.
2. Electronic Communication Systems, John Kennedy , Tata McGraw Hill, 4th ed.

12. Teaching and Learning Strategy
All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF142**
3.	**Course Title**	**Fundamental of Semiconductor Electronics**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Science**

8. Course Summary

Semiconductor Physics deals with concepts which are responsible for the majority of modern technology. These properties determine the material mechanical strength. Semiconductor Physics gives guidance to the principles of the circuits needed for modern electronic devices. It gives both the Transistor & the Semiconductor Chip.

9. Course Objectives

- To provide an insight into the basic semiconductor concepts
- To provide a sound understanding of current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

10. Course Outcomes

On successful completion of the course, students will be having a good knowledge in semiconductor theory and electronic devices.

11. Curriculum Content

Unit 1: Elemental and compound semiconductors: Fermi-Dirac distribution, Fermi levels for Intrinsic and Extrinsic semiconductors, Dependence of fermi level on temperature, Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration.

Unit 2: Carrier transport in semiconductors: drift, conductivity and mobility, variation of mobility with temperature and doping, Excess carriers in semiconductors: Generation and recombination, mechanisms of excess carriers, Einstein relations, Continuity equations, Diffusion length.

Unit 3: PN junctions: Contact potential, Electrical Field, Potential and Charge density at the junction, Energy band diagram, Minority carrier distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction, piecewise linear model of a diode effect of temperature on V-I characteristics

Unit 4:Diode capacitances: switching transients, Electrical Breakdown in PN junctions, Zener and avalanche break down (abrupt PN junctions only), Tunnel Diode basics only, Metal Semiconductor contacts, Ohmic and Rectifying Contacts, current voltage characteristics

Unit- 5: BJT and MOSFET: current components, Minority carrier, distributions, basic parameters, Evaluation of terminal currents (based on physical dimensions),Transistor action, Base width modulation, Metal Insulator semiconductor devices: The ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics, threshold voltage MOSFET: Output characteristics, transfer characteristics, sub threshold characteristics, MOSFET scaling (basic concepts)

Textbook(s)

1. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2. Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill,2015

Reference Books

1. Tyagi M.S., Introduction to Semiconductor Materials and Devices, Wiley India, 5/e, 2008
2. Sze S.M., Physics of Semiconductor Devices, John Wiley, 3/e, 2005
3. Neamen, Semiconductor Physics and Devices, McGraw Hill, 4/e, 2012
4. Pierret, Semiconductor Devices Fundamentals, Pearson, 2006
5. Rita John, Solid State Devices, McGraw-Hill, 2014
6. Bhattacharya .Sharma, Solid State Electronic Devices, Oxford University Press, 2012
7. Dasgupta and Dasgupta , Semiconductor Devices : Modelling and Technology (PHI)

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF141**
3.	**Course Title**	**ELECTRICAL ENGINEERING MATERIALS**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Sciences**

8. Course Summary

This course provides knowledge regarding the structure of different types of materials, to understand the factors affecting thermal and electrical conductivity of materials. To have understanding about different types of materials used in engineering and their applications.

9. Course Objectives

- In this course student will learn the Crystal structure of materials
- The student will learn about electron theory of materials
- The student will learn about thermal conductivity and study the material properties according to use in electrical equipment

10. Course Outcomes

- To have knowledge about the types of engineering materials.
- Various phenomena associated with different types of materials.
- Applications of these materials in different fields.

11. Curriculum Content

Unit 1 Crystal Structure of Materials: Bonds in solids, crystal structure, co-ordination number, atomic radius representation of plane distance b/w two planed packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth

Unit 2 Electrical Engineering Material: Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, Half effect, Drift and Diffusion currents, continuity equation, thermoelectric effect, superconductivity and super conducting materials, optical properties of solids.

Unit 3 Magnetic Material: Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, Properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Unit 4 Dielectric Materials: Polarization and Dielectric constant, Dielectric constant of mono-atomic, Poly atomic gases and solids, frequency dependence of electronic and ionic polarizabilities, dipolar relaxation, dielectric loss, piezoelectricity, ferroelectric materials

Unit 5 Semiconductor Material And Devices: Properties of semiconductors, Conductivity of insulators, Metals and semiconductor in terms of energy bands, Intrinsic and Extrinsic semiconductors, Concentration of charge carriers, Hall effect, Drift and Diffusion current, semiconductor junction diode, Integrated circuits, semiconducting materials.

Textbook(s)

A.J. Dekker, “Electrical Engineering Materials”, Prentice Hall of India

R. K. Rajput, “Electrical Engineering Materials”, Laxmi Publications

Reference Books

Solymar, “Electrical Properties of Materials” Oxford University Press.

Ian P.Hones, “Material Science for Electrical & Electronic Engineering,” Oxford University Press.

J.B.Gupta, “Electrical and Electronics Engineering Materials” Katson publishers

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **Third Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**EEF201**
3.	**Course Title**	**Circuit Analysis and Synthesis**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce students about the concepts of Circuit, network, Graph theory, different types of network theorem, various types of two port networks, network functions, concepts of transfer function, poles and zeros. It also includes overview of network synthesis rules, driving point impedance and admittance, fauster and cauer rules for synthesis of different types of network.

9. Course Objectives

The purpose of this course is to provide basic understanding of the different types of continuous time signals and systems and their mathematical representation. To provide knowledge of graph theory applicable for analysis of electrical circuits. The students will understand of different two port network parameters.

10. Course Outcomes

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

1. An ability to design and analyze electrical circuits
2. An ability to control AC and DC circuits by using Basic Electrical devices
3. An ability to visualize and work on laboratory and multi-disciplinary tasks

11. Curriculum Content

Unit 1: INTRODUCTION TO CONTINUOUS TIME SIGNALS AND SYSTEMS

Basic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics. Waveform synthesis. Introduction to various types of systems, Causal and Non- causal, Stable and Unstable, Linear and Non-linear, Time invariant and Time varying systems.

Analogous System: Mechanical elements for translational and rotational systems, force-voltage and force-current analogy, torque-voltage and torque-current analogy.

Unit -2: GRAPH THEORY

Graph of a Network, definitions, tree, co tree, link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix, Duality, Loop and Node methods of analysis.

Unit-3: NETWORK THEOREMS (APPLICATIONS TO AC NETWORKS) AND NETWORK FUNCTIONS

Review of KVL,KCL ,Nodal & Mesh Analysis and network Theorems for DC ,Super- position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.

Network functions: Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions

UNIT-4: TWO PORT NETWORKS

Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter- relationships between the parameters, Inter- connections of two port networks, Ladder and Lattice networks: T & Π representation

UNIT-5: NETWORK SYNTHESIS

Positive real function; definition and properties; 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.

Textbook(s)

1. William Hayt, Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition
2. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.

Reference Books

1. Kuo, "Network Analysis & Synthesis", Wiley India.
2. Jagan, "Network Analysis", B S Publication.
3. ME Van-Valkenberg; "Network Analysis", Prentice Hall of India.

List of Experiments:

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin's theorem with dc and ac sources.
3. Verification of Norton's theorem with dc and ac sources.
4. Verification of Maximum power transfer theorems in ac circuits.
5. Verification of cascade connection of 2, two -port networks.
6. To find Z and Y parameters of two-port network.
7. Time domain analysis of parallel RLC circuit using MULTI-SIM software.
8. To find current through and voltage across different elements of a given network using MULTI-SIM software.
9. Determination of transient response of current in RL circuit with step voltage input using MULTI-SIM software.
10. Determination of transient response of current in RC circuit with step voltage input using MULTI-SIM software.

List of two value added Experiments

1. Verification of superposition theorem using MULTI-SIM software.
2. Verification of reciprocity theorem using MULTI-SIM software.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **Third Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF202**
3.	**Course Title**	**Signals and Systems**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core (DC)**

8. Course Summary

This course is the study of analog and digital signals, a topic that forms an integral part of engineering systems in many diverse areas, including signal processing, seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumer products.

9. Course Objectives

To develop basic knowledge of signals and systems and its properties in Continuous time and Discrete time domain along with sampling procedure.The course will develop understanding of the concepts and applications of Continuous Time and Discrete Time Fourier Series/Transforms and analyse signals and systems in time as well as frequency domain .The course will develop understanding the concepts of Sampling and aliasing.

10. Course Outcomes

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

1. Classification of various signals and systems (continuous and discrete) based on their properties.
2. Determination of response of LTI systems using graphical or mathematical convolution.
3. Performing sampling of Continuous time signals using Nyquist criterion.

11. Curriculum Content

Unit 1: Time-Domain Analysis of Signals & LT I Systems:

Signals: Definition of Continuous Time (CT) and Discrete Time (DT) signals, Properties of CT & DT Signals, Operations on signals Systems: Types of Systems, Definition of CT & DT systems, system properties, Impulse response and the convolution integral and convolution summation, Properties of convolution, Analysis of LTI systems.

Unit 2: Frequency Domain Analysis of CT Signals and LTI Systems:

Fourier series (FS): Exponential FS and its properties, Continuous Time Fourier Transform (CTFT): Definition & Properties, Frequency Response of LTI systems.

Laplace Transform (LT): RoC, Properties and Applications. Relationship between Laplace transform and CTFT

Unit 3: Frequency Domain Analysis of DT Signals:

Sampling Theorem for Low Pass Signals, Nyquist Criterion, Aliasing, Discrete-Time Fourier Series, Discrete-Time Fourier Transform - Definition & Properties.

Unit 4: Frequency Domain Analysis of DT Systems:
Difference equation representation of I/O relationship, System properties in terms of the impulse response using DTFT, System response for complex-exponential inputs.

Unit- 5: Z-Transform:
Z-transform: Definition, existence and motivation, Evaluation of ZT, ROC and its Properties, Inverse ZT, Relationship between DTFT and z-transform, ZT Properties.

Textbook(s)

1. Signals and Systems, Oppenheim and Willsky with Nawab, 2nd Edition, Prentice Hall.

Reference Books

1. Linear Systems and Signals, B. P. Lathi, Oxford Press, 2nd Edition.
2. Signals and Systems, Tarun Kumar Rawat, 1st Edition, Oxford University Press, 2011
3. Signals and Systems, H P Hsu, Second Edition, Schaum's Outlines, Mc Graw Hill Education

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **Third Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF203**
3.	**Course Title**	**Electronic Devices & Circuits**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce students about fundamentals of semiconductors, formation of P-N junction, different diodes with their applications. The basic mechanism and characteristics of BJT and FETs would be studied by the students.

9. Course Objectives

To Understand

- The behaviour of charge carriers in Crystalline semiconductors
- Principles of p-n junction diode
- Working principles of Bipolar Junction Transistor Characteristics of Field Effect Transistors

10. Course Outcomes

The course provides an understanding of:

1. Understand various semiconductors and their characteristics.
2. Apprehend carrier transport in semiconductor.
3. Analyse PN junction diode and its characteristics for various applications.
4. Understand various types of diode and its characteristics.
5. Analyse characteristics of BJT, JFET and MOSFET.

11. Curriculum Content

Unit I: P-N Junctions:

Review of Fermi level, Review of types of Semiconductor, The abrupt junction: Energy bands in Thermal Equilibrium and biased conditions, Current flow in junctions, V-I characteristic of an ideal diode, Comparison with real diode, C – V characteristics of reverse biased p-n junctions, breakdown in reverse bias, DC and AC equivalent circuit of a p-n junction diode, Characteristic parameters of a diode.

Unit II: Diode Applications

Diode circuit models. Diode application as rectifier-Half and full wave, Derivation of parameters of rectifiers, operation of Filter circuits-shunt capacitor filter, Pi filter circuit, Zener diode as a voltage regulator, clipper, clamper, Diode as a switch, Photodiode and LED.

Unit III: DC and AC analysis of BJT:

Review of construction and working of Bipolar Junction Transistor

Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias Ebers – Moll Model, Small signal analysis using hybrid model of Common emitter BJT, approximate h-parameter model High frequency analysis of BJT using hybrid Pi model, Gain bandwidth product

Unit IV: DC and AC analysis JFET and MOSFET:

Review of construction and working of Field Effect Transistor

Junction Field Effect Transistor: Biasing configurations of JFET for common source configuration, small signal model of Common source, High frequency analysis of CS FET,MOSFET biasing, small signal model

Unit V: Power amplifiers and tuned amplifiers:

Class A large signal amplifiers, second-harmonic distortion, Transformer coupled audio power amplifier, Class B amplifier, Class AB operation, Tuned amplifers, Regulated power supplies, Series voltage regulator

List of Experiments:

1. Measurement of I – V characteristic if p – n junction diode
2. Study of positive and negative Clipper circuit using diode.
3. Study of positive and negative Clamper circuit using diode
4. Measurement of input and output characteristic parameters of BJT for common emitter configuration
5. Measurement of efficiency of a half wave rectifier circuit with and without filter circuit.
6. Measurement of efficiency of a Centre tap full wave rectifier circuit with and without filter circuit.
7. Measurement of I-V characteristics of JFET.
8. Study of switching behaviour of BJT.
9. Study of Zener diode as voltage regulator.
10. Study and verification of class –B Push Pull configuration.

List of two value added Experiments

1. Biasing of BJT for use as amplifier.
2. Design of 5V-1A regulated power supply.

Textbook(s)

1. Sedra and Smith, “Microelectronics Circuits-Theory and applications”, Oxford University Press,7th edition, 2015.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **Third Semester** **Year:** **Third**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF204**
3.	**Course Title**	**DIGITAL SYSTEM DESIGN**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course introduces students to the basic concepts of digital systems, including analysis and design. Both combinational and sequential logic will be covered. Students will gain experience with several levels of digital systems, from simple logic circuits to programmable logic devices and hardware description language.

9. Course Objectives

- To acquire the basic knowledge of digital logics and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.

10. Course Outcomes

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

1. To understand and examine the structure of various number systems and its application in digital design
2. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
3. The ability to understand, analyse and design various combinational and sequential circuits.
4. To develop skill to build digital circuits.

11. Curriculum Content

UNIT 1-INTRODUCTION:

Number Systems, Basic & Universal Logic gates, Boolean algebra, Direct Conversion of various base, Negative number representations, Floating point number representation, BCD & EXCESS-3 arithmetic, Error detecting and correcting codes: Hamming code, parity code, Review and Limitation of K-Map, Quine-Mcclusky Method (Tabular Method).

UNIT 2-COMBINATIONAL LOGIC CIRCUITS:

Characterization of digital circuits: Combinational & Sequential Logic circuit. Design Procedure-Arithmetic Circuits: Adders, Subtractors, Parallel Adder, BCD Adder, and Multiplier. Design

Procedure-Switching Circuits: Decoder, Encoder, Priority Encoder, Multiplexers, Demultiplexers and their applications, Magnitude Comparators. Design Procedure-Other Circuits: Parity checker and generator, Code Conversion: Binary to BCD, BCD to Binary, BCD to Excess-3, Excess-3 to BCD.

UNIT 3-SEQUENTIAL LOGIC CIRCUITS:

Latches. Race around condition, Propagation Delay. Flip-Flops: SR, D, JK & T Flip Flops and their conversions, Master-Slave Flip Flop, Edge Triggered Flip-Flop, Characteristic Table, Characteristic Equation, State Table, State Diagram, Excitation Table & Diagram, Analysis with JK Flip-Flop, Design Procedure of Asynchronous and Synchronous Sequential Circuits, Designing with unused states. Finite State Machine: Mealy and Moore Models.

UNIT 4-APPLICATION OF SEQUENTIAL LOGIC CIRCUITS:

Registers: Registers with Parallel Load, Serial Transfer, Shift Registers with Parallel Load, Bidirectional Shift Register, Universal Register. Counters: Asynchronous Counters-Ripple Up and Down Counters using JK Flip-Flop, impact of Propagation delay. Counters: Synchronous Counters - Binary Counter, Counter with D Flip-Flop, Up & Down Counters, BCD/Decade Counters.

UNIT 5-LOGIC FAMILIES & PROGRAMMABLE LOGIC DEVICES:

Logic Families: Diode, BJT & MOS as a switching element, Characteristics of digital ICs, ECL, TTL, I2L, Tri-state, PMOS, NMOS and CMOS Comparison of standard logic families, PAL, PLA

List of Experiments:

1. Implementation of All Logic Gates using Universal gates (NAND & NOR both).
2. Bread-board implementation (Parallel adder, One bit Multiplier, One bit Magnitude comparator, parity checker)
3. Bread-board implementation of any one code converter (i.e. Gray Code, BCD Code, Excess-3, Hex. etc.).
4. Design of shift registers (SISO, SIPO, PIPO, and PISO), up and down counters.
5. Design of Mod-6 types of Asynchronous Counters.
6. Transfer characteristics of TTL and CMOS inverters.
7. Realization of Decoder, Multiplexer, encoder and De-multiplexers using IC 74138.
8. To design & Implement PAL.
9. To design & implement PLA.
10. Clock circuit realization using 555, CMOS inverter.

Textbook(s)

1. Digital Design, M. Morris Mano and M. D. Ciletti, 4th Edition, Pearson

Reference Books

1. Digital Systems: Principles and Design, Raj Kamal, Pearson
2. Maini, Digital Electronics: Principles and Integrated Circuits, Wiley India.
3. Switching Theory and Finite Automata, Kohavi, TMH Publications.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **III Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF205**
3.	**Course Title**	**Electromagnetic and Wave Propagation**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce students about problem solving techniques using different coordinate systems. It can familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. It can also expose the students to the ideas of electromagnetic waves and structure of transmission line.

9. Course Objectives

To understand

1. The concept of electromagnetic field
2. The electromagnetic wave and their propagation
3. Transmission lines and wave guides.

10. Course Outcomes

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

1. To acknowledge students about electric field and magnetic field.
2. To get acquaints students with the basic idea of electromagnetic wave, characteristics of electromagnetic waves.

11. Curriculum Content

Unit 1: Coordinate Systems and Transformation

Cartesian Coordinates, Circular Cylindrical Coordinates, Spherical Coordinates Vector Calculus: Differential Length, Area and Volume, Line Surface and Volume Integrals, Del Operator, Gradient of a Scalar, Divergence of a Vector and Divergence Theorem, Curl of a Vector and Stoke's Theorem, Laplacian of a Scalar.

Unit 2: Electromagnetic Wave Propagation

Faraday's Law, Electromotive Forces, Displacement Current, Derivation of Maxwell's Equations For Static and Time- Varying Fields. Differential and integral forms, concept of displacement current, Boundary conditions.

Unit 3-Electromagnetic Wave Propagation Applications

Electromagnetic Wave Propagation: Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Wave in Free Space, Plane Waves in Good Conductors, Power and The Poynting Vector, Reflection of a Plane Wave at Normal incidence.

Unit 4-Transmission Lines

Transmission Lines: Transmission Line Parameters, Transmission Line Equations, Input Impedance, Standing Wave Ratio and Power, Smith Chart, Some Applications of Transmission Lines, Low loss RF and UHF transmission lines, Distortion less condition. Transmission line charts-impedance matching.

Unit 5-Waveguides

Wave Guides: Introduction to Planar (Rectangular) Waveguides, Derivation of TE and TM Modes, TEM Mode, Impedance and characteristics impedances. Transmission line analogy for wave guides, Attenuation and factor of wave guides, Resonators.

Textbook(s)

1. Elements of Electromagnetics, M N O Sadiku.

Reference Books

1. Engineering Electromagnetic, William Hayt, McGraw-Hill Electronic Communication Systems, John Kennedy, Tata McGraw Hill, 4th edition.
2. Electromagnetic Fields, K. D. Parsad

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **IV Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF211**
3.	**Course Title**	**Analog Circuits**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce students about analog circuit design concepts. It also includes overview of elementary circuits like BJT as a single stage amplifier, Multi-stage amplifier, oscillators and applications of op-amp as open loop and closed loop circuit. Topics would include biasing of analog circuits, gain frequency analysis in different frequency range of operation, op-amp characteristics and different operation performed by op-amp, IC-555 timer, A-D and D-A convertors.

9. Course Objectives

The purpose of this course is to provide the students with solid foundations in the basic concepts of Bipolar Junction transistor and Operational Amplifier. The main objective of the course is to teach the students how to select the components for desired analog circuit output and design circuit that are appropriate for problems that they might encounter. This course is also about showing the analysis part of the analog circuit for different circuit parameters like gain, bandwidth, and impedance. This course offers the students a mixture of theoretical knowledge and practical experience.

10. Course Outcomes

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

1. The working principles of basic transistor based circuits.
2. The methodology for analysis and design of the amplifiers, oscillators and power amplifiers.
3. To understand the working of operational amplifier
4. To understand analog / special function ICs such as wave shaping ICs, ADC, DAC.
5. To analyse and design the circuits based on the these ICs.

11. Curriculum Content

Unit 1: Multistage amplifiers: -

Review of BJT as an amplifier and it's high frequency , Need for multistage, coupling, types of coupling, Mid-band Frequency response of amplifiers, two stage RC coupled amplifiers, Darlington Amplifier, CASCODE amplifiers.

Unit 2: Feedback & Oscillators :-

Oscillators- concept of negative Feedback, Conditions of oscillation, Feedback topologies and their effect on input, output resistances , Hartley, Colpitt (mathematical analysis), Wein Bridge, RC phase shift Oscillators (mathematical analysis). Quartz crystal oscillators

Unit 3: Introduction to op-amp:-

Operational amplifier: Ideal op – amp, internal block diagram of op-amp (for IC741). Practical op – amp - Transfer characteristic and equivalent circuit, Characteristic parameters of practical op-amp, data sheet of IC741, Differential amplifier, current mirrors as active load.

Unit 4: Applications Op-amp-1:-
Open loop and closed loop configurations of op-amp, Inverting and non – inverting amplifiers, Voltage Follower, V-to-I and I-to-V converters, Instrumentation amplifier, Integrator, Differentiator, Comparators, Schmitt trigger, Low-pass, high-pass and band-pass Butterworth filters.

Unit- 5: Applications Op-amp-2:-
IC 555 Timer and its applications, Astable, Mono-stable and Bi-stable Multivibrator.
Digital to Analog Converter (DAC): R – 2R ladder type DAC.
Analog to Digital Converters: Sample and Hold Circuits, Flash and Successive approximation type ADC, Dual Slope ADC.

Textbook(s)

1. Sedra and Smith, "Microelectronics Circuits-Theory and applications", Oxford University Press,7th edition, 2015
2. Ramakant A.Gayakwad, OP-AMP and Linear ICs, Prentice Hall / Pearson Education, 4th Edition, 2001.

Reference Books

1. Millman and Halkias, "Millman's Electronic Devices & Ciruits" . McGraw Hill Education, 4th Edition, 2015
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson 11th Edition, 2015
3. Donald A. Neamen, "Electronic Circuits -Analysis and Design", McGraw Hill Education, 3rd Edition..
4. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000
5. S.Salivahanan & V.S. Kanchana Bhaskaran, Linear Integrated Circuits, TMH, 2008
6. J.Michael Jacob, Applications and Design with Analog Integrated Circuits, Prentice Hall of India, 1996.

Experiment List:

1. Biasing of BJT for use as amplifier.
2. Measurement of frequency response of CE amplifier.
3. Study of Class B push pull BJT based amplifier.
4. Study of Hartley and Colpitt oscillator.
5. Study of Wien Bridge oscillator.
6. Study of RC phase shift oscillator.
7. Study of OP-Amp based Inverting and non-inverting voltage follower circuits.
8. Measurement of DC parameters of OP-Amp.
9. Study of OP-Amp based analog adder and subtractor.
10. Study of OP-Amp based I to V and V to I converter.
11. Study of OP-Amp based BPF.
12. Study of IC 555 based monostable and astable multivibrator.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF351**
3.	**Course Title**	**PRINCIPLES OF ANTENNA and MICROWAVE**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

The course provides an understanding of transmission parameter, field radiations & antenna parameters Basic antennas & parameter measurement, Microstrip antenna, and array. Also provides an understanding of Wave Propagation and structure of atmosphere.

9. Course Objectives

1. To understand basic terminology and concepts of Antennas.
2. To have knowledge on antenna operation and free space propagation
3. To understand basics of Microwave communication and devices.

10. Course Outcomes

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

- Aware of parameter considerations like antenna efficiency, beam efficiency, radiation resistance etc. in the design of an antenna.
- Knowledge about the means of propagation of Electromagnetic wave i.e. free space propagation and also about frequency dependent layer selection, its respective issues for an effective transmission of information in the form of EM wave to a remote location and related issues.
- Understanding of Microwave components and their mathematics.
- Microwave semiconductor devices used to realized amplifiers and oscillators.

11. Curriculum Content

UNIT 1: FIELD RADIATIONS & ANTENNA PARAMETERS:

Review of Maxwell's equation & electromagnetic wave in brief, plane wave & uniform plane wave in free space, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Antenna Parameters.

UNIT 2: ANTENNA ARRAYS and PRACTICAL ANTENNAS

Antenna Arrays: Introduction, various forms of antenna arrays, arrays of point sources, , multiplication of patterns, Folded dipole antenna, Yagi-Uda antenna, helical antenna, horn antenna, slot antenna, microstrip or patch antennas.

UNIT 3: FREE SPACE WAVE PROPAGATION and MICROWAVE COMMUNICATION:

Basic idea of ground wave, surface wave, and space wave propagation, tropospheric propagation and duct propagation. Microwave frequency range, applications of microwaves, Scattering matrix- Concept of two port scattering matrix representation.

UNIT 4:MICROWAVE PASSIVE COMPONENTS:
Microwave junctions, couplers, Ferrites, properties and applications: Gyrator, Isolator, Circulator, Attenuator, Phase changer, impedance matching networks

UNIT 5: MICROWAVE TUBES AND MEASUREMENTS:
High frequency limitations, Principle of operation of Multi- cavity Klystron, Traveling Wave Tube Microwave measurements: Measurement of power, impedance.

Textbook(s)

1. Krauss J D, "Antennas", 4th edition, McGraw - Hill Inc., New York (1991).
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Liao Samuel, "Microwave Devices & Circuits", PHI Learning, New Delhi, (Latest edition)

Reference Books

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd ed., 2005.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.
3. Robert. E. Collin, 'Foundation of Microwave Engg', McGraw Hill.

List of Experiments

1. Study the Antenna Transmitter and Receiver trainer for different type of Antenna.
2. Draw the radiation pattern & find the characteristics of dipole (half-wave) antenna.
3. Draw the radiation pattern & find the characteristics of folded dipole antenna.
4. Draw the radiation pattern & find the characteristics of Yagi uda antenna.
5. Draw the radiation pattern & find the characteristics of horn antenna.
6. Study of Gunn Diode Characteristics
7. Study of Reflex Klystron Characteristics
8. To study different types of Microwave components.
9. VSWR measurement
10. Waveguide parameters measurement

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **IV Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF213**
3.	**Course Title**	**Computer Organisation**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course will introduce to the students about the elementary knowledge of microprocessor. This explain that how microprocessor interact with the peripherals like memory and input/output devices? Students are able to learn the basic programming skills of assembly language.

9. Course Objectives

1. This course will introduce students to the fundamental concepts underlying modern computer organization and architecture.
2. Main objective of the course is to familiarize students about hardware design including logic design.

10. Course Outcomes

By the end of this course, students should be able to:

1. Understand the basics of computer hardware and how software interacts with computer hardware analyse and evaluate computer performance.
2. Understand how computers represent and manipulate data
3. Use Boolean algebra as related to designing computer logic, through simple combinational and sequential logic circuits

11. Curriculum Content

UNIT 1: Introduction to Digital Electronics and Register Transfer and Micro operation:
Introduction to Digital Electronics: Review of logic gates, combination logic circuit: adder, multiplexer, demultiplexer, encoder, decoder, sequential circuit: flip-flop, registers.
Register Transfer and Micro operation: Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Arithmetic, Logic, Shift Micro-operation, Design of ALU, Design of Fast adder.

UNIT 2: & Computer Arithmetic Algorithm
Computer Arithmetic: Introduction, addition and subtraction algorithms, Booth Multiplication Algorithms, floating point arithmetic operation, IEEE format for floating point numbers.

UNIT 3: Processor Organization & Control Design:
Processor Organization: General register organization, Stack organization, Addressing modes,

Instruction format, Data transfer & manipulations, Program Control.
Control Design: Single and multiple bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro programmed Control, microinstruction format.

U NIT 4: Input-Output Organization:

Input-Output Organization: I/O Interface, Modes of transfer, Interrupts & Interrupt handling, Direct Memory Access, Input-Output processor, Serial Communication.

UNIT 5: Memory Organization:

Device Fundamentals & types of Memory: Tristate devices, buffers, encoder, decoder, latches, Internal memory, semiconductor main memory, cache memory, Magnetic disk, CDROM, magnetic tape, partitioning, paging, virtual memory.
Memory Organization: Memory Hierarchy, Main Memory (RAM and ROM Chips), organization of Cache Memory, Memory management hardware.

Textbook(s)

1. M. Morris Mano, “Computer System Architecture”, Prentice-Hall of India, Pvt. Ltd., Third edition.
2. William Stalling, “Computer Organization and Architecture”, 4th Edition, PHI.

Reference Books

1. Hayes, “Computer Architecture and Organization”, MH.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **IV Semester** **Year:** **Second**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF214**
3.	**Course Title**	**Digital Signal Processing**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

This course addresses the representation, analysis, and design of discrete time signals and systems. The major concepts covered include: Discrete-time processing of continuous-time signals; decimation, interpolation, and sampling rate conversion; flow graph structures for DT systems; time-and frequency-domain design techniques for recursive (IIR) and non-recursive (FIR) filters; linear prediction; discrete Fourier transform, DFT, FFT algorithms and their applications in time and frequency characterizations in DSP system design.

9. Course Objectives

- To understand the Basic Concept & Characteristics of DSP systems.
- To Learn the Concept of Efficient & High Speed Computation in DSP with various algorithms and Transformations.
- To understand the concepts & realizations of Digital Filters.
- To develop the skills of modelling of DSP Systems

10. Course Outcomes

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

- Students will be able to learn the basic principle and characteristics of DSP Systems.
- Students will be able to develop the concept of designing of DSP Systems.
- Students will be able to model the DSP systems practically using MATLAB software.
- Students will be able to characterize the DSP System and then they will be able to analyse the performance of the systems.

11. Curriculum Content

UNIT 1-DISCRETE FOURIER TRANSFORM:

Review of Discrete time signals and DTFT ,Frequency Domain Sampling: The Discrete Fourier Transform, Frequency Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform (DFT), Properties of DFT, DFT as a linear Transformation. Relationship of the DFT to Other Transforms, Multiplication of two DFTs and Circular Convolution, Additional DFT Properties.

UNIT 2-FAST FOURIER TRANSFORM: AN EFFICIENT COMPUTATION OF DFT:

Efficient Computation of the DFT: FFT Algorithms, Computational Complexity of Direct Computation of the DFT, Radix-2 FFT algorithms, Efficient computation of the DFT of two real sequences, efficient computation of the DFT of 2N-Point real sequences.

UNIT 3-IMPLEMENTATION OF DISCRETE-TIME LTI SYSTEMS:

Review of Z Transform **Realization of Discrete-Time LTI Systems (FIR Filter Structure):** Direct form, Linear Phase Structure, Cascade form, Frequency sampling structures, lattice structures.
Realization of Discrete-Time LTI Systems (IIR Filter Structure): Direct form I & II, Cascade form, parallel form Lattice Structures, Signal flow graphs and transposed structures.

UNIT 4-DESIGN OF FIR FILTERS:
Designing of FIR Filters: Symmetry and Anti-symmetry FIR filters, Properties & Design Constraints of FIR Filter, Designing of FIR linear phase FIR filters using Window functions (Rectangular, Hanning, Hamming & Kaiser Window Functions), Designing of FIR linear phase FIR filters using frequency sampling method**.**

UNIT-5: DESIGN OF IIR FILTERS:
Design of IIR Filters from Analog Filters: Properties & Design Constraints of IIR Filter, Designing of IIR filters by approximation of derivatives, impulse invariance method, IIR filter Design by Bilinear Transformation, Characteristics of commonly used analog filters (Butterworth/Chebyshev filter).

Textbook(s)

1. Proakis, J.G. &Manolakis, D.G., "Digital Signal Processing: Principles Algorithms and Applications", PHI.
2. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice- Hall India.
3. Tarun Kumar Rawat, "Digital Signal Processing", Oxford University Press Publications.

Reference Books

1. Rabiner, L.R. and Gold B., "Theory and applications of DSP", PHI.
2. Thomas J, Cavichhhi, "Digital Signal Processing", John Wiley & Sons
3. Roman KUC, Digital Signal Processing, BSP Hyderabad
4. Apte, "Digital Signal Processing", 2nd Edition, John Wiley (India), 2009.
5. Roman Kuc "Introduction to Digital Signal Processing" BSP, Hyderabad.

List of Experiments:

1. Introduction to MATLAB Software and WAP to generation basic DT-Signals (Unit Impulse, Unit Step, Unit Ramp & Exponential Signals).
2. WAP to plot Real, Imaginary Phase and Magnitude of Exponential Function.
3. Study and Plot the aliasing effect by using Sinusoidal signal. Show the plots continuous and sampled signal using subplot.
4. WAP to find the Linear and Circular Convolutions.
5. WAP to Verify the Properties of DTFT: Symmetry, Time Shifting & Modulating with a rectangular pulse of length 21.
6. Verify the Properties of DFT.
7. Study the different window functions in FDA Tool Box of MATLAB with their controlling Parameters.
8. FIR Filter design according to given specifications and control parameters with desired filter length.
9. IIR Filter design according to given specifications and control parameters with desired filter length.

List of value added Experiments

1. FIR Filter design and analysis with various transformations.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: V Semester **Year: Third**

1. Department offering the course	**EECE**
2. Course Code	**EEF302**
3. Course Title	**Control System**
4. Credits (L:T:P:C)	**3:0:1:4**
5. Contact Hours (L:T:P)	**3:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Discipline core**

8. **Course Summary:** This course will introduce students about fundamentals of control theory used in various systems. In this course the student will learn about Time domain and frequency domain analysis of control system and different controllers.

9. **Course Objectives**

- To introduce the state variable representation of continuous and discrete data control systems, stability analysis and time response analysis using state model,
- The concepts of controllability and observability, basic concepts of digital control systems, their stability analysis,
- Use of state feedback for pole placement design, basic concepts and stability analysis of non linear systems

10. **Course Outcomes**

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

- Possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function.
- Find out the time response of a given system and design of different basic controller (P, PI, PID)
- Understand the basic knowledge of servo & servomotor.
- Gain knowledge of finding out system stability in time and frequency domain.
- To draw different plots of control system and compensation design using these plots.

11. **Curriculum Content**

Unit 1 The Control System: Open loop & closed control; servomechanism, Physical examples.
Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit 2 Time Response analysis: Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants.
Controllers: Introduction to P, PI, & PID controller. performance indices

Unit 3

Control System Components: Constructional and working concept of ac servomotor, synchros and stepper motor.
Concept of Stability: Routh-Hurwitz criteria, Root Locus Technique

Unit 4
Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots: gain margin and phase margin.
Stability in Frequency Domain: Nyquist stability criterion, relative stability.

Unit 5
Introduction to Design: The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain.

Textbook(s)

1. I.J. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International.

2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.

Reference Books

1. Norman S. Nise, Control System Engineering 4th edition, Wiley Publishing Co.

2. M.Gopal, "Control System; Principle and design", Tata McGraw Hill.

3. M.Gopal," Modern Control system", Tata McGraw Hill.

4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

List of Experiments

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output V/S input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study PID Controller for simulation proves like transportation lag.

Software based experiments (Use MATLAB, LABVIEW software etc.)

1. To determine time domain response of a second order system for step input and obtain performance parameters.
2. To convert transfer function of a system into state space form and vice-versa.
3. To plot root locus diagram of an open loop transfer function & determine range of gain 'k' for stability.
4. To plot a Bode diagram of an open loop transfer function.
5. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **V Semester** **Year:** **Third Year**

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF302**
3.	**Course Title**	**Principle of Communication**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core(DC)**

8. Course Summary

This course will introduce students about fundamentals of communications by electrical means. In this course the student will learn about basic process of communication, analog modulation techniques, different type of receiver models and fundamental limitations of communication.

9. Course Objectives

The purpose of this course is to introduce the students to the basic concepts of communication systems, implement the basic analog communication techniques/ circuits with the help of theoretical and practical problem solving. Students will understand the basic analog communication techniques which in turn are used as the building blocks of the larger and more complex communication systems.

10. Course Outcomes

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

1. Basic working of communication system.
2. Analog Modulation Techniques and their comparative analysis and applications suitability.
3. Process of Modulation and Demodulation.
4. Types, characterization and performance parameters of transmission channels.
5. Analog to digital conversion and Digital data transmission.
6. Knowledge of different Multiplexing Techniques.

11. Curriculum Content

Unit 1: Introduction to Communication:

Communication system, Analog and Digital Signals, channel bandwidth, redundancy, a periodic representation of Fourier Integral transforms of some useful signals. Signal Transmission through a Linear System, Ideal and Practical Filters, Signal Distortion over a Communication Channel, Signal Energy and Energy Spectral Density, Signal Power and Power Spectral Density, Types of noise in Communication systems.

Unit 2: Amplitude Modulation

Baseband and Pass band Communication, Amplitude modulation-DSB, Amplitude Modulation (AM) Quadrature Amplitude Modulation (QAM),Amplitude Modulation: Single Sideband (SSB),Amplitude Modulation: Vestigial Sideband (VSB),Carrier Acquisition, TRF & Super heterodyne AM Receiver, Receiver characteristics, Behavior of Baseband Systems, Amplitude-Modulated Systems in presence of noise.

Unit 3: Angle Modulation:

Concept of Instantaneous Frequency, Bandwidth of Angle-Modulated Wave ,Generation of FM Waves, Demodulation of FM using PLL, Costas Loop ,Interference in Angle-Modulated Systems, FM Receiver,

Super heterodyne FM Receiver,Behavior of Frequency Modulated Systems in presence of noise, Optimum Pre emphasis-De-emphasis System.

Unit 4: Analog Pulse Modulation:
Sampling theorem for low pass and band pass signals. Aliasing, Sampling Techniques: principle, generation and detection, PAM, PWM, PPM, and Behavior of Pulse Modulated Systems in presence of noise.

Unit- 5: Quantization and Multiplexing:
Quantization, Quantization error, non uniform quantizing, encoding, Introduction to the concept of Pulse-Code Modulation, A Digital Communication System, Frequency division and Time Divisions Multiplexing techniques

Textbook(s)

1. Simon Haykins, 'Communication Systems', John Wiley,5th edition

Reference Books

1. Herbert Taub and Donald Schilling, 'Principles of Communication Systems', Tata McGraw Hill , 2nd Ed.
2. A.B. Carlson, "Communication Systems ",Tata McGraw-Hill 5th Edition
3. B.P.Lathi, 'Modern Analog and Digital Communication systems', Third edition.

List of Experiments:

1. To generate amplitude modulated wave and determine the percentage modulation and Demodulate the modulated wave using envelope detector.
2. To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal.
3. To generate the SSB modulated and Demodulated wave.
4. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal and to demodulate a FM signal using FM detector.
5. To observe the effects of pre-emphasis on given input signal and to observe the effects of De-emphasis on given input signal.
6. To generate the Pulse Amplitude modulated and demodulated waves.
7. To generate Pulse Width modulated and demodulated waves.
8. To generate Pulse Position Modulated and demodulated waves.
9. To construct the frequency division multiplexing and demultiplexing circuit and to verify its operation.

List of Two Value Added Experiments:

1. To design a communication (AM/FM/PM) system for distance of 100 meters.
2. Study of SSB-SC /DSB-SC and VSB using MATLAB

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

Semester: **VI Semester** **Year:** **Third**

1.	**Department offering the course**	**Electronics & Communication Engineering**
2.	**Course Code**	**ECF311**
3.	**Course Title**	**Digital Communication**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**Principle of Communication**
7.	**Course Basket**	**Discipline core (DC)**

8. Course Summary

This course will introduce students about communication systems using digital modulation techniques and various coding techniques used for compression and error detection. This course also covers analog to digital conversion and fundamentals of secure communication which are necessary parts of modern digital communication systems.

9. Course Objectives

The purpose of this course is to understand the building blocks of digital communication system and to prepare mathematical background for communication signal analysis This course enables student to understand the Digital communication techniques which in turn are used as the building blocks of the larger and more complex communication systems and concept of spread spectrum communication system.

10. Course Outcomes

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

1. Knowledge of Compression of data based on probability.
2. Basic understanding of Digital Modulation Techniques and their comparative analysis and applications suitability.
3. Basic Error Detection and correction mechanism of Digital data.

11. Curriculum Content

Unit 1: Elements Of Digital Communication And Information Theory

Model of a Digital Communication, System, Probability Theory, Entropy and Information Rate, Conditional Entropy and Redundancy, Source Coding, Fixed and Variable Length Code Words, Source Coding Theorem, Prefix free code and, Kraft Inequality, Shannon-Fano and Huffman Coding.

Unit 2: Digital Base Band Transmission

PCM Coding, DM, DPCM, ADCM, Data Transfer Rate, Line Coding and Its Properties, NRZ & RZ Types, Signalling Format For Unipolar, Polar, Bipolar(AMI) & Manchester Coding, Matched Filter Receiver, Derivation of Its Impulse Response and Peak Pulse Signal to noise ratio, ISI, Rectangular, sync & Raised cosine pulse comparison

Unit 3: : Digital Modulation Techniques:

Gram-Schmidt Orthogonalization Procedure, Types of Digital Modulation, correlation receiver, Waveforms for Amplitude, Frequency and Phase Shift Keying, Method of Generation and Detection of Coherent & Non-Coherent Binary ASK, FSK & PSK & PSD derivation for Coherent & Non- Coherent Binary ASK, FSK & PSK. Differential Phase Shift Keying, bit error rate comparison of Digital modulation techniques.

Unit 4: Advanced Modulation Techniques:

Introduction to M-ary modulation techniques: QPSK, QAM, MSK, GMSK. Spread spectrum-Introduction, Direct sequence spread spectrum, processing gain, FHSS: Slow and fast FHSS

Unit- 5: Error Control Coding:
Error Free Communication Over a Noise Channel, Hamming code, Relation Between Minimum Distance and Minimum Distance Error Correcting & detection Capability, Linear Block Codes, Encoding and Syndrome Decoding, Cyclic Codes, Encoder and Decoder For Cyclic Codes, Convolution Coding & Viterbi decoding.

List of Experiments:

1. To study sampling and reconstruction of the sampled signal.
2. To study Delta Modulation and Demodulation.
3. To study Adaptive Delta Modulation and Demodulation.
4. To study ASK modulation and Demodulation.
5. To study FSK modulation and Demodulation.
6. To study PSK modulation and Demodulation.
7. To Study TDM/PCM Transmitter /Receiver.
8. To Study different Line Coding Techniques.
9. To Study DHSS, FHSS.

List of Two Value Added Experiments:

1. QPSK modulation and demodulation simulation using MATLAB.
2. MSK modulation and demodulation simulation using MATLAB.

Textbook(s)

1. Simon Haykins, 'Communication Systems', John Wiley,5th edition
2. Singh, R .P. & Sapre, "Communication Systems : Analog & Digital" , TMH 3rd Edition

Reference Books

1. Herbert Taub and Donald Schilling, "Principles of Communication Systems", Tata McGrawHill , 2nd Ed.
2. A.B . Carlson ,"Communication Systems ",Tata McGraw-Hill Latest Edition
3. B.P.Lathi, "Modern Analog and Digital Communication systems", Third edition.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF 347**
3.	**Course Title**	**Microprocessor**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Digital system Design**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce to the students about the elementary knowledge of microprocessor. This explain that how microprocessor interact with the peripherals like memory and input/output devices? Students are able to learn the basic programming skills of assembly language.

9. Course Objectives

1. The student will learn how the hardware and software components of a microprocessor-based system work together to implement system-level features and integrating digital devices into microprocessor based systems;
2. The student will learn the operating principles of, and gain hands-on experience with, common microprocessor peripherals such as timers, USART, and PPI; role of CPU, registers, and modes of operation of 8085 and 8086 microprocessor.
3. Learning Microprocessor instruction sets and learning assembly-programming styles, structured assembly language programming.

10. Course Outcomes

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

The course provides an understanding of:

Identify the basic element and functions of microprocessor.

1. Describe the architecture of microprocessor and its peripheral devices.
2. Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices.
3. Apply the programming techniques in developing the assembly language program for microprocessor application.
4. An ability to design microprocessors based system, components or process as per needs and specifications

11. Curriculum Content

Unit 1

Evolution of Microprocessors, history of computers, Introduction to Microprocessor, Microprocessor systems with bus organization, Microprocessor Architecture & Operations, Tristate devices, buffers, encoder, decoder, latches, Memory devices: Semiconductor memory organization, Category of memory, I/O Device.

Unit 2

Register organization, 8085 Microprocessor Architecture, Address, Data and Control Buses, Pin Functions, Demultiplexing of Buses, Generation of Control Signals, Timing diagrams: Instruction Cycle,

Machine Cycles, T- States, Concept of Address line and Memory interfacing, Address Decoding and Memory Interfacing.

Unit 3

Classification of Instructions, Addressing Modes, 8085 Instruction Set, Instruction And Data Formats, Writing assembly language programs, Programming techniques: looping, counting and indexing, Stack & Subroutines, Developing Counters And Time Delay Routines, Code Conversion, BCD Arithmetic And 16-Bit Data Operations. The 8085 Interrupts, 8085 vector interrupts.

Unit 4

Memory interfacing, I/O interfacing – memory mapped and peripheral mapped I/O Programmable Interfacing Devices Like 8255A PPI, 8253/8254 Timer, 8259A PIT, 8237 DMA Controller, and Serial I/O Concepts 8251A USART. Interfacing of above chips with 8085, Programming them In Different Modes.

Unit 5

A Architecture of 8086, block diagram, register set, flags, Queuing, concept of segmentation, Pin description, operating modes, addressing modes.

Textbook(s)

1. Microprocessor Architecture, Programming, and Applications with the 8085 Ramesh S. Gaonkar – Penram International
2. Microcomputers and Microprocessors: The 8080, 8085 and Z-80 Programming, Interfacing andTroubleshooting John E. Uffenbeck.

Reference Books

1. Microprocessor and Microcontroller fundamentals. The 8085 and 8051 Hardware and Software William Kleitz

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

List of Experiments

1. To perform 8-bit arithmetic operations between two numbers stored at consecutive memory locations: addition, subtraction, multiplication, division.
2. To perform 16-bit arithmetic operations between two numbers stored at consecutive memory locations: addition, subtraction, multiplication, division.
3. To find the largest and smallest element in an array. Also find the sum of elements in an array.
4. Generation of Fibonacci series in 8085 in hexadecimal sequence.
5. Write and execute the program for finding even and odd numbers.
6. To sort the given number in the ascending and descending order using 8085 microprocessor.
7. Code conversion: decimal number to hexadecimal, hexadecimal number to decimal.
8. To add two 8 bit BCD numbers stored at consecutive memory locations.
9. To subtract two 8 bit BCD numbers stored at consecutive memory locations.
10. To interface programmable peripheral interface 8255 with 8085 and study its characteristics in mode0, mode1 and BSR mode.

Value added Experiments:

1. To interface 8253 Interface board to 8085 mp and verify the operation of 8253 in six different modes.
2. To interface a stepper motor with 8051 microcontroller and operate it.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF 349**
3.	**Course Title**	**Microcontroller**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Microprocessor**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce to the students about the elementary knowledge of microcontroller. This explain that how microcontroller interact with the peripherals like memory and input/output devices? Students are able to learn the basic programming skills of assembly language.

9. Course Objectives

1. To understand the concept of microcontroller based system.
2. To enable design and programming of microcontroller based system.
3. To know about the interfacing circuits.

10. Course Outcomes

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

1. The course provides an understanding of:
2. Micro-controller and its applications.
3. Interfacing of Microcontroller.

11. Curriculum Content

UNIT 1: INTRODUCTION:

Introduction, Comparison of microprocessor and microcontroller, evolution of microcontrollers from 4 bit to 32 bit, development tools for microcontrollers: Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.

UNIT 2: MICROCONTROLLER 8051:

Block Diagram, Pin diagram and Pin Functions, General Purpose and Special Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.

UNIT 3: ADDRESSING MODES, INSTRUCTION SET OF 8051:

Addressing modes and accessing memory using various addressing modes, instruction set: Arithmetic, Logical, Simple bit, jump, loop and call instructions and their usage. Time delay generation and calculation, Timer/ Counter programming.

UNIT 4: ASSEMBLY LANGUAGE PROGRAMMING:

Data Transfer: Block move, Exchange, Sorting, Finding largest element in an array. Arithmetic Instructions: Addition/subtraction, multiplication and division, Boolean & Logical Instructions (Bit manipulations). Code conversion: BCD to ASCII, ASCII to Decimal, Decimal to ASCII, Programs to generate delay using on-Chip timer / Counter.

UNIT 5: INTERFACING AND APPLICATION OF MICROCONTROLLER:

Interfacing of PPI 8255, DAC (0804), Temperature measurement (LM35), interfacing seven segment displays, displaying information on a LCD, stepper motor interfacing, DC motor interfacing and PWM, Interfacing a 4 X 4matrix Keypad, Generation of different types of waveforms using DAC.

Textbook(s)

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, 'The 8051 Microcontroller and Embedded Systems Using Assembly and C', (Second Edition, Pearson Education).

Reference Books

- Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93- 329-0125-4.
- Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005
- K. J. Ayala, D. V. Gadre, 'The 8051 Microcontroller & Embedded Systems using Assembly and C, Cengage Learning , India Edition.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

List of Experiments:

I. **Programming**

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division.
3. Boolean & Logical Instructions (Bit manipulations).
4. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII;
5. Programs to generate delay using on-Chip timer /Counter.

II. **Interfacing**

Write Assembly programs to interface 8051 chip to Interfacing modules.

1. Familiarization with KEIL, PROTEUS simulator and trainer kit.
2. Read Push-button switch and display its status on LED.
3. Interfacing 7-Segment LED Display with 8051 microcontroller.
4. Interfacing of 16x2 LCD with 8051 microcontroller and display message on it.
5. Interface 4x4 matrix keyboard with 8051 microcontroller. Display value of pressed switch on LCD.
6. Stepper and DC motor control interface to 8051 microcontroller.

List of Value Added Experiments:

1. External ADC and Temperature control interface to 8051 microcontroller.
2. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency
and amplitude.
3. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.

Undergraduate Course Description Document

Semester: VIIth **Year: Fourth**

1.	**Department offering the course**	**Electronics & Communication Engineering**
2.	**Course Code**	**ECF401**
3.	**Course Title**	**Wireless Communication**
4.	**Credits (L:T:P:C)**	**3:1:0:4**
5.	**Contact Hours (L:T:P)**	**3:1:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Core**

8. Course Summary

The course provides an introduction to wireless communication systems. The course will introduce radio propagation and transmission principles used in different wireless communication systems such as mobile telephone, satellite communication, TV and radio transmissions. The course will discuss radio channel characteristics such as fading, interference and doppler shift to develop a good understanding of the radio engineering area. The course will discuss different techniques used to support voice, data and video communication in wireless systems. The course will also discuss the wireless networks and their basic design thereof from theoretical points of view.

9. Course Objectives

This course aims to provide an overview of Wireless Communication networks area and its applications in communication engineering. This subject also signify the contribution of Wireless Communication networks to overall technological growth. The main objective of this course is to understand the various terminologies, principles, schemes, concepts and different methodologies used in Wireless Communication Networks.

10. Course Outcomes

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

- **a.** Basics of Wireless Communication system and technical challenges
- **b.** Propagation mechanisms and fading effects
- **c.** Wireless transceivers and Multiple access schemes

11. Curriculum Content

UNIT I: SERVICES AND TECHNICAL CHALLENGES:

Review of fundamentals of Digital Communication, Types of Services, Requirements for the services, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems, Principles of Cellular networks, Review of 2G, 3G cellular systems, Introduction to OFDM system and evolution of 4G.

UNIT II: WIRELESS PROPAGATION CHANNELS:

Propagation Mechanisms, Propagation effects with mobile radio, Channel Classification, Link calculations, Narrowband and Wideband models, Fading effects- Small scale and Large scale fading, Path loss components.

UNIT III: WIRELESS TRANSCEIVERS:

Structure of a wireless communication link, Modulation and demodulation – Quadrature/4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, Power spectrum and Error performance in fading channels

UNIT IV: SIGNAL PROCESSING IN WIRELESS SYSTEMS:
Principle of Diversity, Macro-diversity, Micro-diversity, Signal Combining Techniques, Transmit diversity, Rake Receiver, Equalizers- Linear and Decision Feedback equalizers, Review of Channel coding and Speech coding techniques.

UNIT V: MULTIPLE ACCESS SCHEMES:
FDMA- Pre assigned FDMA, Demand-Assigned FDMA, TDMA-Reference Burst; Traffic Date, Frame Efficiency and Channel capacity, Spread Spectrum Systems- Cellular Code Division Multiple Access Systems- Principle, Power control, Effects of multipath propagation on Code Division Multiple Access

Textbook(s)

1. Rappaport. T.S., "Wireless communications", Pearson Education, 2003
2. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006

Reference Books

- Gordon L. Stuber, "Principles of Mobile Communication", Springer International Ltd.,2001.
- Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF341**
3.	**Course Title**	**Digital Design using Verilog**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Digital System Design**
7.	**Course Basket**	**DE**

8. Course Summary

This course will introduce students about problem solving techniques using programs and design of algorithms and their complexity. It also includes overview of elementary data structures such as Arrays, Stack, Queues, and Linked Lists and advanced data structures such as graphs, trees and hashing. Topics would include Time and Space Complexities, Lists, Stacks and Queues, Searching and Sorting, Hashing, Basic concepts in Trees, Advanced concepts in Trees, Priority Queues and Graphs.

9. Course Objectives

- Designing digital circuits, behavioural and RTL modelling of digital circuits using Verilog HDL.
- Verifying these models and synthesizing RTL models to standard cell libraries and FPGAs.
- Students gain practical experience by designing, modelling, implementing and verifying several digital circuits.

10. Course Outcomes

The course provides an understanding of:

- Describe Verilog hardware description languages (HDL).
- Design Digital Circuits.
- Write behavioural models of digital circuits.
- Write Register Transfer Level (RTL) models of digital circuits.
- Verify behavioural and RTL models.
- Describe standard cell libraries and FPGAs.
- Synthesize RTL models to standard cell libraries and FPGAs.
- Implement RTL models on FPGAs and Testing & Verification.

11. Curriculum Content

UNIT 1:

ASIC design flow, Introduction to Verilog; Design methodologies, Language construct and lexical conventions. Data types; System task and compiler directives, modules and ports, Gate level modeling**.**

UNIT 2:

Modeling at data flow level, Continuous Assignment Statement; Delays; Operators; Verilog for combinational Circuits, Design of Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter.

UNIT 3:

Behavioral modeling: Structured procedures, procedural assignments, Timing Controls; Conditional statements: case, case x and case z statements; Loops: while, for, repeat, forever; Sequential and parallel blocks, force-release; Construct assign-de-assign construct; Design of Flip flop using Verilog; Design of Shift register using Verilog; Design of Counters using Verilog.

UNIT 4:
Functions, Tasks; Timing and delays: delay models; Path delay modeling, timing checks; Switch level modeling: Switch- modeling elements; switch level modeling: Examples User defined primitives: UDP, Combinational UDP; User defined primitives: Sequential UDP, UDP Table Shorthand Symbols

UNIT 5:
State Machine: Moore state model; State Machine: Mealay state model; Verilog code for Moore-type FSM, Specification of Mealy FSM using Verilog; Mealy-type FSM for Serial Adder and Verilog code Moore-type FSM for Serial Adder and Verilog code; Programmable logic device: Introduction, Block diagram. Macrocell structures and characteristics of PLDs and CPLDs; Macrocell structures and characteristics of PLDs and CPLDs. FPGA design flow; Architecture and features of FPGAs.

List of Experiments:

1. Simulation using all the modeling styles and Synthesis of all the logic gates using Verilog HDL.
2. Simulation using all the modeling styles and Synthesis of 1-bit half adder and 1-bitFull adder using
3. Verilog HDL.
4. Simulation using all the modeling styles and Synthesis of 2:1 Multiplexer and 4-4:1Multiplexer using
5. Verilog HDL.
6. Simulation and Synthesis of 1:4 Demultiplexer using Verilog HDL.
7. Simulation and Synthesis of 2:4 Decoder using Verilog HDL.
8. Simulation and Synthesis of 4:2 Encoder using VERILOG HDL.
9. Simulation and Synthesis of 4:2 Priority Encoder using VERILOG HDL.
10. Simulation and Synthesis of magnitude comparator 1-bit using VERILOG HDL.
11. Simulation and Synthesis of D flip flop using VERILOG HDL.
12. Simulation and Synthesis of JK, T Flip Flop using VERILOG HDL

Textbook(s)

1. Samir Palnitkar, 'Verilog HDL', Sunsoft Press.
2. Charles Roth, 'Fundamental of Logic Design', Cengage Learning.

Reference Books

1. T.R. Padmanabhan& B. Bala Tripura Sundari, 'Design through Verilog HDL', Wiley Pub. 2007.
2. Michael John Sebastian Smith, 'Application-Specific Integrated Circuits', Addison-Wesley, 1997.
3. Stephen Brown and ZvonkoVranesic, 'Fundamentals of Digital Logic with Verilog Design', Third Edition, McGraw Hill.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF342**
3.	**Course Title**	**Filter Design**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Analog Circuits**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course emphasizes the students about the designing of analog filters and their design issues. The subject focuses the core designing of active filters for high frequency applications.

9. Course Objectives

- Introduction to Active Filters
- To learn and develop the design approach of active filters
- To study the basic parameters that affects the performance of active filters
- To study higher order and universal filters.

10. Course Outcomes

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

- The course provides an understanding of Active filters
- Understanding of Development and design approach for analog filtering
- Skills to design the high frequency analog filters.

11. Curriculum Content

UNIT 1: Introduction to Active Filters:

Filters and Signals, Filter type, mathematics of elementary filters (Butterworth, Chebyshev, Bessel-Thomson and Elliptical Filters), Active filter applications, VCVS.

UNIT 2: Sallen – Key Filters & Universal Filters:

Sallen –Key Filters (First order and Second order LPF & HPF), Multi-Feedback Filter-Low Pass and High Pass Filters, Deliyannis's Band Pass Filter, Universal Filter (State Variable Filter)-Second order Low-Pass and Second Order High – Pass Filters.

UNIT 3: Sensitivity & Filters with GIC:

Magnitude and Phase Sensitivity, root sensitivity, Filter with GIC (Generalized Impedance Converter)-LPF, HPF & Narrow band – pass and band rejected.

UNIT 4: OTA Filters & Delay Filters:

Singe OTA Low –Pass Filter with passive components – First Order and Second order, OTA-C Filter, Non-ideal features of OTA, Time delay & Transfer function, Bessel-Thomson response, Design of Bessel-Thomson filter.

UNIT 5: Switched Capacitor Filters:

Switched Capacitor Resistors, Integrator, Universal Filters, LMF100, Low pass, high pass filters, limitations of SC – Filters.

List of Experiments:

1. Introduction to PSPICE Simulation.
2. PSIPCE Simulation of differential amplifier.
3. PSIPCE Simulation of Op-Amp based Differentiator, Integrator.
4. PSIPCE Simulation of Op-Amp based Rectifier, clipper and clamper circuits.
5. PSIPCE Simulation of Wien- Bridge Oscillator.
6. PSIPCE Simulation of Passive filters (LPF & HPF).
7. PSIPCE Simulation of passive filters (NB – BP & BR)
8. PSIPCE Simulation of Op-Amp based square wave generator.
9. PSIPCE Simulation of Op-Amp based first order active filter (LPF & HPF).
10. PSIPCE Simulation of Op-Amp based second order active filter (LPF & HPF).

Textbook(s)

1. S.A.PACTITIS, 'Active Filters -Theory and Design", CRC Press, Taylor & Francis.
2. Rolf Schumann, Haiqiao Xiao, and Mac Van Valkenburg, 'Design of Analog Filters', Second Edition,

Reference Books

1. M.E.Van Valkenburg, Holt Sonders, 'Analog Filter Design', International Edition (HRW Series)
2. Steve Winder, 'Analog and Digital Filter Design', Second Edition, Newnes Pub. USA.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF343**
3.	**Course Title**	**VLSI Technology**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

The main focus of the subject is on semiconductor processes involved in the fabrication of very very large scale silicon integrated circuits involving billions of transistors. Initially, the course will attempt to study a comprehensive range of individual processes, and towards the end, these processes are integrated together into a process schedule for the fabrication of CMOS and bipolar VLSI circuits. Because integrated circuits fail from time to time, failure analysis plays an important role in process development. The course will include lectures on analytical techniques employed in understanding the causes of failure in order to modify the processes for better reliability.

9. Course Objectives

This course aims to To understand the unit processes which comprise fabrication process of silicon integrated circuits. This subject also focus To understand basic process sequence of various transistors and IC. The main objective of this course is to understand the various terminologies, principles, schemes, concepts and different methodologies used in VLSI technology.

10. Course Outcomes

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

1. Basic processes which are required for IC fabrication
2. Process sequences for ICs
3. Problems involved in micro fabrication

11. Curriculum Content

UNIT 1:

Crystal Growth: MGS, EGS, Czochralski crystal Puller, Silicon shaping, Wafer Preparation.
Epitaxy: Vapor phase epitaxy, liquid phase epitaxy.

UNIT 2:

Oxidation: Thermal oxidation, dry and wet oxidation, plasma oxidation Lithography: Photo lithography, electron beam lithography and X-ray lithography
Diffusion: Fick's laws, diffusion mechanisms, Constant source and limited source diffusion

UNIT 3:

Ion Implantation, Reactive Plasma Etching, Di-electric and Poly-Silicon Film Deposition

UNIT 4:

Metallization: Thermal evaporation, electron beam evaporation, Sputtering, Metallization
Failure mechanism Isolation Techniques

UNIT 5:

Assembly & Packaging: Die bonding, wire bonding, packaging
IC fabrication Process Sequence: Process sequence for BJT, NMOS,CMOS ICs

Textbook(s)

1. S.M.Sze, VLSI Technology, Mc Graw Hill.
2. S.K.Ghandhi, VLSI Fabrication Principles.

Reference Books

1. Pucknell DA &Eshraghian K, Basic VLSI Design, PHI

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF441**
3.	**Course Title**	**Data Communication and Networks**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course focuses on the fundamentals of data communication networks. One goal is to give some insight into the rationale of why networks are structured the way they are today and to understand the issues facing the designers of next-generation data networks. Much of the course focuses on network algorithms and their performance. Students are expected to have a strong mathematical background and an understanding of probability theory. Topics discussed include: layered network architecture, Link Layer protocols, high-speed packet switching, queueing theory, Local Area Networks, and Wide Area Networking issues, including routing and flow control

9. Course Objectives

- To understand the concept of Computer Communication.
- To learn the basics of Data communication and Networks
- To understand the concept of protocols and security of data communication network.
- To develop and design the protocol systems for advance computer communication.

10. Course Outcomes

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

2. Understanding and Implementation of Computer Networks.
3. Understanding the concept of Protocols and its design structure.
4. Understand and apply the technologies of communication in data communications.
5. Understand and implementation of algorithms in routing and congestion.
6. Understand and implementation of network and data security.

11. Curriculum Content

UNIT 1: Introduction to Data Communication Network & Physical Layer:
Review of Fundamental Concepts of communication systems and its types ,Switching systems, network hardware and software, Layering, design issues for layering, reference models and their comparison, example of networks. Physical Layer: Transmission media and channel impairments, modulation, multiplexing, digital channels, switching.

UNIT 2: Data Link Layer:
Design issues, framing, error control, elementary data link protocols and sliding window protocols, HDLC, data link layer in internet. Medium Access Control : Channel allocation problem, MAC protocols-Aloha, CSMA, collision free protocols, limited contention protocol, Ethernet, IEEE 802.3 standard, Repeaters, bridges, routers and gateways.

UNIT 3: Network Layer:
Design issues, VC and datagram subnets, routing algorithms for wired and wireless hosts, congestion prevention policies, load shedding. Connectivity of networks, connectionless internetworking, internetwork routing, fragmentation, IP protocols, IP addressing, OSPF, IPv6.

UNIT 4: Transport Layer:

Transport service and primitives, Addressing, connation establishment and release, flow control, buffering, multiplexing and crash recovery. Introduction to UDP. Modeling TCP connection management, TCP congestion control, Performance issues.

UNIT 5: Higher Layers:
DNS name space and DNS server, overview of www, http. Introduction of cryptography, substitution cipher and transposition cipher, DES, cipher methods, public key algorithms. Social issues - privacy, freedom of speech, copy right.

Textbook(s)

1. Forouzan, B.A., “Data Communication and Networking”, 4th Ed., Tata McGraw-Hill.
2. Ertsekas, Dimitri, and Robert Gallager. Data Networks (2nd Edition). Upper Saddle River, NJ: Prentice Hall, 1991. ISBN: 0132009161.

Reference Books

1. Kurose, J.F. and Ross, K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Ed., Addison Wesley.
2. Tanenbaum, A.S, “Computer Networks”, 4th Ed., Pearson Education.
3. Stallings W., “Data and Computer Communication”, 8th Ed., Prentice-Hall.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF344**
3.	**Course Title**	**ADVANCED ANTENNAS**
4.	**Credits (L:T:P:C)**	**2:0:1 :3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

The course provides an understanding of transmission parameter, antenna parameter, RF Antennas Microstrip antenna, and array.

Also provides an understanding of Modern antennas as SIW, conformal, leaky wave and beamforming NW etc.

9. Course Objectives

1. The objective of this course is to provide an in-depth understanding of modern antenna concepts, and practical antenna design for various applications.
2. The course will explain the theory of different types of antennas used in communication systems.
3. Starting from the basic antenna parameters, the course will discuss various types of antennas including the planar printed antennas.
4. An in-depth study will be made for the analysis and design of different types on antennas currently being used in wireless and satellite communication.

10. Course Outcomes

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

The course provides an understanding of:

- Fundamental concepts, Basic antenna parameters, Radiation from wires and loops, Aperture and Reflector Antennas, Broadband Antennas, Micro strip Antennas, Antenna Arrays
- Basic Concept of Smart Antennas.
- A brief introduction of smart antenna concept will be given at the end with a view that the student can further explore the topic, if interested.

11. Curriculum Content

UNIT 1: Introduction- Antenna and its parameter:

Fundamental Concepts: Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

UNIT 2: Radiation from Wires, Loops And Aperture Antenna:

Small circular loop, Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral. Broadband Antennas: Broadband concept, Log-periodic antennas, frequency independent antennas.

UNIT 3: Microstrip Antennas and Array:

Basic characteristics of microstrip antennas, feeding methods, design of rectangular and circular patch antennas, Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, MS Arrays, Antenna for mobile communication & personal wireless communication.

UNIT 4: Introduction to Satellite Communications Antenna:
Contoured Beam Antennas, Multiple Beam Antennas, Multi-Band Antennas, Reconfigurable Beam Antennas, Hybrid Antennas, PIM, Multipaction, Test Methods.

UNIT 5: Basic Concepts of Modern Antennas:
Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming, Conformal Antenna, SIW Antenna.

LIST OF EXPERIMENTS

1. Design and simulation of rectangular patch antenna using micro strip feed line.
2. Design and simulation of rectangular patch antenna using probe feed.
3. Design and simulation of circular patch antenna using micro strip feed line.
4. Design and simulation of circular patch antenna using inset feed.
5. Design and simulation of antenna arrays using patch antennas.
6. Design and simulation of any conformal antenna.
7. Design and simulation inset feed wave antenna.
8. Design and simulation of monopole antenna.

Textbook(s)

1. C. A. Balanis, "Antenna Theory and Design", 3 rd Ed., John Wiley & Sons., 2005.

Reference Books

1. Constantine A. Balanis “Modern Antenna Handbook”, 780470036341 |Online ISBN: 9780470294154 |DOI:10.1002/9780470294154,Copyright © 2008 John Wiley & Sons, Inc.
2. Thomas A. Milligan “Modern Antenna Design” (Wiley – IEEE) , 2nd edition, Hardcover – 29 Jul 2015
3. W. L. Stutzman, and G.A. Thiele, "Antenna Theory and Design", 2 nd Ed., John Wiley & Sons., 1998.
4. R. S. Elliot, "Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**Electronics & Communication Engineering**
2.	**Course Code**	**ECF442**
3.	**Course Title**	**Digital Image Processing**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Digital Signal Processing**
7.	**Course Basket**	**DE**

8. Course Summary

This course will introduce students about digital image processing and its use in different kind of applications like medical imaging and satellite imaging. The course offers the understanding of image processing with different – different algorithms and techniques along with all techniques used digital image processing.

9. Course Objectives

- To learn the fundamentals of Digital Image Processing
- To learn the basic operations of Digital Image Processing
- To develop the algorithms for DIP
- To study various transforms and filters used in DIP.

10. Course Outcomes

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

- The course provides an understanding of:
- Digital Image Processing and its scientific significance.
- Skill to develop the algorithm for digital image processing.
- Skills to use digital signal processing in various applications.

11. Curriculum Content

UNIT 1: Fundamentals of Digital Image Processing:

Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter**.**

UNIT 2: Image Enhancement in Frequency Domain:

Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Low pass Filters; Sharpening Frequency Domain Filters – Gaussian High pass Filters. Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering–Band pass Filters; Minimum Mean-square Error Restoration**.**

UNIT 3: Colour Image Processing:

Colour Image Processing: Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of

Connected Components, Convex Hull, Thinning, Thickening**.**

UNIT 4: Image Registration & Segmentation:
Registration: Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging–Algorithms to Establish Correspondence, Algorithms to Recover Depth segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection**.**

UNIT 5:
Feature Extraction: Representation, Topological Attributes, Geometric Attributes. Description: Boundary-based Description, Region-based Description, Relationship. Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching.

List of Experiment:

1. Display of Gray scale Images.r
2. Histogram Equalization.
3. Design of Non-linear Filtering
4. Determination of Edge detection using Operators.
5. 2-D DFT and DCT
6. Filtering in frequency domain.
7. Display of color images.
8. Conversion between color spaces.
9. DWT of images.
10. Segmentation using watershed transform

Textbook(s)

1- Rafael C. Gonzalvez and Richard E.Woods., Digital Image Processing 2nd Edition, Pearson Education.

Reference Books

- A.K. Jain. , Fundamentals of Digital Image Processing, Prentice Hall, Upper Saddle River, NJ.
- R.J. Schalkoff. , Digital Image Processing and Computer Vision, John Wiley and Sons, NY.

12. Teaching and Learning Strategy
All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**Electronics & Communication Engineering**
2.	**Course Code**	**ECF443**
3.	**Course Title**	**Design of Communications**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Principle of Communication**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce students about the designing aspects of various communication systems. It will also make the students to explore the different aspects of

9. Course Objectives

- To understand the concept of Radio Communication System design and their performance
- To understand the basics of Radio circuit design for communication networks
- To learn the basics of receiver design and with different – different modulation techniques
- To understand the concept of frequency synthesis and Frequency Mixing

10. Course Outcomes

The course provides an understanding of:

- Basic Receivers design for radio communication.
- Noise Performance of Communication Networks
- Skills to use Modern Communication system design

11. Curriculum Conten

UNIT 1:

Radio Communication Systems, Network Noise & Intermodulation Distortion:

Introduction to Radio Communication Systems, Noise sources, noise measures, design of low noise networks, inter- modulation distortions. Frequency selective networks and transformers: Series resonant circuits, parallel resonant circuits with transformers, impedance matching and harmonic filtering using reactive networks.

UNIT 2:

Radio Circuits & Amplifiers: General features of audio amplifiers, audio mixers, Wideband amplifiers: Review of high frequency analysis of BJT and FET amplifiers, input compensation, neutralization and feedback techniques for wide banding cascade amplifiers, high frequency amplifiers using MOSFETS

UNIT 3:

Phase Locked Loop Circuits Basic PLL operation, transient response of PLL, Linear model of the PLL-1st order, 2nd order PLL, lock range and capture range, phase detectors, PLL application- tracking filters, angle modulation, frequency demodulation, amplitude demodulation, phase shifters, signal synchronizers, frequency translators PLL IC 565, digital PLL.

UNIT 4:

Frequency Synthesizers: Direct frequency synthesis, frequency synthesis by phase lock, 565 as frequency synthesizer, effect of reference frequency on loop performance variable modulus dividers,

down conversion, methods for reducing switching time, multiple loop frequency synthesizer, fractional N loops, direct digital synthesis, synthesizer design.

UNIT 5:

Mixers, Modulators & Demodulators: Frequency mixers, switching type mixers, diode ring mixers, square law mixers, BJT and FET mixers, review of balanced modulator principle, applications of balanced modulator, IC based Balance modulator/demodulator, amplitude modulators, product detector, frequency doubler, AM generation and detection**.**

Textbook(s)

1. Modern Communication Circuits-Jack Smith, Mc-Graw Hill publication

Reference Books

- Stensby, J. L., Phase Locked Loops, CRC Press LLC, Boca Raton, FL, 1997.
- Bowick, C., RF Circuit Design, Newnes Publishing, Burlington, MA, 1982.
- McClaning, K. and Vito, T., Radio Receiver Design, Noble Publishing Corp., Atlanta, GA, 2000.
- Tomasi, W., Advanced Electronic Communications Systems, Fifth Edition, Prentice-Hall Inc., Englewood Cliffs, NJ, 2001.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Computer

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF444**
3.	**Course Title**	**OPTICAL FIBRE COMMUNICATION**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce students about the overview of Optical Communication Link and Optical fiber characteristics: modes, loss, dispersion, nonlinearities. This course also provide the knowledge of optical transmitters components like directly modulated semiconductor lasers, and receivers end components like photodiodes, avalanche photodetectors. It can also familiarize the students about system design and performance: bit-error rate, signal-to-noise ratio and Optical amplifiers: Erbium-doped fiber amplifiers, Rmaan amplifiers

9. Course Objectives

- Compute and simulate the modes in slab waveguide, step index fiber and graded index fiber.
- Calculate and simulate optical fiber parameters.
- Calculate and simulate the attenuation and signal degradation in fiber.
- Understand the structure, the performance and the signal analysis of optical sources and detectors.
- Design optimum single mode and multimode fiber link

10. Course Outcomes

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

- To comprehend the basic elements of optical fiber transmission link, fiber modes
- To visualize the significance of the different kind of losses, signal distortion in optical wave guides, signal degradation factors and dispersion management techniques in optical system performance.
- To compare the various optical source materials, LED structures, quantum efficiency as well as structures and figure of merit of Laser diodes.
- To analyze the fiber optic receiver operation and configuration.
- To analyze the system performance of optical transmitters, receivers.
- To analyze and deign optical fiber link with encapsulation of different system components.

11. Curriculum Content

UNIT 1: Overview of Optical fiber Communications:

Brief review of analog and digital communication system ,Optical Spectral bands, Evolution of fiber optic system, Elements of an optical fiber transmission link, transmission widows, advantages of optical fiber link over conventional systems, applications of fiber optic transmission systems. Optical fibers: Structures, Waveguiding : Optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers ,single mode and multimode fibers, Derivation for numerical aperture, V number and modes supported by step index fiber, mode field diameter, Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes.

UNIT 2: Signal Degradation in Optical Fibers :
Signal distortion in optical waveguides, attenuation, scattering loss, bending loss, pulse broadening in multimode fiber, derivations, graded index fiber, Characteristics of Single Mode Fibers, dispersion in single mode fiber and derivations, dispersion shifted fiber, dispersion flattened fiber.

UNIT 3: Optical sources and power launching:
Optical Sources: Semiconductor Physics background, Light emitting diode (LEDs)- structures, materials, Figure of merits, characteristics & Modulation. Laser Diodes - threshold conditions, Einstein relation.Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity. Power Launching and Coupling : Source to fiber power launching, fiber-to-fiber joints, LED coupling to single mode fibers, Splicing single mode fiber

UNIT 4: Photodetectors:
Principles of operation, types of detectors , photodiode materials, photodetector noise, detector response time, temperature effects on gain, comparison of photodetectors.

UNIT 5: Optical Receiver Operation:
Receiver operation, error sources, receiver configuration, Preamplifier types, Eye diagrams, Coherent detection, Specification of receivers
Transmission Systems**:** Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, line coding.

List of Experiments:

1. Setting -up of Analog/ Digital Optical communication Link
2. Measurement of attenuation characteristics of an optical fiber
3. Measurement of NA of a multimode fiber
4. Measurement of Mode field diameter of a single mode fiber.
5. Measurement of Dispersion of optical fiber
6. Performance of PAM,PWM and PPM on fiber optic link
7. Preparation of optical fiber end and practices on splicing/connectorization
8. Setting -up of voice link on Optical communication Link
9. Calculate for Step Index Fibers (using MATLAB): NA, Acceptance Angle, Normalized propagation constant β, V number, Check whether the fiber is single mode or multi-mode, graph- b vs V.
10. Calculate for Graded Index Fibers (using MATLAB): Normalized propagation constant β, V number, Check whether the fiber is single mode or multi-mode, graph- b vs V, cut off wabelength.

Textbook(s)

1. Gerd Keiser, Optical Fiber Communications, third edition, McGraw Hill

Reference Books

- John M. Senior, Optical Fiber Communications, PHI/Pearson
- Djafar Mymbaev & Lowell L, Scheiner, Fiber optical communication Technology, Pearson
- G. Agrawal, Fiber optic Communication Systems, John Wiley and sons

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF345**
3.	**Course Title**	**MATLAB For Engineers**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:4**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course develops programming skills for data analysis,numerical analysis and graphical visualization.

9. Course Objectives

- To aim at providing programming skills from basic level onwards using MATLAB software
- To aim at using MATLAB software for data acquisition, data analysis,
- To aim at using MATLAB software for graphical visualization, numerical analysis, algorithm development, signal processing and many other applications.

10. Course Outcomes

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

- Illustrate the direct connection between the theory and real-world applications encountered in the typical engineering and technology programs.

11. Curriculum Content

Unit 1:

Basics MATLAB environment, Variables, Basic data types, Relational and Logic operators, Conditional statements, Input and Output, Loops and branching.

Unit 2:

Matrices Creating and Manipulating matrices, Matrix maths and Matrix functions, Colon operator, Linspace, Cross product, Dot product, Logical functions, Logical indexing, 3-dimensional arrays, Cell arrays, Structures, Plotting: 2-D and 3-D plots: Basic plots, subplots, Histograms, Bar graphs, Pie charts.

Unit 3:

Simulink Introduction, Block diagram, Functions, Creating and working with models, Defining and managing signals, Running a simulation, analyzing the results.

Unit 4:

M-file scripts Creating, saving and running an M-file, Creating and running of a function, Function definition line, H1 and help text lines, Function body, Sub-functions, Nested functions, File I/O handling, M-file debugging.

Unit 5:

Applications Root finding, Data analysis, Statistical functions, Polynomials, Curve fitting, Interpolation, Ordinary differential equations, Integration and differentiation, Signal processing applications, Circuit analysis applications, Control system applications.

Textbook(s)

- D Hanselman and B Littlefield, Mastering Matlab 7, Pearson Education.

Reference Books

- A Gilat, Matlab: An Introduction with Applications, John Wiley and Sons, 2004.
- Y Kirani Singh and B BChaudhari, Matlab Programming, Prentice Hall of India, 2007
- Steven T Karris, Introduction to Simulink with Engineering Applications, 2nd edition, Orchard Publication, 2008.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF445**
3.	**Course Title**	**Satellite Communication**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce students to Basic satellite system and it's functioning, Orbital dynamics and satellite launching mechanism, Functioning of Space segment and Earth Station ,Satellite link design, Uplink, downlink and Transponder model, Latest applications of services provided by satellite systems

9. Course Objectives

- To introduce the students to Satellite systems and their functioning
- To understand the orbital dynamics and satellite launching mechanism.
- To understand the space segment and the functioning of various satellite subsystems
- To understand the Earth station system architecture and satellite link design
- To understand the latest satellite mobile services and specialised services in use.

10. Course Outcomes

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

The course provides an understanding of:

- Basic satellite system and it's functioning
- Orbital dynamics and satellite launching mechanism
- Functioning of Space segment and Earth Station
- Satellite link design equations
- Latest applications of services provided by satellite systems

11. Curriculum Content

Unit 1: OVERVIEW OF SATELLITE SYSTEMS, ORBITS AND LAUNCHING METHODS

Review of concept of communication systems, Evolution of satellite systems, Basic elements of a satellite system, Satellite Frequency bands, Orbital Satellites, Kepler's Laws, Orbital Elements, Solar time and Sidereal Time, Satellite orbits, Orbital perturbations, Orbital parameters, Look angles, Satellite launching Mechanism.

Unit 2: **SPACE SEGMENT**

Introduction to satellite subsystems, Transponder subsystem, Antenna Subsystem, AOCS, TT&C Subsystem, Communication Subsystems, Power Subsystem, Thermal Subsystem, Reliability and Quality Assurance .

Unit 3: EARTH SEGMENT & SATELLITE LINK DESIGN:

Elements of earth station, Types of earth station – FSS, BSS, MSS, Earth station architecture, Earth station design considerations, Satellite Link design: basic transmission equation, Satellite uplink model, Satellite downlink model, Transponder model, Link Equations, Noise considerations- Overall System Noise Temperature, Noise calculation for cascaded stages, G/T ratio for earth stations

Unit 4: SATELLITE MULTIPLE ACCESS TECHNIQUES

FDMA: Single Access – Pre assigned FDMA, Demand-Assigned FDMA, SPADE System. Bandwidth-limited and Powerlimited TWT amplifier operation, FDMA downlink analysis. TDMA: Reference Burst; Traffic Date, Frame Efficiency and Channel capacity, pre-assigned TDMA, Demand assigned TDMA.

CDMA: Direct Sequence CDMA system, Frequency Hopping CDMA system

Unit- 5: SATELLITE MOBILE AND SPECIALIZED SERVICES

Satellite Mobile Services: Satellite Mobile Services , Radarsat , Global Positioning System , Orbcomm, Satellite telephony, Satellite television, Satellite radio, satellite Data Communication Services. Specialized Services: Weather forecasting satellites, navigation Satellites, Military communication Satellites, EDUSAT systems, Telemedicine.

Textbook(s)

1. Dennis Roddy, Satellite Communications, McGraw Hill , 3rd Edition 2001

Reference Books

1. M.Richharia- Satellite Communication Systems, Mc Graw Hill, 2nd Edition
2. Timothy Pratt,CharlesBostian& Jeremy Allnutt, Satellite Communications, John Wiley & Sons, 2nd Edition,2006
3. R.N.Mutagi-, Satellite Communications- Principles and Applications, Oxford University Press, Ist Edition 2016

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF446**
3.	**Course Title**	**OPTICAL NETWORK**
4.	**Credits (L:T:P:C)**	**3:0:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

The course will give the student in-depth understanding of the functionality of optical networks and how they may be implemented. How an optical network can work together with an IP-based network infrastructure for ensuring both high reliability and performance in access, metro and transport networks, is paid special attention and Media-Access Control Protocols. The topics covered include building blocks for optical networks and systems. Principles and the function of optical circuit switched networks, both network elements like reconfigurable add/drops and optical cross-connects as well as the principle of a wavelength routed optical network are covered

9. Course Objectives

- Define the main possibilities and limitations of optical network technologies
- Identify and illustrate the main differences between optical networking and traditional networking
- Solve simple WDM network design and optimization problems
- Assess the concept and analyse/compare the benefits of various optical layer survivability strategies
- Identify, illustrate, and compare the main issues in management and control of optical networks

10. Course Outcomes

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

- Understand the concept of optical networking components and architectures.
- Gain wide knowledge of Optical Networks and applications.

11. Curriculum Content

UNIT 1: Introduction and Components:

Brief review of optical fiber communication,Light propagation in optical fibers-Loss & bandwidth, Services, Circuit Switching, Packet Switching, Optical Networks, Optical Layer, Transparency and All Optical Networks. Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers- Erbium Doped Fiber amplifiers, Raman amplifiers, Semiconductor optical Amplifiers, Cross talk in SOAs., Switches, Wavelength Converters.

UNIT 2: Optical Network Architectures:

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Test beds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT 3: Network and Design:

SONET/SDH- Multiplexing, SONET/ SDH Layers, Frame Structure, Frame Structure, Physical Layer, Elements of a SONET/SDH Infrastructure. ATM - Functions of ATM, Adaptation Layers, Quality of Service, Flow Control, Signaling and Routing. WDM Network Elements.

UNIT 4: Transmission System Engineering:
System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Cross talk, Dispersion, Fiber Nonlinearities, Wavelength Stabilization .Design of Soliton Systems, Design of Dispersion–Managed Soliton Systems

UNIT 5: WDM Network Design and Management:
Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, Optical Cross connects. Cost Trade Offs, wavelength assignment problems, ,LTD and RWA Problems, Dimensioning Wavelength-Routing Networks, Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

Textbook(s)

1. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition

Reference Books

1. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India,
2. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall,

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF447**
3.	**Course Title**	**PHOTONICS**
4.	**Credits (L:T:P:C)**	**3:0:0:0**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Fundamental of Electronics Engineering**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce students about problem solving techniques using different coordinate systems. It can familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. It can also expose the students to the ideas of electromagnetic waves and structure of transmission line.

9. Course Objectives

- Physical principles and engineering applications of optical field.
- Design principles covering the behaviour of optical components and photonic devices

10. Course Outcomes

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

- The basic physics behind optoelectronic devices.
- Develop basic understanding of light emitting sources and detectors.
- Develop detailed knowledge of photonic devices and sensors.
- Acquire detailed knowledge of photonic switching devices for photonic integrated circuits.

11. Curriculum Content

Unit 1 Fundamentals of Photonics:

This course provides students with a working knowledge of optics and photonics, including wave optics, physical optics and introductory laser physics. It also provides a basis for further study in photonics. Wave optics content: solutions of the wave equation, optical cavities, Fresnel and Fraunhofer diffraction integrals dispersion, polarisation, birefringence and applications; optical activity; Faraday effect. Laser physics content: laser resonators; Einstein coefficients; stimulated amplification of light; laser oscillators; mode control; overview of some real lasers.

UNIT 2: Semiconductor Photon Sources and Detectors:

Semiconductor Photon Sources: LEDs, Semiconductor Laser Amplifiers, Semiconductor Injection Laser; Semiconductor Photon Detectors: Properties of Semiconductor; Photodetectors, Photoconductors, Photodiodes. Avalanche Photodiodes, Noise in Photodetectors.

UNIT 3: Dynamic and Active devices and Applications:

Electro-optic devices, Acousto-optic devices, Thermo-optic and magneto-optic device, Integrated optical amplifiers. Applications Examples: fiber optic sensors; Optical signal processing.

UNIT 4: Photonic switching and computation

Photonics Switches, All-Optical Switches ,Bistable Optical Devices, Optical interconnects ,Optical computing.

UNIT 5: Integrated Photonic Circuits:
Nonlinear integrated optics ;Opto-electronic integrated circuits; Silicon based photonic integrated circuits; Nano photonic structures; Bio photonic applications.

Textbook(s)

1. Saleh and Teich,"Fundamentals of Photonics" second edition, Wiley, 2007

Reference Books

1. C R Pollock and M Lipson: Integrated photonics, Kluwer Pub, 2003
2. T Tamir, Guided wave opto-electronics, Springer Verlag, 1990.
3. W. Lucke, "Introduction to Photonics"

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF448**
3.	**Course Title**	**Spread Spectrum Systems**
4.	**Credits (L:T:P:C)**	**3:0:0:3**
5.	**Contact Hours (L:T:P)**	**3:0:0**
6.	**Prerequisites (if any)**	**Digital Communication**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course will introduce students about spreading techniques using various methods. It also includes overview of Direct sequence spread spectrum systems, FHSS and hybrid spread spectrum systems.

9. Course Objectives

The purpose of this course is to provide the students with understanding of basic concepts of spread spectrum systems. Also, it provides detailed information about the entire process of PN sequence generation. This course also aims at application of spread spectrum systems in current communication technologies

10. Course Outcomes

The course provides an understanding of:

(a) Defining of spread spectrum parameters.

(b) Principle concept of PN sequences and their generation.

(c) Application of spread spectrum systems in current communication technologies

1 Curriculum Content

1.

UNIT 1

Introduction: Introduction to spread spectrum, origin of spread spectrum systems, different types of spread spectrum techniques, direct sequence system, frequency hopping systems, hybrid systems, Process gain factor for hybrid spread spectrum systems.

UNIT 2

Coding for Communication and Ranging: Property of codes for spread spectrum, maximal length sequences and their properties Autocorrelation and cross correlation of codes, composite codes (Gold code sequences) and their generation, mirrored and non-mirrored sequences, analysis of PN sequences with respect to correlation bound.

UNIT 3

Modulation and Demodulation: Balance modulator, quadric-phase modulator, frequency synthesis for spread spectrum modulation, in line and heterodyne correlation, base band recovery, phase lock loop, COSTAS loop, FM feedback, PDM and FH demodulators.

UNIT 4

Need for Synchronization: Need for synchronization, types of synchronizers, RF link- Noise figure, co-channel users, dynamic range and AGC, propagation medium,

UNIT 5

Test and Evaluation of Spread Spectrum System: Testing and evaluation of spread spectrum parameters as Selectivity, sensitivity, jamming margin, synch acquisition, processing gain. Transmitter measurements, cross correlation, synch acquisition

Textbook(s)

1. R. C. Dixon, “Spread Spectrum Systems with Commercial Application”, John Wiley, 3rd Ed.

Reference Books

- H. Taube and D. L. Schilling, “Principles of Communication Systems”, Tata McGraw Hill, 2nd Ed. Reprint 2007

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF346**
3.	**Course Title**	**VLSI Design**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**Electronics Devices and Circuits**
7.	**Course Basket**	**Discipline Elective(DE)**

8. Course Summary

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. ... The course is designed to give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon.

9. Course Objectives

The basic objective of this course is introduction to basic theories and techniques of digital VLSI design in CMOS technology and study of fundamental concepts and structures of designing digital VLSI systems including static and dynamic logical circuits.

10. Course Outcomes

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

1. Be able to use mathematical methods and circuit models in analysis of CMOS digital electronics circuits.
2. Be able to create models of moderately sized CMOS circuits that realize specified digital functions.

11. Curriculum Content

Unit 1: Introduction:

VLSI design methodologies, VLSI design flow, Design Hierarchy, Concepts of regularity, modularity and locality, VLSI design styles: full custom, semi- custom, FPGA, Gate array. MOS Transistor: MOS structure, MOS system under external bias, threshold voltage, V-I characteristics, derivation of drain current, channel length, substrate bias effect.

Unit 2: Cmos Inverter:

Resistive load inverter, Enhancement/depletion load inverter (circuit diagram, advantages and disadvantages); Static CMOS inverter: Voltage transfer characteristics, calculation of VIL, VIH and VTH, noise margin concepts and their evaluation, power consumption.

Unit 3: MOS Design and Logic:

MOS Layers, stick diagrams, MOS Design style, Design rules and layout, layout diagrams; Combinational MOS logic circuit: Design of two input NOR gate and two input NAND (calculation of VOH and VOL), Complex logic circuits and layout. CMOS transmission Gate; Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable elements, SR latch circuit, JK latch.

Unit 4: Dynamic Logic Circuit and Memories:

Basic principles of Pass Transistor circuit. CMOS Transmission gate logic, Dynamic CMOS logic, High performance Dynamic CMOS structures: DOMINO ,MEMORIES: Memory classification, Non-volatile memory: design of NAND and NOR based ROM; DRAM: design (1T, 2T, 3T), read and write operations and operating modes; SRAM: design and operation.

Unit- 5: Design for Testability:
Fault types and models: Physical defects, Electrical Faults and Logical Faults, controllability and observability, Design for testability, Ad Hoc testing, structured design for testability, Built-In self-Test (BIST) Techniques.

Textbook(s)

1. Sung-Mo Kang, 'CMOS Digital Integrated Circuits', Tata McGraw Hill

Reference Books

1. Neil H.E. Weste, 'Principle of CMOS VLSI Design', Pearson Education India
2. Jan M. Rabey, 'Digital Integrated Circuist', Prentice Hall Publication
3. A.Pucknell and Kamran Eshraghian, 'Basic VLSI Design by Douglas'

List of Experiments:

1. Study the V-I characteristics of NMOS transistor
2. Study of different invertor designs
   a) Resistive load inverter
   b) NMOS load inverter
   c) PMOS load inverter
   d) CMOS inverter
3. Implement and verify the functionality for the following using CMOS technology
   a) Two input NAND gate
   b) Two input NOR gate
4. Implement and verify the functionality for a Boolean function using CMOS technology.
5. Draw the layout for the following and verify its functionality.
   CMOS inverter
   two input NAND gate
   two input NOR gate
6. Draw and verify the layout the following function

$$X = \overline{(AB + D + EF)}$$

7. Study of different design styles
8. Implementation of minor project based on VLSI

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF449**
3.	**Course title**	**Microwave Devices**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**EM & WP**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to Install and maintain microwave devices, components and accessories used in telecommunication field.

9. Course Objectives

1. To introduce the students to low frequency & high frequency transmission .
2. To understand the high frequency transmission parameter component and devices
3. To understand the the functioning scattering parameter in MW component.
4. To understand the high frequency sources and cavity structure.

10. Course Outcomes

The course provides an understanding of:

- Microwave components and Set up of microwave bench for optimum operation.
- Microwave semiconductor devices used to realized amplifiers and oscillators.

11. Curriculum Content

UNIT 1: TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION

Low frequency parameters-impedance, admittance, hybrid and ABCD. High frequency parameters-Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor, applications of RF

UNIT 2. RF TRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS

Amplifier power relation, stability considerations, gain considerations noise figure, impedance matching networks, frequency response, T and Π matching networks, microstripline matching networks.

UNIT 3. MICROWAVE PASSIVE COMPONENTS

Microwave frequency range, significance of microwave frequency range - applications of microwaves. Scattering matrix -Concept of N port scattering matrix representation- Properties of S matrix- S matrix formulation of two-port junction. Microwave junctions - Tee junctions -Magic Tee - Rat race - Corners - bends and twists - Directional couplers - two hole directional couplers- Ferrites - important microwave properties and applications – Termination - Gyrator- Isolator-Circulator - Attenuator - Phase changer – S Matrix for microwave components – Cylindrical cavity resonators.

UNIT 4: MICROWAVE SEMICONDUCTOR DEVICES

Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs - Principles of tunnel diodes - Varactor and Step recovery diodes - Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT devices. Parametric devices - Principles of operation - applications of parametric amplifier .Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques, HEMT.

UNIT 5. MICROWAVE TUBES AND MEASUREMENTS

Microwave tubes- High frequency limitations - Principle of operation of Multicavity Klystron, Reflex Klystron, Traveling Wave Tube, and Magnetron. Microwave measurements: Measurement of power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

List of Experiments:

1. Gunn Diode Characteristics
2. Reflex Klystron Characteristics
3. Attenuation Measurement
4. VSWR Measurement
5. Waveguide Parameters Measurement
6. Impedance and Frequency Measurement
7. Scattering Parameters of Magic Tee
8. Directional Coupler Characteristics
9. Radiation Pattern of Horn Antenna
10. Measurement of losses for microwave Link

List of Two Value Added Experiments:

1. Measurement of losses for Analog Optical Link
2. Visit a place where waveguides are used for microwave communication. (Such as airport, earth station, Telephone exchange, Microwave link repeater, TV broadcast)

Textbook(s)

1. Liao Samuel, "Microwave Devices & Circuits", PHI Learning, New Delhi, (Latest edition)
2. D.M. Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.
3. Kennedy George "Electronics communication system", Tata McGraw hill, New Delhi (Latest edition)

Reference Books

1. Microwave & RADAR Engineering by Gautam A. K, S K Kataria Publications, New Delhi,(Latest edition)
2. Merrill I. Skolnik, 'Introduction to radar systems', McGRAW-HILL BOOK

COMPANY,(2nd edition)
3. Robert. E. Collin, 'Foundation of Microwave Engg', McGraw Hill.
4. M.M. Radmanesh , 'RF & Microwave Electronics Illustrated', Pearson Education, 2007

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF348**
3.	**Course Title**	**Biomedical Instrumentation**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Discipline Elective**

8. Course Summary

This course introduces the students to the various technical details of the different biomedical Instrumentation systems aiming to make them aware of the principles and concepts involved.

9. Course Objectives

- Requirement of bio-medical and its application
- Concept of bio-potential electrodes and measurements related to them.
- Concepts of bio-transducers and measurements related to them.
- Concept of bio-medical instruments and their uses.

10. Course Outcomes

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

The course provides an understanding of:

- Bio-medical instruments and measurements.
- Principle of working of bio-medical transducers.
- Skills to use modern bio-medical tools and equipment for measurements related to human body.

11. Curriculum Content

Unit 1: ANATOMY AND PHYSIOLOGY:
Basic Cell Functions, Origin of Bio-potentials, Electrical Activity of Cells, components of man Instrument system, types of bio-medical stems, design factors and limitations of biomedical instruments, terms and transducers to various physiological events.

Unit 2: **BIO-POTENTIAL ELECTRODE:**
Types of bio-potential electrodes., Electrode-Electrolyte interface, half cell potential, Polarization- polarisable and non- polarisable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body surface recording electrodes for ECG, EMG, EEG. Electrodes standards.

Unit 3: BIO-TRANSDUCER:
Transduction Principles: Resistive Transducers Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. Strain Gauge type Blood pressure transducers. Thermo resistive transducer, Inductive Transducers, Capacitive Transducer Piezoelectric Transducer Bio potential Measurement.

Unit 4: BIOMEDICAL INSTRUMENTATION CARDIAC MEASUREMENT:
Cardiovascular System, Heart Structure, Cardiac Cycle, ECG Theory, ECG Electrodes, Electrocardiograph, Indicator dilution methods; Measurement of continuous Cardiac output derived from aortic pressure waveforms, cardiac Arrhythmias; Phonocardiogram, Measurement of heart rate, Blood pressure, Temperature, Respiration rate, Blood Flow meters.

Unit- 5: BIOTELEMETRY AND ELECTRICAL SAFETY:
Bio-telemetry design, single channel bio telemetry transmitter and receiver system based on AM, FM and, pulse modulation. Significance of Electrical Danger, physiological effect of current, ground shock Hazards.

Textbook(s)

1. Joseph J. Carr & John. M. Brown, 'Introduction to Biomedical Equipment technology'

Reference Books

1. J.G. Webster, 'Medical instrumentation application and design', Houghton Miffin Co., Boston USA.
2. Mohan Murali H, 'Monograph on Biomedical engineering', O.U. Press 1985.
3. Geddes L. A. & L. E. Baker, 'Principles of Applied Biomedical Instrumentation', Wiley, 1989.
4. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, 'Biomedical Instrumentations and Measurements' (2nd edition), PHI, 1991.
5. R.S. Khandpur, 'Handbook of Biomedical Instrumentation', McGraw Hill.

LIST OF EXPERIMENTS

1. Pulse measurement
2. Heartbeat measurement
3. Automatic BP measurement
4. Heart sound study using electronics stethoscope
5. ECG measurement

Following experiments to be done on the breadboard

6. Design of low noise and low frequency amplifier for biomedical application
7. Design of Instrumentation amplifier
8. Construction of chopper amplifier

Two Value Added Experiments to be added by Instructor.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF451**
3.	**Course Title**	**ANN & FUZZY LOGIC**
4.	**Credits (L:T:P:C)**	**2:0:1:3**
5.	**Contact Hours (L:T:P)**	**2:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**DE**

8. Course Summary: This course is about the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations

9. Course Objectives

- To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.
- Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.

10. Course Outcomes: On successful completion of the course, students will be able to achieve the following:

1. Understand the fundamental theory and concepts of neural networks
2. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

11. Curriculum Content

Unit 1 Neural Networks-1(Introduction & Architecture): Neuron, biological neuron, Artificial Neuron and its model, activation functions, Neural network architecture: Single layer and multilayer feed forward networks, recurrent networks, and various learning techniques.

Unit 2 Back propagation networks Architecture: perceptron model, single layer artificial neural networks, multilayer perceptron model; back propagation algorithm, effects of learning coefficient; factors affecting back propagation training, applications.

Unit 3 Fuzzy logic-I (Introduction): Basic concept of fuzzy, Fuzzy sets and crisp sets, Fuzzy sets theory and operations, Properties of fuzzy sets. Fuzzy and crisp relation.

Unit 4 Fuzzy Membership Functions, Rules: Membership functions, inference in fuzzy logic, fuzzy if then rules, fuzzifications & defuzzifications, fuzzy controller.

Unit 5 Application of Neural and fuzzy logic: Application of neural network, Neural Network approach in load flow study. Fuzzy logic application in industries.

Textbook(s)

1. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI

Reference Books

1. Simon Haykins, ”Neural Networks” Prentice Hall of India
2. Moore, “Digital control devices”, ISA press, 1986.
3. Kumar Satish, “Neural Networks”, Tata Mc Graw Hill
4. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill 1997

List of Experiments:

1. Calculate the output of a simple neuron
2. Create and view custom neural networks
3. Classification of linearly separable data with a perceptron
4. Classification of a 4-class problem with a 2-neuron perceptron
5. ADALINE time series prediction with adaptive linear filter
6. Classification of an XOR problem with a multilayer perceptron
7. Classification of a 4-class problem with a multilayer perceptron
8. Radial basis function networks for function approximation
9. Classification with a 2-layer perceptron
10. Pattern association with a linear neuron

List of Two Value Added Experiments:

1. Character Recognition using Hopfield network
2. Classification with a 2-neuron perceptron

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1. Department offering the course	**EECE**
2. Course Code	**ECF452**
3. Course Title	**Latest Trends in Communication**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**None**
7. Course Basket	**DE**

8. Course Summary

The course provides an understanding of SDR and Cognitive radio, Wireless system and standards OFDM and it's variants, MIMO Systems, Wireless Adhoc networks and wireless network capacity .

9. Course Objectives

1. To introduce the students to Latest trends in Communication.
2. To understand the wireless communication systems and standards.
3. To understand the OFDM and MIMO systems.
4. To understand the wireless networks.

10. Course Outcomes

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

Understanding of:

- SDR and Cognitive radio.
- Wireless system and standards
- OFDM and it's variants
- MIMO Systems
- Wireless Adhoc networks and wireless network capacity

11. Curriculum Content

Unit 1: Software Defined Radios and Cognitive radios
Review of concept of OSI-model, TCP-IP model,Software defined radio: Concept of SDR, Hardware/Software architecture of SDR.
Cognitive radio: Definition, spectrum sensing, spectrum management, computational intelligence, architecture and radio resource management, Dynamic Spectrum Access.

Unit 2: **Wireless Communication System and Standards**
Broadcast networks-DAB, DVB, DTH, BWA, Infrastructure based cellular networks- GSM, GPRS, EDGE, CDMA based cellular standards, WLL, IMT-2000, 3G and beyond- HSDPA, HSUPA, HSPA, LTE, LTE-A.

Unit 3: OFDM principles
Basic principles of orthogonality, Single vs Multicarrier systems, OFDM Block diagram, Mathematical representation of OFDM signal, Advantages and disadvantages of OFDM systems, other variants of OFDM, Protection against multipath using Cyclic prefix, Peak-to-average Power Ratio.

Unit 4:
MIMO Systems: MIMO based system architecture, Antenna considerations for MIMO, MIMO channel modelling, Space time coding, Spatial Multiplexing, Diversity, Beamforming versus spatial multiplexing MIMO capacity; Smart antennas.

Unit 5: Wireless Ad Hoc and networks and wireless network capacity:
Mobile ad hoc networks, Bluetooth, Wi-Fi standards, WiMAX standards, Wireless Sensor Networks, data aggregation and routing for WSN, Ultra Wideband, energy efficiency and cross-layer design, Wireless capacity and channel state estimation wireless network capacity.

Textbook(s)

1. KE-LIN-DU , M.N.S. Swamy. Wireless Communication systems, Cambridge University Press. 1st edition.

Reference Books

1. Paulraj, A., Nabar, R. and Gore, G., "Introduction to Space-Time Wireless Communications", Cambridge University,Press. 2003
2. UpenaDalal, Wireless Communication , Oxford University Press, 1st edition 2009.

12. Teaching and Learning Strategy
All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1. Department offering the course	**EECE**
2. Course Code	**ECF453**
3. Course Title	**PLC, DCS and SCADA**
4. Credits (L:T:P:C)	**3:0:0:3**
5. Contact Hours (L:T:P)	**3:0:0**
6. Prerequisites (if any)	**None**
7. Course Basket	**Discipline Elective**

8. Course Summary

This course introduces the students to the various technical details of PLC, DCS and SCADA systems used in the industries. The students also learn the basic programming skills of PLC. The SCADA systems teaches the visual performance of the various components connected in the systems.

9. Course Objectives

- To acquaint the students with Industrial PLC & DCS systems.
- To familiarize the students with basic PLC programming.
- To acquaint the students with Reliability & Redundancy concepts.
- To acquaint the students with basic communication protocols of Industrial PLC & DCS systems.

10. Course Outcomes

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

- Basic understanding of PLCs and their industrial usage.
- Fundamental Programming using Ladder logic programming.
- Basic understanding of DCS and their industrial usage.
- Basic understanding of Reliability & Redundancy.
- Basic understanding of Communication Protocols used by PLC & DCS systems.

11. Curriculum Content

UNIT 1: Fundamentals of PLCs:

PLC Fundamentals, Discrete state Vs continuous state control, Building blocks of PLCs, PLC advantages & Disadvantages, Communication in PLCs, Types of PLCs, PLC Applications, Comparative study of industrial PLCs.

UNIT 2: PLC Functionality & Programming:

Programming methods- Relay & logic ladder diagrams, Boolean Logic, High Level Languages. Basic PLC Programming – Programming ON/OFF inputs to produce ON/OFF outputs, Relation of Digital Gate Logic to Contact/Coil Logic, Creating Ladder Diagrams from Process Control Descriptions. Basic PLC Functions – Register Basics, Timer Functions, Counter Functions. Intermediate PLC Functions – Arithmetic Functions, Number Comparison Functions

UNIT 3: DCS:

Evolution of DCS, Elements of DCS, Building blocks of DCS, Detailed descriptions and functions of field control units, Operator stations and data highways, Comparative study of industrial DCS, Case studies in DCS.

UNIT 4: Reliability& Redundancy Concepts:

Reliability, Reliability calculations, intrinsically safe instrumentation, Redundancy Concepts.

UNIT 5: Communication in DCS:
Basics of Computer Networks, Special Requirements of Network used for control, Communication protocols, Communication in DCS, Link Access Mechanism, Manufacturer Automation Protocols, Field Bus and Smart Transmitters.

Textbook(s)

1. Moore, Digital Control Device, ISA Press, 1986.

Reference Books

6. Huges T, Programmable Logic Controllers, ISA Press, 1994
7. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI 5th Edition, 2005
8. Tanaenbaum AS, Computer Networks, Prentice Hall, 1998.
9. Luckas MP, Distributed Control Systems, Van Nostrand Reinhold co., Newyork, 1986.

12. Teaching and Learning Strategy

All materials (ppts, assignments, etc.) will be uploaded in Moodle/MS Team.

Undergraduate Course Description Document

1. Department offering the course	**EECE**
2. Course Code	**ECF454**
3. Course Title	**TRANSDUCER AND INSTRUMENTATION**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Discipline Elective**

8. Course Summary

This course introduces the students to the various transducers and sensors that are used in the laboratory and industries. It broadly covers the electrical, mechanical, hydraulic, pneumatic, thermal, opto-electronic transducers explaining the principles on which they work.

9. Course Objectives

- To make students understand the Identification, classification construction, working principle and application of various transducers used for Displacement measurement, Temperature measurement, Level measurement, and Miscellaneous measurement
- To make the students learn the selection procedure, applications and comparative study of various Transducers
- To understand the role of the various elements of a measurement system and to specify and evaluate a measurement system for a given application
- To make the students evaluate the technological and physical limitations of a specific sensor and propose a suitable sensor for a given measurement situation.

10. Course Outcomes

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

The course provides an understanding of:

- Working principles of sensors and transducers.
- Measurement of physical quantities like displacement, temperature, pressure, etc.
- Applications of various transducers used in industry.
- Analyze smart sensors for their relevant applications.

11. Curriculum Content

Unit 1: Transducers:

Definition, principle of sensing & transduction, classification, Static and Dynamic characteristics. Mechanical and Electro- mechanical sensors: Resistive Transducers – potentio-metric type (linear and logarithmic), Strain gauge- resistive and semiconductor type, rosettes. Inductive sensors - Reluctance type, Mutual inductance, LVDT: Construction, material, I/O curve, applications, RVDT, Hall Effect Sensor. Capacitive transducers - variable distance-parallel plate type, variable area- parallel plate, cylindrical type, and variable dielectric constant type. Piezoelectric element: piezoelectric effect, materials.

Unit 2: **Thermal Sensors:**
Classification, Bimetallic Thermometer, Resistance thermometer (RTD), , Thermistors, Thermocouples – Principle of working, Thermoelectric Laws, Radiation Pyrometers, Optical Pyrometers, Pyrometers, Liquid Crystal Thermometer, Digital Thermometer.

Unit 3: Pressure Sensors:
Types, Manometers, Bourdon Tube – C Type, spiral type, Helical Type, Bellows, Diaphragms, Pressure Measurement using: LVDT, Potentiometer, Photoelectric Transducer.

Unit 4: Opto-Electronic Sensors:
Photo-emissive transducer, Photo-Conductive Transducer, Photo-Voltaic Transducer, Applications of Photo Diode and Photo Transistors as transducers, Optical encoders, Stroboscope, Fibre Optic Sensors.

Unit- 5: Miscellaneous Measurements:
Measurements of Liquid Level, Measurement of Humidity, Measurement of pH value, Sound measurement of using Microphone, ultrasonic sensors, Measurement of Nuclear Radiations: Geiger Muller Tube, Scintillation detectors, MEMS Sensors, Introduction to Smart Sensors.

Textbook(s)
1. D. Patranabis, “Sensors and Transducers,” 2nd edition, Prentice Hall of India Private Limited

Reference Books
10. B.C. Nakra & K. Chaudhry, “Instrumentation, Measurement and Analysis”, Tata Mc Graw Hill 2nd Edition.
11. A.K. Sawhney and Puneet Sawhney,“Mechanical Measurements & Instrumentation & Control,” Dhanpat Rai & Co., India
12. D.V.S. Murthy, “Transducers and Instrumentation,” Prentice Hall of India Private Limited (2003).
13. Ian R. Sinclair, “ Sensors & Transducers”, 3rd Edition, Newnes Publications.
14. E.O. Doebelin and Dhanesh N Manik, “Measurement Systems,” 6th Edition, McGraw Hill Education, India

LIST OF EXPERIMENTS
1. Measurement of unknown resistance with the help of a dc potentiometer.
2. To determine the characteristics of LVDT
3. To determine the characteristics of RVDT.
4. Measurement of strain using strain gauge.
5. Measurement of load using strain gauge based load cell.
6. Temperature measurement using thermocouple.
7. Temperature measurement using RTD.
8. Pressure measurement using Bourdon Tube.
9. Measurement of speed using Stroboscope/optical encoder.
10. Displacement measurement using IR Sensor.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

FREE ELECTIVE

Approved by 20th Meeting of Academic Council-DIT University

1. Department offering the course	**EECE**
2. Course Code	**ECF 381**
3. Course Title	**Microcontroller**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Free Elective**

8. **Course Summary:** This course is about the fundamentals Microcontroller system and its implementation.
9. **Course Objectives:**
   - To understand the concept of microcontroller based system.
   - To enable design and programming of microcontroller based system.
   - To know about the interfacing circuits and implementing them practically.
10. **Course Outcomes:**

On successful completion of the course, students will have understanding of:

- Micro-controller and its applications.
- Interfacing of Microcontroller.

11. Curriculum Contents:

UNIT I: INTRODUCTION:

Introduction, Comparison of microprocessor and microcontroller, evolution of microcontrollers from 4 bit to 32 bit, development tools for microcontrollers: Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives

UNIT II: MICROCONTROLLER 8051:

Block Diagram, Pin diagram and Pin Functions, General Purpose and Special Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.

UNIT III: ADDRESSING MODES, INSTRUCTION SET OF 8051:

Addressing modes and accessing memory using various addressing modes, instruction set: Arithmetic, Logical, Simple bit, jump, loop and call instructions and their usage. Time delay generation and calculation, Timer/ Counter programming.

UNIT IV: ASSEMBLY LANGUAGE PROGRAMMING:

Data Transfer: Block move, Exchange, Sorting, Finding largest element in an array. Arithmetic Instructions, Bit manipulations Instructions. Code conversion: BCD to ASCII, ASCII to Decimal, Programs to generate delay using on-Chip timer / Counter.

Text Books:

1. Muhammad Ali Mazidi, Janice GillispieMazidi and RolinMcKinlay, 'The 8051 Microcontroller and Embedded Systems Using Assembly and C', (Second Edition, Pearson Education).

Reference Books

1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005
3. K. J. Ayala, D. V. Gadre, ‘The 8051 Microcontroller & Embedded Systems using Assembly and C, Cengage Learning , India Edition.

List of Experiments:

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division.
3. Boolean & Logical Instructions (Bit manipulations).
4. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII;
5. Programs to generate delay using on-Chip timer /Counter.

II. INTERFACING

Write Assembly programs to interface 8051 chip to Interfacing modules.

1. Familiarization with KEIL, PROTEUS simulator and trainer kit.
2. Read Push-button switch and display its status on LED.
3. Interfacing 7-Segment LED Display with 8051 microcontroller.
4. Interfacing of 16x2 LCD with 8051 microcontroller and display message on it.
5. Interface 4x4 matrix keyboard with 8051 microcontroller. Display value of pressed switch on LCD.
6. Stepper and DC motor control interface to 8051 microcontroller.

List of Two Value Added Experiments:

1. External ADC and Temperature control interface to 8051 microcontroller.
2. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
3. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.

12. Teaching and Learning Strategy

- All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

1. Department offering the course	**EECE**
2. Course Code	**ECF382**
3. Course Title	**Biomedical Instrumentation**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Free Elective**

8. **Course Summary:** This course is about fundamental concepts of bio-medical instruments just like bio-potential electrodes, bio-transducers and their measurements
9. **Course Objectives:** The students will learn

- Requirement of bio-medical and its application
- Concept of bio-potential electrodes and measurements related to them.
- Concepts of bio-transducers and measurements related to them.
- Concept of bio-medical instruments and their uses experimentally.

10. **Course Outcomes:** The course provides an understanding of:

- Bio-medical instruments and measurements.
- Principle of working of bio-medical transducers.
- Skills to use modern bio-medical tools and equipment for measurements related to human body.

11. **Curriculum Contents**

UNIT I: ANATOMY AND PHYSIOLOGY:
Basic Cell Functions, Origin of Bio-potentials, Electrical Activity of Cells, components of man Instrument system, types of bio-medical stems, design factors and limitations of biomedical instruments, terms and transducers to various physiological events.

UNIT II: BIO-POTENTIAL ELECTRODE:
Types of bio-potential electrodes., Electrode-Electrolyte interface, half cell potential, Polarization- polarisable and non-polarisable electrodes, Ag/AgCl electrodes, Electrode circuit model; Electrode and Skin interface and motion artifact. Body surface recording electrodes for ECG. Electrodes standards.

UNIT III: BIO-TRANSDUCER:
Transduction Principles: Resistive Transducers Strain Gauge- types, construction, selection materials, Gauge factor, Bridge circuit, Temperature compensation. Strain Gauge type Blood pressure transducers. Inductive Transducers, Capacitive Transducer, Piezoelectric Transducer.

UNIT IV: BIOTELEMETRY AND ELECTRICAL SAFETY:
Bio-telemetry design, single channel bio telemetry transmitter and receiver system based on AM, FM and, pulse modulation. Significance of Electrical Danger, physiological effect of current, ground shock Hazards.

Text Books:

1.Joseph J. Carr & John. M. Brown, 'Introduction to Biomedical Equipment technology'
2.R.S. Khandpur, 'Handbook of Biomedical Instrumentation', McGraw Hill.=

Reference Books:

1 J.G. Webster, 'Medical instrumentation application and design', Houghton Miffin Co., Boston USA.
2 Mohan Murali H, 'Monograph on Biomedical engineering', O.U. Press 1985.
3 Geddes L. A. & L. E. Baker, 'Principles of Applied Biomedical Instrumentation', Wiley, 1989.

4 Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, 'Biomedical Instrumentations and Measurements' (2nd edition), PHI, 1991.

LIST OF EXPERIMENTS:

1.Pulse measurement

2.Heartbeat measurement

3.Automatic BP measurement

4.Heart sound study using electronics stethoscope

5.ECG measurement

Following experiments to be done on the breadboard

6.Design of low noise and low frequency amplifier for biomedical application

7.Design of Instrumentation amplifier

8.Construction of chopper amplifier

Two Value Added Experiments to be added by Instructor.

12. Teaching and Learning Strategy

- All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

1. Department offering the course	**EECE**
2. Course Code	**ECF481**
3. Course Title	**Analog Electronics**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Free Elective**

8. **Course Summary:** This course is about fundamental concepts of Semiconductors, electronics devices and their characteristics.

9. **Course Objective**: To teach the fundamental concepts of various electronic devices, circuits and their application. To develop ability among students for problem formulation, system design and solving skills.

10. **Course outcomes:**

- Students will be able to build, develop, model, and analyze the electronic circuits along with learning the device ratings and characteristics
- Students will be able to design and analyse electronic circuits

11. **Curriculum Content**

Unit-I

Semiconductor materials and properties Group-IV materials, Covalent bond, electron-hole concepts Basic concepts of energy bands in materials, concepts of forbidden gap Intrinsic and extrinsic semiconductors, donors and acceptors impurities

Unit-II

Junction diode and diode applications p-n junction, depletion layer, v- i characteristics, diode resistance, capacitance diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage).

Diode Applications Rectifiers (half wave and full wave), filter (C – filter), clipping circuits, clamping circuits, voltage multipliers

Unit-III

Breakdown diodes Breakdown mechanisms (zener and avalanche), breakdown characteristics, zener diode application as shunt regulator

Unit-IV

Bipolar Junction Transistor
Basic construction, transistor action, CB, CE and CC configurations, input/output Characteristics,

Transistor Amplifier
Graphical analysis of CE amplifier, concept of voltage gain, current gain.

Unit-V

Field Effect Transistor

JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristics equation CG, CS and CD configurations,
MOSFFT: depletion and enhancement type MOSFET-construction, operation and characteristics.

Textbook(s):

1. Boylestad and Nashelsky, 'erlectronic Decvices and circuits' PHI, 6e, 2001.

Reference Books:

1. A Mottershead, 'Electronic devices and circuits'. PHI, 2000.
2. Morris Mano, 'Digital Computer Design', PHI, 2003.
3. R.K. Singh & Ashish, Basic Electronics Engg. Laxmi Publication, 2007.
4. Milman & Halkias, Integrated electronics Electronics, PHI, 2005

List of Experiments:

1. To study V-I characteristics of p-n junction diode.
2. To study V-I characteristics of zener diode.
3. To study half-wave rectifier and calculate ripple factor and efficiency.
4. To study full-wave rectifier and calculate ripple factor and efficiency.
5. To study clipper circuits.
6. To study clamper circuits.
7. To study the input and output characteristics of CB and CE transistor.
8. To study drain and transfer characteristics of JFET.

12. Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

1. Department offering the course	**EECE**
2. Course Code	**ECF482**
3. Course Title	**Cellular Communication Network**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Free Elective**

8. Course Summary: This course is about fundamental concepts of communication technologies and Networks. Fundamentals of protocol system and modulation techniques have been included to make the students familiar about Cellular Communication Network

9. Course Objectives:

- To understand the concept of Computer Communication.
- To learn the basics of Data communication and Networks
- To develop and design the protocol systems for advance computer communication.

10. Course Outcomes:

The course provides an understanding of:

- Fundamental of Computer Communication and networks.
- Protocol design and their design issue.

11. Curriculum Contents

UNIT I: Introduction to Communication:

Communication system, Analog and Digital Communication, channel bandwidth. Ideal and Practical Filters, Concept of Signal Distortion over a Communication Channel, Energy Signal and Power Signal, Introduction to noise in Communication systems.

UNIT II: Introduction to Modulation techniques:

Concept of Amplitude Modulation, Concept of Frequency & Phase Modulation, Concept of ASK, FSK & PSK, Concepts of PCM.

UNIT III: Introduction to Data Communication Network & OSI Model:

Switching systems, network hardware and software, Layering, design issues for layering, reference models and their comparison, example of networks. Concepts of OSI model.

UNIT IV: Introduction to Data Communication Protocols and transmission media

MAC protocols- Aloha, CSMA, collision free protocols, Ethernet, IEEE 802.3 standard, IP protocols, IP addressing, OSPF, IPv4, IPv6. Transmission media and channel impairments, multiplexing, digital channels, switching. Repeaters, bridges, routers and gateways.

Text Books:

1. Forouzan, B.A., “Data Communication and Networking”, 4th Ed., Tata McGraw-Hill.
2. Simon Haykins, ‘Communication Systems’, John Wiley,5th edition

Reference Books:

1. Kurose, J.F. and Ross, K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Ed., Addison Wesley.
2. Tanenbaum, A.S, “Computer Networks”, 4th Ed., Pearson Education.
3. Stallings W., “Data and Computer Communication”, 8th Ed., Prentice-Hall.

List of Experiments:

1. To generate amplitude modulated wave and determine the percentage modulation and Demodulate the modulated wave using envelope detector.
2. To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal.
3. To generate the SSB modulated and Demodulated wave.
4. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal and to demodulate a FM signal
5. To study ASK modulation and Demodulation.
6. To study FSK modulation and Demodulation.
7. To study PSK modulation and Demodulation.
8. To Study TDM/PCM Transmitter /Receiver.

12. Teaching and Learning Strategy

- All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

1. Department offering the course	**EECE**
2. Course Code	**ECF483**
3. Course Title	**Digital Image Processing**
4. Credits (L:T:P:C)	**2:0:1:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**None**
7. Course Basket	**Free Elective**

8. **Course Summary:** This course is about the fundamentals of image processing and different operations involved. Different tools which are used in DIP are also part of course.
9. **Course Objectives:**
   - To learn the fundamentals of Digital Image Processing
   - To learn the basic operations of Digital Image Processing
   - To develop the algorithms for DIP
   - To study various transforms and filters used in DIP.
10. **Course Outcomes:**

On successful completion of the course, students will be able to achieve the following:
- The course provides an understanding of:
- Digital Image Processing and its scientific significance.
- Skill to develop the algorithm for digital image processing.
- Skills to use digital signal processing in various applications.

11. Curriculum Contents:

UNIT 1: Fundamentals of Digital Image Processing:
Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter**.**

UNIT 2: Image Enhancement in Frequency Domain:
Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Low pass Filters; Sharpening Frequency Domain Filters – Gaussian High pass Filters. Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering–Band pass Filters; Minimum Mean-square Error Restoration**.**

UNIT 3: Colour Image Processing:
Colour Image Processing: Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening**.**

UNIT 4: Image Registration & Segmentation:
Registration: Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo

Imaging–Algorithms to Establish Correspondence, Algorithms to Recover Depth segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection**.**

UNIT 5: Feature Extraction

Feature Extraction: Representation, Topological Attributes, Geometric Attributes. Description: Boundary-based Description, Region-based Description, Relationship. Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching.

Textbook(s)

1. Rafael C. Gonzalvez and Richard E.Woods., Digital Image Processing 2nd Edition, Pearson Education.

Reference Books

4. A.K. Jain. , Fundamentals of Digital Image Processing, Prentice Hall, Upper Saddle River, NJ.
5. R.J. Schalkoff. , Digital Image Processing and Computer Vision, John Wiley and Sons, NY.
6.

List of Experiments:

1. Display of Gray scale Images.
2. Histogram Equalization.
3. Design of Non-linear Filtering
4. Determination of Edge detection using Operators.
5. 2-D DFT and DCT
6. Filtering in frequency domain.
7. Display of color images.
8. Conversion between color spaces.
9. DWT of images.

12. Teaching and Learning Strategy

- All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/MS Team. Refer to your course in Moodle/MS Team for details.

Undergraduate Course Description Document

1.	**Department offering the course**	**EECE**
2.	**Course Code**	**ECF144**
3.	**Course Title**	**DIGITAL ELECTRONICS and APPLICATIONS**
4.	**Credits (L:T:P:C)**	**3:0:1:4**
5.	**Contact Hours (L:T:P)**	**3:0:2**
6.	**Prerequisites (if any)**	**None**
7.	**Course Basket**	**Engineering Science (For Non- B.Tech ECE/EE)**

8. Course Summary

This course introduces students to the basic concepts and applications of digital systems, including analysis and design. Both combinational and sequential logic will be covered.

9. Course Objectives

- To acquire the basic knowledge of digital logic and its application to understand digital electronics circuits.
- To familiarize with the design of various combinational digital circuits using logic gates
- To prepare students to perform the analysis and design of various digital electronic circuits.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits

10. Course Outcomes

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

5. To understand and examine the structure of various number systems and its application in digital design
6. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
7. The ability to understand, analyse and design various combinational and sequential circuits.

11 Curriculum Content

UNIT 1-INTRODUCTION:

Number Systems, Basic & Universal Logic gates, Boolean algebra, Direct Conversion of various base, Negative number representations, BCD & EXCESS-3 arithmetic, Error detecting and correcting codes: Hamming code, parity code, Review and Limitation of K-Map, Quine-Mcclusky Method (Tabular Method).

UNIT 2-COMBINATIONAL LOGIC CIRCUITS:

Arithmetic Circuits: Adders, Subtractors, Parallel Adder, BCD Adder. Switching Circuits: Decoder, Encoder, Priority Encoder, Multiplexers, Demultiplexers and their applications, Magnitude Comparators. Parity checker and generator, Code Conversion: Binary to BCD, BCD to Binary.

UNIT 3-SEQUENTIAL LOGIC CIRCUITS:

Latches, Race around condition, Propagation Delay. Flip-Flops: SR, D, JK & T Flip Flops and their conversions, Master-Slave Flip Flop, Edge Triggered Flip-Flop, Characteristic Table, Characteristic Equation, State Table, State Diagram, Excitation Table & Diagram. Design

Procedure of Sequential Circuits, Designing with unused states. Finite State Machine: Mealy and Moore models.

UNIT 4-APPLICATION OF SEQUENTIAL LOGIC CIRCUITS: REGISTER AND MEMORY

Registers: Registers with Parallel Load, Serial Transfer, Shift Registers with Parallel Load, Bidirectional Shift Register, Universal Register.

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and Dynamic RAM.Introduction to FPGA , its design methodology and programming.

UNIT 5- APPLICATION OF SEQUENTIAL LOGIC CIRCUITS: COUNTERS

Counters: Asynchronous Counters-Ripple Up and Down Counters using JK Flip-Flop, impact of Propagation delay.

Counters: Synchronous Counters - Binary Counter, Counter with D Flip-Flop, Up & Down Counters, BCD/Decade Counters.

List of Experiments:

1. Implementation of All Logic Gates using Universal gates (NAND & NOR both).
2. Bread-board implementation of half adder, full adder, half subtractor and full subtractor using logic gate.
3. Bread-board implementation of 4 bit Parallel adder using logic gate
4. Bread-board implementation of One Bit Magnitude comparator using logic gate
5. Bread-board implementation of parity generator and parity checker circuit.
6. Clock circuit realization using 555.
7. Design of shift registers (SISO, SIPO, PIPO, and PISO)
8. Truth table verification of SR and JK Flip-flop.
9. Design of Mod-6 types of Asynchronous Counters.
10. Design 3 bit synchronous up/ down counter

Textbook(s)

2.Digital Design, M. Morris Mano and M. D. Ciletti, 4th Edition, Pearson

Reference Books

4. Digital Systems: Principles and Design, Raj Kamal, Pearson
5. Maini, Digital Electronics: Principles and Integrated Circuits, Wiley India.
6. Switching Theory and Finite Automata, Kohavi, TMH Publications.