Shri. B. V. V. Sangha's

Basaveshwar Engineering College, Bagalkote

Vision and Mission of the Institute

VISION

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio economic development.

MISSION

1) To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change
2) To carry out innovative cutting edge research and transfer technology for industrial and societal needs
3) To imbibe moral and ethical values and develop compassionate, humane professionals

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

Vision, Mission Statements and Values

Vision

To achieve excellence in electronics and communication engineering through quality education and research for developing competent professionals.

Mission

1. Foster a dynamic teaching and learning process.
2. Encourage research through innovation and collaboration.
3. Imbibe moral, ethical values and social responsibilities.

Values

The values of the department are

1. Work is Worship
2. Ethics and Integrity
3. Empathy and Compassion
4. Indian Ethos
5. Mutual Respect

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

SWOC Analysis

S:Strength:

1. Infrastructure
   - (i.) ICT enabled classrooms/seminar hall with good ambience.
   - (ii.) Well equipped laboratories to cater curriculum requirements.
   - (iii.) Department library with good number of titles and volumes.
   - (iv.) Scope for academic extension programmes.
2. Faculty
   - (i.) 75% of faculty with Ph.D.
   - (ii.) Faculty with minimum of 12 years teaching experience.
   - (iii.) Faculty retention ratio is 100 %.
3. Students
   - (i.) Students with academic and competitive bent of mind.
   - (ii.) 75% of the students are placed in reputed industries.
   - (iii.) 10% to 15% of the students are registering for B.E. Honours Degree.
4. Curriculum
   - (i.) Research and industry oriented adaptive curriculum.
   - (ii.) Curriculum with integrated courses.
5. Alumni
   - (i.) Alumni works in reputed organizations across the world.
   - (ii.) Alumni interactions with students and faculty to bridge the gap between campus and corporate.

W:Weakness:

1. IPR competencies are inadequate.
2. Relatively less number of memberships in professional bodies.
3. Limited collaborative activities.
4. Less number of inter-disciplinary courses and projects.
5. Less number of industry supported laboratories/courses.
6. Inadequate number of funded projects.
7. Less scope for co-curricular and cultural activities.

O:Opportunities:

1. Establishment of Distant Learning Center (DLC) using existing resources.
2. Participation in collaborative projects/ research work with allied institutions.
3. Fostering alumni participation in academics and placement activities.
4. Establishment of Skilling Centers for students.
5. Faculty exchange programs with academia and industry.
6. Organizing conferences.
7. Facilitating incubation centers for alumni.
8. Scope for academic extension programmes
9. Training on computer usage/ programming languages for general public.
10. Enhancing consultancy activities.

C:Challenges:

1. To incorporate experiential teaching learning process.
2. Adapting curriculum to future industry needs.
3. Fostering collaboration to enhance research, innovation and entrepreneurship activities.
4. Attracting diversified students.
5. Strategies to strengthen the placement activities for higher packages and core companies.
6. Secure additional research grants and consultancy opportunities.
7. Enhance quality publications and file patents.

POs

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs

(1) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

(2) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

(3) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Program Educational Objectives (PEOs)

In order to prepare the students to excel in industry and higher education, the following Program Educational Objectives (PEOs) are framed.

PEO1: To prepare students to excel in postgraduate programmes or to succeed in industry/technical profession through global, rigorous education.

PEO2: To provide students with a solid foundation in mathematical, scientific, electronics and communication engineering, interdisciplinary subjects necessary to formulate, solve, and analyze engineering challenges.

PEO3: To train students with good scientific and engineering breadth so as to comprehend, analyze, design and create novel products and solutions for the real-life problems.

PEO4: To inculcate in students professional and ethical attitudes, academic environment, aware of excellence, effective communication skills, leadership and managerial skills, ethical codes and guidelines and the lifelong learning needed for a successful professional career.

PEO5: To strengthen the knowledge of students in multi-disciplinary areas of engineering. To inculcate research attitude among students to meet the societal needs.

Basaveshwar Engineering College (Autonomous), Bagalkote

Department of Electronics and Communication Engineering

Credit split-up for Undergraduate Program

Break-up of Credits for B.E (Common to all Branches)

Applicable to 2021-22 (Regular) and 2022-23 (Lateral Entry) Batch - 160 credits

Sem.	BSC	ESC	HSSM	AEC	PCC	PEC	OEC	Proj.	Int.	Tech. Sem.	Mand. (UHV)	Total
1.	07	10	02	01								**20**
2.	07	09	02	02								**20**
3.	03		01	01 (Dept.)	14						01	**20**
4.	03		01		14				02			**20**
5.			01	02 (SS)	10	03	03		03			**22**
6.	03				08	03	06	02				**22**
7.			03		03	06		08				**20**
8.				03 (MOOCS) 02 (Dept.)					10	01		**16**
Tot.	**23**	**19**	**10**	**11**	**49**	**12**	**09**	**10**	**15**	**01**	**01**	**160**

I Semester B.E. (Common to all Branches)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA101C	Engineering Mathematics - I	03	3	0	0	50	50	100
2.	BSC	21UPH102C	Engineering Physics	03	3	0	0	50	50	100
3.	ESC	21UEE105C	Basic Electrical Engineering	03	3	0	0	50	50	100
4.	ESC	22UEC104C	Basic Electronics	03	3	0	0	50	50	100
5.	ESC	21UCS103C	Principles of Programming with C	03	3	0	0	50	50	100
6.	BSC	21UPH108L	Engineering Physics Laboratory	01	0	0	2	50	50	100
7.	ESC	21UCS109L	Programming Practice using C	01	0	0	2	50	50	100
8.	HSSM	21UHS106C	Communicative English	02	2	0	0	50	50	100
9.	AEC	21UHS107C	Scientific Foundations of Health	01	2	0	0	50	50	100
Total				20	18	0	4	450	450	900

II Semester B.E. (Common to all Branches)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA201C	Engineering Mathematics - II	03	3	0	0	50	50	100
2.	BSC	21UCH210C	Engineering Chemistry	03	3	0	0	50	50	100
3.	ESC	21UME212C	Elements of Mechanical Engineering	03	2	2	0	50	50	100
4.	ESC	21UCV211C	Engineering Mechanics	03	3	0	0	50	50	100
5.	ESC	21UME213L	Computer Aided Engineering Drawing	03	2	0	2	50	50	100
6.	BSC	21UCH214L	Engineering Chemistry Laboratory	01	0	0	2	50	50	100
7.	HSSM	21UHS206C	Professional Writing Skills in English	02	2	0	0	50	50	100
8.	AEC	21UHS215C	Innovation and Design Thinking	02	1	0	2	50	50	100
Total				20	16	2	6	400	400	800

III Semester B.E. (E & CE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA301C	Numerical Techniques and Integral Transforms	03	3	0	0	50	50	100
2.	PCC	21UEC302C	Electronic Devices and Circuits	03	3	0	0	50	50	100
3.	PCC	21UEC303C	Digital Electronics and Logic Design	03	3	0	0	50	50	100
4.	PCC	21UEC304C	Network Analysis	03	3	0	0	50	50	100
5.	PCC	21UEC305C	Data Structures using “C”	03	3	0	0	50	50	100
6.	PCC	21UEC306L	Electronic Devices and Circuits Laboratory	01	0	0	3	50	50	100
7.	PCC	21UEC307L	Digital Electronics Laboratory	01	0	0	3	50	50	100
8.	AEC	21UEC308C	Higher Programming Paradigm	01	0	0	3	50	50	100
9	UHV	21UHS324C	Universal Human Values - II	01	1	0	0	50	50	100
10.	HSSM	21UHS321C	Constitution of India	01	1	0	0	50	50	100
11.	PCC	21UMA300M	Bridge Course Mathematics – I*	--	3*	0	0	50*	50*	100*
Total				20	17 20*	0	9	500 550*	500 550*	1000 1100*

IV Semester B.E. (E & CE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA401C	Statistics and Probability Distributions	03	3	0	0	50	50	100
2.	PCC	21UEC402C	Signals and Systems	03	2	2	0	50	50	100
3.	PCC	21UEC403C	Linear Integrated Circuits	03	3	0	0	50	50	100
4.	PCC	21UEC404C	Analog and Digital Communication	03	3	0	0	50	50	100
5.	PCC	21UEC405C	Microcontrollers	03	3	0	0			
6.	PCC	21UEC406L	Communication Engineering Laboratory	01	0	0	3	50	50	100
7.	PCC	21UEC407L	Microcontroller Laboratory	01	0	0	3	50	50	100
8.	INT	21UEC408I	Internship - I	02	--	--	--	100	00	100
9.	HSSM	21UHS422C 21UHS423C	Sanskrutika Kannada Balake Kannada	01	1	0	0	50	50	100
10.	PCC	21UMA400M	Bridge Course Mathematics – II*	--	3*	0	0	50*	50*	100*
Total				20	15 18*	2	6	400 450*	400 450*	800 900*

V Semester B.E. (E & CE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1	PCC	21UEC501C	Digital Signal Processing	03	3	0	0	50	50	100
2	PCC	21UEC502C	Control Engineering	03	3	0	0	50	50	100
3	PCC	21UEC503C	CMOS Digital VLSI Design	03	3	0	0	50	50	100
	PCC	21UEC504L	CMOS Digital VLSI Laboratory	01	0	0	3	50	50	100
5	PEC	21UEC505E 21UEC506E 21UEC507E	1) Java Programming 2) Digital System Design using Verilog 3) Mobile Communication	03	3	0	0	50	50	100
6	OEC1	21UEC535n 21UEC532N	1) Communication Systems 2) Digital Electronics and Microcontrollers	03	3	0	0	50	50	100
7	INT	21UEC510I	Internship – II	03	-	-	-	70	30	100
8	HSSM	21UBT523C	Environmental Studies	01	1	0	0	50	50	100
9	AEC	21UHS521C	Quantitative Aptitude and Professional Skills	02	2	0	0	50	50	100
Total				**22**	**17**	**2**	**5**	**450**	**450**	**900**

VI Semester B.E. (E & CE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UEC601C	Information Theory and Coding	03	3	0	0	50	50	100
2.	PCC	21UEC602C	Electromagnetic Theory	03	3	0	0	50	50	100
3.	PCC	21UEC603C	Computer Networks	03	3	0	0	50	50	100
	PCC	21UEC604L	Computer Networks Laboratory	01	0	0	3	50	50	100
5	PCC	21UEC605L	Advanced Communication Laboratory	01	0	0	3	50	50	100
6	PEC	21UEC606E 21UEC607E 21UEC608E 21UEC609E 21UEC610E	1) Biomedical Signal Processing 2) Computer Organization 3) Image Processing 4) Embedded Systems 5) Wireless Networks	03	3	0	0	50	50	100
7	OEC2	21UEC611N 21UEC612N	1) Sensor Technology 2) Image Processing 3) Sensors and Actuators	03	3	0	0	50	50	100
	OEC3	21UEC613N 21UEC614N	1) Modeling and Simulation of engineering Systems 2) Nanotechnology	03	3	0	0	50	50	100
9	MP	21UEC613P	Mini Project	02	-	-	-	50	50	100
Total				**22**	**15**	**0**	**6**	**400**	**400**	**800**

VII/VIII Semester B.E. (E & CE), Group – 1*

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	PCC	21UEC701C	**Microwaves and Antennas**	03	3	0	0	50	50	100
2.	PEC	21UEC702E 21UEC703E 21UEC704E 21UEC718E 21UEC706E 21UEC707E 21UEC716E	**1) Multimedia Communication** **2) Machine Learning** **3) Micro Electro Mechanical Systems** **4) VLSI Testing** **5) Advanced Tools for VLSI Design** **6) Speech Signal Processing** **7) IoT(Hardware Orientation)**	03	3	0	0	50	50	100
3	PEC	21UEC717E 21UEC710E 21UEC712E 21UEC713E 21UEC714E 21UEC715E 21UEC705E	**1) Multi-rate Signal Processing** **2) Wavelets** **3) Operating Systems** **4) ANN(Artificial Neural Networks)** **5) Cryptography and Network Security** **6) IC Technology** **7) Satellite Communications**	03	3	0	0	50	50	100
5.	Project	21UEC708P	**Project Work**	08	--	--	--	50	50	100
7	HSSM	21UEC709C	**Human Resource and Management**	03	3	0	0	50	50	100
Total				**20**	**12**	**0**	**0**	**250**	**250**	**500**

- **7th and 8th semesters are swapped between group 1 and group 2 students**
- *** Offered between 3rd to 6th semester**

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	AEC	21UECXXXX	MOOCs*	03	-	-	-	-	-	-
2.	AEC	21UEC802C	Research Methodology	02	-	-	-	50	50	100
3.	Seminar	21UEC803S	Technical Seminar	01	-	-	-	50	50	100
4.	INT	21UEC804T	Internship - III	10	-	-	-	50	50	100
Total				**16**	-	-	-	**150**	**150**	**300**

Syllabus for
B.E. I & II – Semester
(For students admitted to I year in 2021-22)

21UEC104C	Basic Electronics	03-Credits, L:T:P (3:0:0)
Hrs/Week: 03		**CIE Marks:**50
Total Hours: 40		**SEE Marks:**50

UNIT - I	10 Hrs

Semiconductor Diodes: Introduction, PN junction diode, characteristics and parameters, diode approximations, DC load line analysis

Diode Applications: Introduction, half wave rectification, full wave rectification, full wave rectifier power supply: Capacitor filter circuit, voltage multiplier, diode logic gates

Zener Diodes: Junction breakdown, circuit symbol and package, characteristics and parameters, equivalent circuit, Zener diode voltage regulator.

Self-study component: ESAKI diode and its working

UNIT – II	10 Hrs

Bipolar Junction Transistors: Introduction, BJT voltages and currents, common base characteristics, common emitter characteristics, common collector characteristics,

BJT Biasing: Introduction, DC load line and bias point, BJT amplification, voltage divider bias.

Amplifier and Oscillator: Single stage CE-amplifier, RC-phase shift oscillator, LC oscillator

Self -study component: BJT as a switch

UNIT - III	10 Hrs

Operational Amplifiers: Introduction, the operational amplifier, block diagram representation of typical op-amp, schematic symbol, op-amp parameters - gain, input resistance, output resistance, CMRR, slew rate, bandwidth, input offset voltage, input bias current and input offset current, the ideal op-amp, equivalent circuit of op-amp, open loop op-amp configurations, differential amplifier, inverting & non inverting amplifier

Op-Amp Applications: Inverting configuration, non-inverting configuration, differential configuration, voltage follower, integrator, differentiator

Self-study component: Op-Amp as zero crossing detector

UNIT - IV	10 Hrs

Boolean Algebra and Logic Circuits: Binary numbers, number base conversion, octal & hexadecimal numbers, complements, basic definitions, axiomatic definition of Boolean algebra, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, digital logic gates

Combinational logic: Introduction, design procedure, adders- half adder, full adder

Communications: Introduction to communication, communication system, modulation

Self-study component: Half subtractor and full subtractor

Reference books:

1) Mike Tooley, 'Electronic Circuits, Fundamentals & Applications', 4th Edition, Elsevier, 2015.
2) Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203- 0417-84.
3) D P Kothari, I J Nagrath, 'Basic Electronics', 2nd edition, McGraw Hill Education (India),Private Limited, 2018

Course Outcomes:

A student who successfully completes this course should be able to

CO1: Design the basic circuits to get V-I characteristics of semiconductor devices.

CO2: Design a BJT amplifier to meet the given specifications.

CO3: Identify and analyze the different configurations of operational amplifier.

CO4: Design simple logic circuits using basic gates.
CO5: Design type of modulation necessary for a given communication applications.

Course Outcomes	**Programme Outcomes**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	2	**-**	2	2	**-**	**-**	**-**	**-**	**-**	**-**
CO2	3	2	3	**-**	2	1	**-**	**-**	**-**	**-**	**-**	**-**
CO3	3	2	3	**-**	3	-	**-**	**-**	1	**-**	**-**	**-**
CO4	2	1	1	**-**	2	1	**-**	**-**	1	**-**	**-**	**1**
CO5	2	1	1	**-**	2	1	**-**	**-**	1	**-**	**-**	**1**

Syllabus for
B.E. III & IV – Semester
(For students admitted to I year in 2021-22)

SUBJECT CODE: 21UMA301C	Numerical Techniques and Integral Transforms	Credits: 03
L:T:P - **3-0-0**		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**xx Hrs.**
Numerical Analysis-I: Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).	
UNIT–II	**xx Hrs.**
Numerical Analysis-II: Numerical differentiation using Newton's forward and backward formulae-problems. Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method.	
UNIT–III	**xx Hrs.**
Fourier series: Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.	
UNIT–IV	**xx Hrs.**
Fourier transforms and z-transforms: Infinite Fourier transforms and inverse Fourier transforms-simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems	

Reference Books *

Textbooks:

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.

Reference Book:

1. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Course Outcomes**

After completion of the course student will be able to

1. **Solve engineering problems using non-linear equations and interpolation techniques.**
2. **Solve problems using numerical differentiation and numerical integration.**
3. **Perform numerical solutions of ordinary differential equations.**
4. **Understand Fourier analysis that provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.**
5. **Understand the basic concepts of Fourier transforms and z –transforms, to solve ode, pde and difference equations.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

21UEC302C	Electronic devices and Circuits Design	Credits:03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10Hrs.
Field Effect Transistors: Introduction, construction, operation and characteristics of JFETs, transfer characteristics, depletion type MOSFET, enhancement type MOSFET, practical applications. **Thyristors:** Introduction, construction, operation and characteristics of SCR, TRIAC, UJT. **Diode applications:** clippers and clampers. **Self-study component:** Comparison between Si and Ge diode, study of Data sheets of different types of Si and Ge diodes, Zener diodes.	
UNIT–II	**10 Hrs.**
Optoelectronic Devices: Light units, Light emitting diode (LED), liquid crystal displays (LCD), photo conductive cell, photo diode and solar cells, photo transistors, opto-couplers. **Miscellaneous Devices:** Schottky diode, varactor diode, power diode, tunnel diode. **Self-study components:** Voltage Variable Capacitors (VVC) , Thermistors: operation ,characteristics and applications.	
UNIT–III	**10 Hrs.**
FET Biasing: Introduction, Fixed bias configuration, Self bias configuration, Voltage divider biasing, Common gate configuration, Design, Trouble shooting, p-channel FETs, Universal JFET bias curve. **Self- study components:** Study of multistage amplifier: classification, distortions in amplifier, two stage RC coupled amplifier and its frequency response.	
UNIT–IV	**10 Hrs.**
FET amplifiers: Introduction, JFET small signal model, voltage divider bias configuration. **Power Supplies** (Voltage Regulators) **:** Introduction, general filter considerations, capacitor filter, RC filter, discrete transistor voltage regulation, IC voltage regulators.	
Reference Books *	
1. Nashelesky & Boylestead, 2009, "Electronic Devices & Circuit Theory" 10th Edition, Pearson 2. D.A.Bell, 2007, "Electronic Devices & Circuit" , 4th Edition, PHI 3. M. D. Singh, K. B. Khanchandani, 2007, "Power Electronics", 2nd Edition, McGraw Hill Publication	
Course Outcomes**	
After completion of the course student will be able to **1.** Analyze different types of electronic devices and design clipper and clamper circuits. **2.** Differentiate the characteristics and importance of different optoelectronic devices. **3.** Choose a specific FET and other components to design an amplifier. **4.** Design a regulated power supply to meet the given specifications.	

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	3	2	
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	1	-

21UEC303C	Digital Electronics and Logic Design	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 40		SEE Marks: 50

UNIT-I	10 Hrs.

Principles of Combinational Logic and Design: Review of Boolean algebra, simplification and implementation of Boolean expression using basic gates and universal gates. Definition of combinational logic, canonical forms, generation of switching equations from truth tables, K-maps (up to 5 variables), Quine-McCluskey minimization technique, map entered variables.

UNIT–II	10Hrs.

Analysis and Design of Combinational Circuit using MSI Components: General approach, binary adder and subtractors, cascading full adders, look ahead carry, decimal adders, comparators, decoders, encoders, multiplexers.

UNIT–III	10Hrs.

Flip-Flops: The basic bistable element, latches, timing considerations, master-slave SR flip-flops, master slave JK flip-flop, edge triggered flip-flop, positive edge triggered D flip-flop, negative edge triggered D flip-flop, characteristic equations.

Applications of Flip-Flops: Registers (SISO, SIPO, PISO and PIPO) and bidirectional shift register.

UNIT–IV	10Hrs.

Applications of Flip-Flops: Counters, binary ripple counters, synchronous binary counters, counters based on shift registers, design of synchronous counters, design of asynchronous counter using clocked JK, D, T and SR flip-flops.

Sequential Circuit Design and Analysis: Introduction to Mealy and Moore models, state machine notation, synchronous sequential circuit analysis, construction of state diagrams.

Reference Books *

1. Donald D Givone, 2002, " Digital Principle and Design ". Tata McGraw Hill
2. John M Yarbrough, 2001,"Digital Logic Applications and Design", Thomson Learning
3. Thomas L. Floyd, "Digital Fundamentals", 9th edition, PHI
4. Charles H Koth, 2004,"Fundamentals of Logic Design", Thomson learning
5. Meno and Kim, 2001,"Logic and Computer Design Fundamentals",2 nd edition ,Pearson
6. Malvino and Leech, "Digital Principles & Applications", 2nd edition, PHI

Course Outcomes**

After completion of the course student will be able to

1. **Simplify the given Boolean expressions using Boolean algebra, K-map, Quine McCluskey and map entered variables methods.**
2. **Design and analyse combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) decoder and gates.**
3. **Analyse different types of latches, flip flops and shift registers.**
4. **Design, model and analyse synchronous and asynchronous sequential circuits.**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	1	-	1	-	-	-	-	-	3	1	
CO2	3	3	3	2	1	-	1	-	-	-	-	-	3	1	
CO3	3	3	3	2	1	-	1	-	-	-	-	-	3	1	
CO4	3	2	3	2	2	-	1	-	-	-	-	-	3	1	

SUBJECT CODE: 21UEC304C	Network Analysis	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Basic concepts: Concept of voltage, current and power, ideal and practical representation of energy sources, source transformation, network reduction using star-delta transformation, mesh current and node voltage analysis with dependent and independent sources for AC and DC networks, concept of super mesh and super node.	
UNIT–II	**10 Hrs.**
Network theorems: Superposition, Millman's, Thevenin's, and Maximum power transfer theorems. **Network topology:** Graph of a network, concept of tree and co-tree, incidence matrix, tie-set matrix, cut-set matrix, analysis of networks, network equilibrium equations.	
UNIT–III	**10 Hrs.**
Resonance circuits: Series and parallel resonance circuits, frequency of resonance, frequency responses, Q-factor, bandwidth. **Two port network parameters:** Z, Y, h, transmission parameters and relationship between parameters.	
UNIT–IV	**10 Hrs.**
Laplace transformation: Basic theorems, Laplace transform of periodic functions, application of Laplace transform to RL and RC circuits. **Attenuators:** Symmetrical T, PI, bridge T, Lattice attenuators, Asymmetrical T, L, and PI attenuators. **Equalizers:** Two terminal series and shunt equalizers.	

Reference Books *

Textbooks:

1. Roy Choudhary, "Networks and systems", 2nd Edition, New Age International Publications, 2006. G. K. Mithal, "Network Analysis", Khanna Publishers, 1997.

Reference Books:

1. Hayt, Kemmerly and Durbin, "Engineering Circuit Analysis", 6th Edition, TMH, 2006.
2. M.E. Van Valkenberg "Network analysis", Prentice Hall of India, 3rd Edition, 2000.

Course Outcomes**

After completion of the course student will be able to

1. **Simplify networks using source transformation, star-delta conversion and determine current, voltage, power using nodal and mesh analysis to AC and DC networks.**
2. **Apply network theorems and topology for complex networks to find responses.**
3. **Analyze series and parallel resonant circuits and find different network parameters.**
4. **Apply concept of Laplace transformation to networks and waveforms, design attenuators and simple equalizers.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	1	1	-	-	1	-	-	1	3	-	-
CO2	3	3	1	2	1	1	-	-	1	-	-	1	3	-	-
CO3	3	3	1	2	1	1	-	-	1	-	-	1	3	-	-
CO4	3	2	1	2	1	1	-	-	1	-	-	1	3	-	-

SUBJECT CODE: 21UEC305C	Data Structures using "C"	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introduction: Data structures, classifications (primitive & non primitive), data structure operations, pointers and dynamic memory allocation, pointers to arrays , structures, self-referential structures, pointers to structures. Functions: Functions (Passing structure variable as an argument, passing whole structure as argument, passing structure variable as a pointer argument, etc).	
UNIT–II	**xx Hrs.**
Dynamically allocated arrays **(**Using calloc() or malloc()**)**, array Operations: traversing, inserting, deleting, searching, and sorting. Stacks: definition, stack operations (push, pop and display. Test: underflow and overflow conditions), array representation of stacks, stacks using dynamic arrays, Stack Applications: infix to postfix conversion, evaluation of postfix expression, program to evaluate postfix expression, program to convert Infix to Postfix expression.	
UNIT–III	**xx Hrs.**
Recursion - Factorial, GCD, Fibonacci sequence, tower of Hanoi. Queues: Definition, array representation, queue operations (Insert, delete and display), circular queues operations (Insert, delete and display), De-queues(Insert, delete and display), Priority Queues(Insert, delete and display). programming examples.	
UNIT–IV	**xx Hrs.**
Linked Lists: Definition, representation of linked lists in memory, Linked list operations: Traversing, searching, insertion, and deletion. Doubly linked lists(Traversing, searching, insertion, and deletion), Circular linked lists(Traversing, searching, insertion, and deletion). Implementation of stack and queue using singly linked list. Programming Examples.	

Reference Books *

Text Books

1. Ellis Horowitz and Sartaj Sahni,'' Fundamentals of Data Structures in C'', Universities Press, 2nd Edition, 2014
2. Gilberg & Forouzan,'' A Pseudo-code approach with C'', Cengage Learning, 2nd Edition,2014
3. Seymour Lipschutz, Schaum's Outlines, '' Data Structures'', McGraw Hill, Revised 1st Edition, 2014
4. Behrouz A. Forouzan and Richard F. Gilberg, '' Computer Science A Structured Programming Approach Using C'', Thomson, 2ndEdition

Reference Books

1. A M Tenenbaum, '' Data Structures using C'', PHI, 1989Robert Kruse, '' Data Structures and Program Design in C'', PHI, 2nd edition,1996

Course Outcomes**
After completion of the course student will be able to **1. Demonstrate the concepts of a) various types of data structures, operations and algorithms, b) Sorting and searching operations.** **2. Analyze the performance of stack, queue, lists, trees, and searching and sorting techniques.** **3. Write the C programs for all the applications of data structures.** **4. To solve real world problems by applying data structure concepts.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	2	1	-	-	-	-	1	2	-	2
CO2	3	2	-	-	-	1	1	-	-	-	-	2	2	-	2
CO3	3	3	-	-	-	1	1	-	-	-	-	3	2	-	2
CO4	3	2	-	-	-	1	2	-	-	-	-	3	2	-	2

SUBJECT CODE: 21UEC306L	Electronic Devices and Circuits Laboratory	Credits: 01
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Sl. No	LIST OF THE EXPERIMENTS
1.	V-I characteristics and analysis of diode.
2.	Analysis of diode as a half-wave and full-wave rectifier.
3.	V-I characteristics and their analysis of Zener diode.
4.	Zener diode as a voltage regulator and its regulation analysis.
5.	Input and output characteristics and their analysis of Bipolar Junction Transistor (BJT) in common base, common collector and common emitter configuration.
6.	Design, implementation and frequency response of transistor (BJT) as an amplifier
7.	Design and implementation of transistor (BJT) as an oscillator.
8.	Input and output characteristics and their analysis of field effect transistor (FET).
9.	Design, implementation and frequency response of FET as an amplifier.
10.	V-I characteristics and analysis of unijunction transistor (UJT).
11.	Implementation of UJT as a relaxation oscillator.
12.	V-I characteristics and analysis of silicon controlled rectifier (SCR).
13.	Study of SCR as half-wave and full-wave controlled rectifier.
14.	Simulation and analysis of Amplifiers and Oscillators.
15.	Simulation and analysis of DC and AC excited RL and RC circuits.

Course Outcomes**

After completion of the course student will be able to

1. **Characterize semiconductor devices based on their characteristics.**
2. **Realize rectifiers, controlled rectifiers and regulators.**
3. **Design amplifiers and oscillators for given specifications.**
4. **Simulate and analyze basic electronic circuits.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	2	2	1	2	2	2	2	2	3	0	0
CO2	3	2	2	2	3	2	2	3	2	2	2	1	3	0	0
CO3	3	2	2	2	2	3	2	3	2	3	2	3	3	0	0
CO4	3	2	2	1	3	1	2	3	1	2	1	3	3	0	0

SUBJECT CODE: 21UEC307L	Digital Electronics Laboratory	Credits: 1
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

LIST OF THE EXPERIMENTS	
Sl. No.	
1	Simplification, realization of Boolean expression(s) using basic logic gates.
2	Implementation of Boolean expression(s) using universal gates.
3	Design of full adder and full subtractor implementation using basic logic gates.
4	Realization of a. Parallel adder / subtractor using 7483chip b. Decoder chip to drive LED display
5	Design and implementation of code converters (any two).
6	Implementation of three variable Boolean expression(s) using a. 8:1MUX b. 4:1MUX
7	Implementation of three variable Boolean expression(s) using 3:8 decoder and gates.
8	Design of two-bit comparator using basic logic gates and study of 7485 magnitude comparator.
9	Truth table verification of flip-flops: a. Master Slave JK flip-flop implementation using only NANDgates b. JK flip flop using7476.
10	Design of a. 4-bit asynchronous up counter using JK flip-flop(7476) b. 4-bit asynchronous down counter using JK flip-flop(7476) c. Mod-n asynchronous counter (7476) (n <=4)
11	Design of a. UP counter using 74193 b. DOWN counter using 74193
12	Design of shift registers using 7 495 viz. SIPO, SISO, PISO, PIPO shift right, shift left.
13	Simulate any 6 experiments covering both combinational and sequential circuits using circuit simulator- PROTEUS VSM.

Course Outcomes**

After completion of the course student will be able to

1. **Should be able to design combinational circuits and implement it using a) basic logic Gates b) universal gates, c) multiplexers and d) decoder and gates**
2. **Should be able to design and realize latches and flip flops**
3. **Should be able to design and implement asynchronous counters**
4. **Should be able to design and implement synchronous counters and shift registers**
5. **Should be able to simulate combinational and sequential circuit using PROTEUS software**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	0	0	0	0	1	1	0	0	2	3	0
CO2	2	2	3	0	0	0	0	0	1	1	0	0	2	3	0
CO3	1	2	3	0	0	0	0	0	1	1	0	0	2	3	0
CO4	2	2	3	0	0	0	0	0	1	1	0	0	2	3	0
CO5															

SUBJECT CODE: 21UEC308C	Higher Programming Paradigm	Credits: 01
L:T:P – 2-0-0		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

UNIT-I	10 Hrs.
Datatypes in python: comments in python, Docstrings, How python sees variables, Datatypes in python, Sequences in python, Literals in python, Determining the data type of a variable, Identifiers and reserved words, Naming conventions in python **Operators in Python:** Operator, operator precedence and associativity, Mathematical functions **Input and Output:** Output statements, Input statements, Command Line arguments **Control Statements Strings and Characters**	
UNIT–II	**10 Hrs.**
Functions: Defining a function, calling a function, Returning Results from a function, Returning multiple values from a function, Formal and actual arguments, local and global variables, passing a group of elements to a function, recursive functions, the special variable__nam. **Lists and tuples: lists, tuple , Dictionaries.**	
UNIT–III	**10 Hrs.**
Exceptions: exceptions, exception handling, types of exceptions, user defined exceptions **Files in python:** files, types of files in python, opening a file, closing a file, working with text files containing strings, working with binary files, pickle in python.	
UNIT–IV	**10 Hrs.**
Object Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism.	

Reference Books *

Text Books

1. Core Python Programming by Dr. R.NageswawaRao, Dreamtech press, 2nd Edition 2018.

Reference Books

1. Introduction to Python Programming by Gowrishankar S. Veena A. , CRC Press Taylor & Francis Group, 1st Edition 2019.
2. Python Programming by Michael Urban and Joel Murach , Mike Murach Elizabeth Drake, 1st Edition,2016

Course Outcomes**

After completion of the course student will be able to

1. **Explain syntax and semantics of different statements and functions in Python.**
2. **Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications.**
3. **Demonstrate Exception Handling and file operations.**
4. **Explain class, objects, polymorphism, inheritance.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-		**3**	
CO2	3	2	3	-	2	1	-	-	-	-	-	-		**3**	
CO3	3	2	3	-	3	-	-	-	1	-	-	-		**3**	
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**		**3**	

SUBJECT CODE: 21UMA300M	Bridge Course Mathematics -I	Credits: Mandatory
L:T:P -		CIE Marks: 50
Total Hours/Week:03		SEE Marks: 50

UNIT-I	10 Hrs.
Differential Calculus: Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only) without proof. Problems	
UNIT–II	**10 Hrs.**
Partial differentiation: Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems	
UNIT–III	**10 Hrs.**
Integral Calculus: Evaluation of double and triple integrals. Area bounded by the curve. Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.	
UNIT–IV	**10 Hrs.**
Vector Calculus: Vector Differentiation: Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems	

Reference Books *

Textbooks:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference Books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:**Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

Course Outcomes**

After completion of the course student will be able to

1. **Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.**
2. **Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.**
3. **Apply the concept of multiple integrals and their usage in computing the area and volumes.**
4. **Apply the knowledge of vector calculus to solve the engineering problems**

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO2	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO3	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UMA401C	Statistics and Probability Distributions	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Statistics: Curve fitting by the method of least squares $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$ Correlation, expression for the rank correlation coefficient and regression.	
UNIT–II	**10 Hrs.**
Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution function, Problems on expectation and variance	
UNIT–III	**10 Hrs.**
Probability distributions: Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.	
UNIT–IV	**10 Hrs.**
Markov chains: Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.	

Reference Books *

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.Author/s last Name, initial (Year), Book Title (edition), Publisher

Course Outcomes**

After completion of the course student will be able to

1. **To apply the least square sense method to construct the specific relation for the given group of data.**
2. **To understand the concept of probability.**
3. **To apply the concept of probability to find the physical significance of various distribution phenomena.**
4. **To understand the concepts of probability distributions.**
5. **To apply the concept of Markov Chain for commercial and industry purpose.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	--	--	--	--	--	--	--	--	--	--	1	2	--
CO2	1	2	--	--	--	--	--	--	--	--	--	--	1	2	--
CO3	1	--	--	--	--	--	--	--	--	--	--	--	1	--	--
CO4	1	--	-- -	--	--	--	--	--	--	--	--	--	1	--	---
CO5	1	--	--	--	-- -	--	--	--	--	--	--	--	1	--	--

21UEC402C	Signals and Systems	Credits: 03
L:T:P - 2 : 2: 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction: Definition of signals and systems, classification of signals, elementary signals, basic operations on signals, interconnection of systems and operations, properties of systems.	
UNIT–II	**10 Hrs.**
Time domain representation of LTI systems: Convolution sum, convolution integral, impulse response representation. Properties of impulse response.	
UNIT–III	**10 Hrs.**
Fourier and inverse Fourier representation of signals: Introduction to complex sinusoidal signals and their use in Fourier representation of periodic signals (brief review of CTFS and DTFS). Continuous time Fourier transform, Discrete time Fourier Transform (DTFT), properties of DTFT and applications.	
UNIT–IV	**10 Hrs.**
Z -Transforms: Introduction, properties of ROC, properties of Z-transform and relation of Z -transform with Fourier transforms. Inverse Z-transform, transform analysis of LTI systems, transfer function, stability and causality, and solution of difference equations using Z-transform.	

Reference Books *

1. Simon Haykin and Barry Van Veen, Signals and Systems (2nd Edition), John Wiley &Sons
2. Michel J. Roberts, 2003 , Signals and Systems (2nd Edition), Tata McGraw Hill
3. Allan V. Oppenheam, Alan S. Willsky, and Hamid Nawab, 1997, Signals and Systems (2nd Edition), Pearson Education Asia.

Course Outcomes**

After completion of the course student will be able

1. Represent, characterize, and analyze CT and DT signals and systems.
2. Analyze CT and DT systems in time domain using convolution.
3. Analyze CT and DT systems in frequency domain, using Fourier tools like CTFT and DTFT.
4. Apply z-transform and its properties in the analysis of discrete-time signals and systems.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO2	3	3	1	0	0	0	0	0	0	0	0	0	3	0	0
CO3	3	3	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0

21UEC403C	Linear Integrated Circuits and Its Applications	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Differential Amplifiers: Introduction, differential amplifier, differential amplifier circuit configurations, dual- input balanced output differential amplifier, dual- input unbalanced output differential amplifier, single input balanced output differential amplifier, single input unbalanced output differential amplifier, constant current bias, current mirror, cascaded differential amplifier stages, level translator.

Introduction to operational amplifiers: Introduction, block diagram representation of a typical op-amp, the ideal op-amp, equivalent circuit of an op-amp, ideal voltage transfer curve, open loop op-amp configurations.

Self study component: Numericals on differential amplifiers

UNIT–II	10 Hrs.

An op-amp with negative feedback: Block diagram representation of feedback configuration, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier.

The practical op-amp: Input offset voltage, input bias current, input offset current, total output offset voltage, common mode configuration, common mode rejection ratio, power supply rejection ratio, slew rate

Self study component: To derive gain, input resistance of differential amplifier with three op-amps

UNIT–III	10 Hrs.

General applications: The peaking amplifier, summing, scaling and averaging amplifiers, integrator, differentiator.

Active filters: First order and second order low pass butter worth filter, first order and second order high pass butter worth filter, higher order filters, band pass filter, band reject filters.

Self study component: To study All pass filter

UNIT–IV	10 Hrs.

Oscillators and waveform generator: Introduction, phase shift oscillator, wien bridge oscillator, square wave generator, triangular wave generator.

Comparators and converters: Basic comparator, zero crossing detector, sample and hold circuit.

The 555 Timer: Block diagram, connection diagram, 555 timer as Astable and Monostable multivibrators

Self study component: To study voltage-controlled oscillator and Schmitt trigger

Reference Books *

1. Gayakwad Ramakanth A. "Operational Amplifiers and Linear Integrated Circuits", 3rd & 4th Edition, PHI.
2. D. Roy Choudary, "Linear Integrated Circuits", 2nd Edition.

Course Outcomes**
After completion of the course student will be able to 1. Identify and analyze the different configurations of differential amplifier. 2. Analyze the different feedback amplifiers and various parameters of practical op-amp. 3. Design the active filters and amplifiers using op-amp. 4. Design waveform generators, data comparators and converters.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	1	-	-	-	1	-	-	-	3	1	-
CO2	3	3	1	1	1	-	-	-	1	-	-	-	3	1	-
CO3	3	3	2	2	1	1	1	-	1	-	1	1	3	1	-
CO4	3	2	2	1	1	1	1	-	1	-	1	1	3	1	-

21UEC404C	Analog and Digital Communication	Credits: 03
L : T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Linear modulation: Baseband and carrier communication, time domain and frequency domain description, generation and detection of Amplitude Modulation (AM) waves. **DSB-SC modulation:** Time and frequency domain representation, generation and detection of DSB-SC modulated waves. **SSB modulation:** Time domain representation of SSB signal, generation and detection of SSB modulated waves, Quadrature Amplitude Modulation (QAM). **Vestigial sideband modulation:** Frequency domain representation, generation and detection of VSB, comparison of amplitude modulation techniques, super heterodyne receiver.	
UNIT–II	**10 Hrs.**
Angle modulation: Concept of angle modulation, relation between frequency and phase modulation, bandwidth of angle modulated wave. **Generation of FM:** direct and indirect methods, PLL, demodulation of FM, pre-emphasis and de-emphasis, FM radio.	
UNIT–III	**10 Hrs.**
Digital Communication: Model of digital communication systems Sampling process: Sampling Theorem, quadrature sampling of Band pass signal, reconstruction of a message from its samples, signal distortion in sampling. Line codes, unipolar, polar and Manchester codes and their power spectral densities.	
UNIT–IV	**10 Hrs.**
Digital Modulation Techniques: Digital Modulation formats, Coherent binary modulation techniques (ASK, PSK, FSK), Probability of error for each ASK, PSK, FSK. Coherent quadrature modulation techniques, MSK, (without derivation of probability of error equation). Non-coherent binary modulation techniques (FSK and DPSK).	

Reference Books

1. B. P. Lathi "Modern Digital and Analog Communication Systems", 3rdEdition, Oxford University, 2006
2. Simon Haykin, "Digital communications", John Wiley, Edition 2014
3. George Kennedy "Electronic Communication Systems", 3rdEdition, Tata McGraw Hill Publication, 1984
4. B. P. Lathi "Communication Systems", 3rd Edition, B. S. Publications, 2009 Simon Haykin "Communication Systems", 3rd Edition, John Wiley and Sons, 2005
5. John. G. Proakis, & Masoul salehi" Fundamental of Communication System" Pearson Education, Edition 2014
6. Bernard Sklar and Prabitrakumary Ray, "Digital Communication Fundamentals and Applications", Pearson Publications, 2010
7. K. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley & Sons, 2006

Course Outcomes
After completion of the course student will be able to **1. Compute spectrum of modulated and demodulated signals.** **2. Analyze amplitude modulation and demodulation circuits.** **3. Do analysis of angle modulation and demodulation techniques.** **4. Design sampling and reconstruction circuit for given different sampling frequencies.** **5. Design different digital modulation /demodulation techniques.**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO2	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO3	3	3	2	0	1	0	0	0	0	0	0	0	3	0	0
CO4	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0
CO5	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC405C	8051 Microcontroller	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Microprocessors and Microcontrollers: Introduction, Harvard Vs Von Neumann architecture, comparison between microprocessors and microcontrollers, 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, ports and circuits, external memory.	
UNIT–II	**10 Hrs.**
8051 Instructions and Programming: addressing modes, types of instructions, instruction set, data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, programs using all the above instructions and concepts.	
UNIT–III	**10 Hrs.**
Programming peripherals in assembly: Timer and counter programming. Serial Port Programming: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts.	
UNIT–IV	**10 Hrs.**
Programming external hardware interrupts and serial communication interrupts. Interfacing: Introduction, need for interfacing, interfacing the following devices using assembly-LCD module, ADC808/DAC808, key-pad, stepper motor. Interfacing with the 8255: Programming the 8255, Interfacing the 8255.	

Reference Books *

1. Kenneth J. Ayala, "The 8051 Micro controller Architecture, Programming & Applications", Penram International, 2nd Edition,1996
2. Muhammad Ali Mazidi, and Janice GillispieMazidi, "The 8051 Micro controller and Embedded Systems", Pearsons Education, 2nd edition, 2007.
3. Craig Steiner, "The 8051/8052 Microcontroller: architecture, assembly language, and Hardware interfacing", WP Publishers and Distributors, 200*6*.
4. David Calcutt, Fred cwon, "8051 microcontroller", Elsevier, 1st Edition, 2004.
5. Dr.UmaRao and Dr.AndhePallavi, "The 8051 microcontroller architecture, programming and applications", Pearson Education,2010.

Course Outcomes**

After completion of the course student will be able to

1. **Comprehend the architecture of 8051 microcontroller.**
2. **Write programs in assembly language for 8051 to explore its capabilities.**
3. **Program inbuilt peripheral like timer/counter, serial and interrupt peripheral in assembly language.**

4. **Interface devices like LCD, Keypad, DAC, ADC, Stepper motor and PPI 8255 for different applications using assembly language.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	1	1	1	3	1	1	0	0	0	3	0
CO2	3	2	2	1	1	2	1	3	2	1	1	1	0	3	0
CO3	3	2	3	2	2	3	2	3	3	3	3	2	0	3	0
CO4	3	2	2	2	3	2	2	3	2	2	2	2	0	3	0

SUBJECT CODE:21UEC406L	Communication Engineering Laboratory	Credits: 01
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

LIST OF EXPERIMENTS

1. Design and verification of second order active low pass filter
2. Design and verification of second order active high pass filter
3. Design and verification of second order active band pass filter
4. Design and verification of second order active band elimination filter
5. Realization of Amplitude Modulation (AM) and demodulation for a given modulation index
6. Realization of Frequency Modulation (FM)
7. Realization of Pulse Width Modulation (PWM)
8. Realization of Pulse Position Modulation (PPM)
9. Realization of Pulse Amplitude Modulation (PAM)
10. Realization of Pre-emphasis and De-emphasis circuits
11. Realization of frequency demodulation using PLL
12. Generation of PN sequence

Course Outcomes**

After completion of the course student will be able to

1. **Design and verify the frequency response of active filters for a given specifications.**
2. **Design and characterize AM and FM modulation and demodulation circuits.**
3. **Construct pre-emphasis and de-emphasis circuits.**
4. **Verify the PAM, PWM & PPM circuits.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO2	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO3	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO4	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0

SUBJECT CODE: 21UEC407L	Microcontroller Laboratory	Credits: 01
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

1. Move an 8-bit data byte to a register/memory using all addressing modes.
2. Block of data transfer in internal RAM locations.
3. Exchange block of data internal/external memory locations.
4. Average of n-eight bit numbers.
5. Programs on basic arithmetic operations.
6. Programs using logical instructions.
7. Search a byte in a given array.
8. Find largest/smallest number in an array.
9. Sorting the given array of numbers in ascending/descending order.
10. Code conversion programs.
11. Addition/multiplication of two matrices.
12. Determine Fibonacci series of a given number.
13. Programs on stack operations.
14. Programs on serial communication.
15. Programs on interrupts.

Part-B

Developing interfacing Embedded 'C' programs in keil cross-compiler, fusing machine code on flash board/Circuit and testing the code.

1. Stepper motor
2. DC motor
3. Buzzer
4. LCD
5. Keypad
6. Analog to Digital Conversion (ADC)
7. Digital to Analog Conversion (DAC)
8. Seven Segment Display (SSD)

Course Outcomes**

After completion of the course student will be able to

1. **Conduct experiments to understand fundamental concepts of 8051 microcontroller.**
2. **Write efficient programs in assembly level language of the 8051 microcontroller.**
3. **Write program to interface different peripherals.**
4. **Develop the embedded C program to perform a defined task.**

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	0	0	0	0	0	0	0	0	0	0	3	
CO2	3	2	2	0	1	0	0	0	0	0	0	0	0	3	
CO3	3	2	3	0	2	0	0	0	0	0	0	0	0	3	
CO4	3	2	2	0	3	0	0	0	0	0	0	0	0	3	

SUBJECT CODE: 21UEC408T	Internship - I	Credits: 02
L:T:P – --		CIE Marks: 100
Total Hours/Week: --		SEE Marks: --

Course Plan
Each student shall identify current topic relevance to Electronics and Communication Engineering branch, get approval of concern faculty, undergo the domain specific training, study it thoroughly, apply the skills to develop software/hardware module and prepare own report and present in the class individually.
Course Outcomes**
After completion of the course student will be able to **1. Demonstrate the skills acquired during the internship** **2. Develop the small projects (Software/Hardware) by understanding the real time applications.** **3. Integrate the different modules developed during the internship.** **4. Develop the technical document for the internship.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2		3		1					2	1	2	3
CO2	3	3	2		3		2					2	1	1	2
CO3	3	3	2		3		3		1	3		2	1	1	1
CO4	1	1	1		3		2		1	3		2	2	1	1

SUBJECT CODE: 21UMA400M	Bridge Course Mathematics-II	Credits: --
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Differential Equations-1:Ordinary differential equations of first order: Variable seperable, Homogeneous. Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.	
UNIT–II	**10 Hrs.**
Differential Equations-2:Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters (second order); Cauchy's and Legendre homogeneous equations.	
UNIT–III	**10 Hrs.**
Laplace Transform: Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function.	
UNIT–IV	**10 Hrs.**
Inverse Laplace transforms: Properties, Convolution theorem, Solutions of linear differential equations	

Reference Books *

Text Book:

1. SB.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszing's Advanced Engineering Mathematics volume I and volume II,wiley India Pvt.Ltd.,2014.
3. H K Das, Higher Engineering Mathematics

Reference Books:

1. Erwin Kreyszing's Advanced Engineering Mathematics,wiley India Pvt.Ltd.,2014.
2. Elementary Differential Equations by Earl D. Rainville and Phillip E, Bedient, Sixth Edition.

Course Outcomes**

After completion of the course student will be able to

1. **Solve first order differential equations of certain types and interpret the solutions.**
2. **Solve second and higher order linear differential equations.**
3. **Apply Laplace transforms for standard functions and its properties**
4. **Apply Inverse Laplace transforms for standard functions**
5. **Apply Inverse Laplace transforms for solve differential equations.**

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	--	--	--	--	--	--	--	--	--	--			
CO2	1	2	--	--	--	--	--	--	--	--	--	--			
CO3	1	--	--	--	--	--	--	--	--	--	--	--			
CO4	1	--	-- -	--	--	--	--	--	--	--	--	--			

Syllabus for
B.E. V & VI – Semester
(For students admitted to I year in 2021-22)

SUBJECT CODE: 21UEC501C	Digital Signal Processing	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, properties: multiplication of two DFTs, circular convolution and additional properties of DFT. Application of DFT in linear filtering: overlap add and overlap save method.	
UNIT–II	**10 Hrs.**
Fast Fourier Transform Algorithms: Need for efficient computation of DFT, Radix 2 FFT algorithms for computation of DFT and IDFT: Decimation in time and decimation in frequency algorithms. Goertzel algorithm and chirp-Z transform algorithm.	
UNIT–III	**10 Hrs.**
IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters. Design of IIR filters from analog filters (i.e. Butterworth and Chebyshev), Transformation techniques: Impulse invariance method, Approximation of derivative (Backward difference and Forward difference) method. Bilinear transformation method.	
UNIT–IV	**10 Hrs.**
FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing (Rectangular, Hamming, Hanning and Bartlet) method, FIR filter design using frequency sampling method. Implementation of discrete time systems - Structures for IIR and FIR systems: Direct form I, Direct form II, Cascade and Parallel realization.	

Reference Books *

Textbook:

1. Proakis and Manolakis, “Digital Signal Processing-Principles Algorithms and Applications” PHI Publication, III Edition, 1997.

Reference Books:

1. Oppenheim and Schaffer, “Discrete Time Signal Processing” PHI Publication, III Edition, 2003.

Course Outcomes**

After completion of the course student will be able to

1. **Compute and use DFT for linear filtering applications.**
2. **Calculate DFT and IDFT using FFT and IFFT algorithms.**
3. **Design IIR filters using Butterworth and Chebyshev approximations and draw their structures.**
4. **Design FIR filters using windowing and frequency sampling techniques and draw their structures.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	0	1	0	0	0	0	0	0	0	3	0	0
CO2	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0
CO3	3	3	3	0	1	0	0	0	0	0	0	0	3	0	0
CO4	3	2	3	0	1	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC502C	Control Engineering	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
System modeling: Definition of control system, Concept of feedback and its significance, open loop and closed loop systems, Modeling of Electrical, Mechanical and Electromechanical systems, Differential equations of physical system. Transfer function, Block diagram representation and Reduction technique, Signal flow graph representation and reduction using Mason's gain formula.	
UNIT–II	**xx Hrs.**
Time domain analysis of control systems: Introduction, standard test signals, Unit step response of a second order system, Steady state error analysis, time domain specifications. Stability analysis technique: Concept of stability, Location of Roots in the s-plane for stability, methods of determining stability, Routh-Hurwitz stability criterion.	
UNIT–III	**xx Hrs.**
Root-Locus Technique: Introduction, Procedure for constructing Root-locus. Stability analysis using root locus. Frequency Domain Analysis: Introduction, Bode plots, Gain and Phase cross over frequency, gain margin, phase margin, Frequency domain specifications-resonant peak, resonant frequency, and bandwidth.	
UNIT–IV	**xx Hrs.**
Polar plots, Nyquist stability criterion; Principle of argument, mapping, Nyquist path, Nyquistcriterion, Nyquist Plot and stability analysis. State Space Analysis: Introduction, concept of state and variables, state model, Non homogeneous solution of a state equation.	

Reference Books *

1. Nagrath and Gopal, "Control System Engineering", New Age publication.
2. K. Ogeta, "Modern control engineering", Person education, Asia/PHI 4th edition, 2002.
3. Benjamin C.Kuo, "Automatic Control Systems", PHI 7th edition.
4. Richard C. Dorf and Robert. H. Bishop, "Modern Control Systems", Person Education, 8 thEdition, 2002.
5. M. Gopal, "Control Systems-Principles and Design", TMH, 2nd Edition, 2002.
6. David. K. Chng, "Analysis of Linear systems", Narosa publishing house, 1996

Course Outcomes**

After completion of the course student will be able to

1. Mathematically model electrical, mechanical and electromechanical control systems.
2. Characterize the control systems in time domain.
3. Analyze stability of a control system using root locus technique and frequency domain analysis using Bode plotting techniques.
4. Determine the stability of control systems using polar and Nyquist plotting technique and represent the control systems using state space techniques.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

SUBJECT CODE: 21UEC503C	CMOS Digital VLSI Design	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction: A Brief History, Preview, MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning. **MOS Transistor Theory:** Introduction, Long- Channel I-V Characteristics, C-V Characteristics (simple MOS capacitance models), Non ideal I-V Effects, DC Transfer Characteristics. **CMOS Processing Technology:** Introduction, CMOS Technologies.	
UNIT–II	**10 Hrs.**
Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model (Logical effort, parasitic delay, delay in logic gate, drive), Logical Effort of Paths, **Power:** Introduction, Dynamic Power, Static Power.	
UNIT–III	**10 Hrs.**
Interconnect: Introduction (wire Geometry), Interconnect Modeling, Interconnect Impact (Delay, Energy, Cross talk). **Combinational Circuit Design:** Introduction, Circuit families, Silicon-On-Insulator Circuit Design.	
UNIT–IV	**10 Hrs.**
Sequential Circuit Design: Introduction, Circuit Design of Latches and Flip Flops (conventional CMOS latches, conventional CMOS flip flops, pulsed latches, resettable latches and flip flops, enabled latches and flip flops, incorporating logic into latches, dual edge triggered flip flops. **Array Subsystems:** Introduction, SRAM (SRAM cells, ROW circuitry, column circuitry), Read-Only Memory, Serial Access Memories, Content Addressable Memory, Programmable Logic Arrays.	

Reference Books *

Text Book:

1. Neil H. E. Weste, David Harris "CMOS VLSI Design A Circuits and Systems Perspective"
2. Pearson Education Publisher, Fourth Edition, 2015.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic "Digital Integrated Circuits A Design
2. Perspective" Pearson Education Publisher, Second Edition. 2010.
3. John P Uyemura "Introduction to VLSI Circuits and Systems" Wiley Publication 2002.
4. R. Jcob Baker, Harry W. Li and David E Boyce "CMOS Circuit Design, Layout, and Simulation"

Course Outcomes**

After completion of the course student will be able to

1. **Draw the layout of CMOS circuits; apply the knowledge of fabrication processes and MOSFET transistors in VLSI design.**

2.	**Draw RC equivalent circuit of CMOS circuits and estimate delay and power.**
3.	**Model & design of interconnects in chips, design of combinational circuits.**
4.	**Design basic buildings of sequential and memory blocks using MOSFET transistors.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	0	0	0	0	0	0	0	0	0	3	1	0
CO2	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO4	3	3	3	0	0	1	2	0	0	0	0	0	3	2	0

SUBJECT CODE: 21UEC504L	CMOS Digital VLSI Laboratory	Credits: 01
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

NAME OF THE EXPERIMENT
Design following CMOS/TG based circuits with given specifications* and complete the VLSI design flow mentioned below using appropriate tool: a) Draw the schematic and verify the following i) DC Analysis ii)Transient Analysis b) Draw the Layout and verify the DRC,ERC c) Check for LVS d) Extract RC and back annotate the same and verify the design. 1) CMOS inverter 2) CMOS two input NAND gate 3) CMOS two input NOR gate 4) CMOS two input OR gate 5) CMOS two input AND gate 6) TG based two input XOR and XNOR gates 7) Negative edge triggers D flip flop using TGs and inverters 8) 4:1 MUX using TGs and inverters 9) 3- Bit up counter 10) 3-Bit SISO shift register **An appropriate constraint should be given*
Course Outcomes**
After completion of the course student will be able to **1. Design CMOS/ TG based gates, MUX, flipflops, counters and shift register.** **2. Draw the layout, run DC and transient analysis for designed CMOS standard cells.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0
CO2	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC505E	JAVA Programming	Credits:03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introducing classes, Objects and Methods: Introducing Classes, Class Fundamentals, The GeneralForm of a Class, A Simple Class, Declaring Objects, A Closer Look at new, Assigning Object Reference Variables, Introducing Methods, Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameter , Constructors, Parameterized Constructors, The this Keyword, The finalize( ) Method, A Stack Class. A Closer Look at Methods and Classes : Overloading Methods , Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Introducing Nested and Inner Classes, Exploring the String Class, Using Command Line Arguments.	
UNIT–II	**xx Hrs.**
Inheritance: Inheritance, Inheritance Basics, Member Access and Inheritance, Example, A Super class Variable Can Reference a Subclass Object, Using super, Using super to Call Super class Constructors, A Second Use for super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Why Overridden Methods?, Applying Method Overriding. Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding, Using final to Prevent Inheritance, The Object Class. Packages and Interfaces: Packages, Defining a Package, Finding Packages and CLASS PATH, A Short Package Example, Access Protection, An Access Example, Importing Packages, Interfaces, Defining an Interface, Implementing Interfaces, Nested Interfaces.	
UNIT–III	**xx Hrs.**
Exception Handling : Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Displaying a Description of an Exception, Multiple catch Clauses , Nested try Statements, throw, throws, finally, Java's Built-in Exceptions , Creating Your Own Exception Subclasses, Using Exceptions . Multithreaded Programming : The Java Thread Model, Thread Priorities, Synchronization, Messaging, The Thread Class and the Runnable Interface, The Main Thread, Creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, Using is Alive( ) and join( ).	
UNIT–IV	**xx Hrs.**
Multithreaded Programming Continuous: Thread Priorities, Inter thread Communication, Deadlock, Suspending, Resuming, and Stopping Threads, Suspending, Resuming, and Stopping Threads. The Applet Class :Two Types of Applets, Applet Basics, The Applet Class, Applet Architecture, An Applet Skeleton, Applet Initialization and Termination, Overriding update( ), Simple Applet Display Methods, A Simple Banner Applet, Using the Status Window, The HTML APPLET Tag, Passing Parameters to Applets, get Document Base( ) and get Code Base( ), Applet Context and show Document( ), The Applet Stub Interface .	

Reference Books *

1. From Complete Reference, "The Complete Reference" 7th edition
2. E. Balagururusamy, "Program with JAVA" 4th edition
3. Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehensive Introduction" McGraw Hill
4. The JAVA tutorials, 4th Edition by SUN Microsystems

Course Outcomes**

After completion of the course student will be able to

1. **Use fundamentals of class, objects, methods, operators, constructors.**
2. **Write programs using Inheritance, Super class, methods overriding, object class, final key,packages & interfaces in java code.**
3. **Handling Exceptions fundamentals, exception hierarchy, exception JAVA Programming fundamentals & Multithreaded Programming concepts.**
4. **Establish Inter thread communication, set thread priorities, solve deadlock , operations of suspend(),resume(), Stop(). Programming for applets.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	0	0	0	2	1	0	0	0	0	1	2	0	2
CO2	3	2	0	0	0	1	1	0	0	0	0	2	2	0	2
CO3	3	3	0	0	0	1	1	0	0	0	0	3	2	0	2
CO4	3	2		0	0	1	2	0	0	0	0	3	2	0	2

SUBJECT CODE: 21UEC506E	Digital System Design using Verilog	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to Verilog: Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays,	
UNIT–II	**10 Hrs.**
Introduction to Verilog cont.: Loops in Verilog, Testing a Verilog Model. **Design Examples:** Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and De-bouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.	
UNIT–III	**10 Hrs.**
Additional Topics in Verilog: Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks. **Hardware Testing and Design for Testability:** Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.	
UNIT–IV	**10 Hrs.**
Component Test and Verification: Test-bench, Combinational circuit testing, Sequential circuit testing, Test-bench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive test-bench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates	

Reference Books *

1) Charles Roth, Lizy Kurian John, and ByeongKil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016
2) Zainalabedin Navabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed,2008
3) Palnitkar, Samir. “Verilog HDL: a guide to digital design and synthesis” Vol. 1. Prentice Hall Professional,2003.
4) Sagdeo, Vivek. “The complete Verilog book”. Springer Science & Business Media,2007.
5) Smith, Douglas J., and Alex Foreword By-Zamfirescu. “HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog” Doone Publications,1998.
6) Bhasker, Jayaram. “A Verilog HDL Primer”. Star Galaxy Publishing,1999.

Course Outcomes**
After completion of the course student will be able to write 1. **Verilog code for combinational and sequential circuits.** 2. **Verilog code for a simple digital system for given specifications using different design styles.** 3. **Verilog code using advanced Verilog Concepts.** 4. **Develop Test benches to automate simulation and verification of design.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO2	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO3	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO4	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0

SUBJECT CODE: 21UEC507E	Mobile Communications	Credits: 03
L:T:P - N_L :02 N_T:00 N_P:00		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

UNIT-I	10 Hrs.
Wireless standard organizations. Wireless transmission: Frequencies for radio communication, signals, antennas, signal propagation. Medium access control: Motivation for specialized MAC, SOMA, FDMA, TOMA, CDMA.	
UNIT–II	**10 Hrs.**
Telecommunication systems: GSM, UMTS and IMT2000, 4GLTE networks, 5G networks over view. Broadcast system: Overview, cyclical repetition of data, digital audio broadcasting, and digital video broadcasting.	
UNIT–III	**10 Hrs.**
Wireless LAN: IEEE802.11 system architecture, protocol architecture, physical layer, medium access controller, MAC management. 802.11b. and 802.11a. Bluetooth: user scenarios, architecture, radio layer.	
UNIT–IV	**10 Hrs.**
Mobile network layer dynamic host configuration protocol, mobile Ad-hoc network. Mobile transport layer: Traditional TCP , classical TCP improvement, TCP over2.5/3G wireless network, performance enhancing proxies.	

Reference Books *

1. Jochen Schiller, 2003 "Mobile Communications", second edition PearsonEducation.
2. Gary Mullett, 2006 “Introduction to wireless telecommunication systems and networks ", First Edition Cengage learning

Course Outcomes**

After completion of the course student will be able to

1. identify the different mobile accessing techniques.
2. Identify the different architecture of mobile communications
3. Design and develop the different configurations of LAN systems.
4. Develop different network layer and transport layer protocols.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	2	-	3	-	-	1	-	1	-	1	1	0	3
CO2	2	-	2	-	3	-	-	1	-	1	-	1	1	0	3
CO3	2	-	3	-	2	-	-	1	-	1	-	1	1	0	3
CO4	2	-	3	-	3	-	-	1	-	1	-	1	1	0	3

SUBJECT CODE: 21UEC535N	Communication Systems	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introduction to Communication Systems: Elements of Communication Systems, Need for Modulation, Electromagnetic Spectrum and typical applications, Terminologies in communication systems. **Amplitude Modulation Techniques:** Elements of analog communication, Theory of amplitude modulation techniques, Generation of amplitude modulated signals.	
UNIT–II	**xx Hrs.**
Angle Modulation Techniques: Theory of angle modulation techniques, Frequency modulation, Practical issues in frequency modulation, Comparison of FM and AM, Generation of frequency modulation: Transistor reactance modulator, Varactor diode modulator, Stabilized reactance modulator-AFC. **Pulse Modulation Techniques:** Introduction, Pulse analog modulation techniques, Pulse digital modulation techniques	
UNIT–III	**xx Hrs.**
Digital Modulation Techniques: Introduction, Basic digital modulation schemes, M-ary digital modulation techniques. **Radio Transmitters and Receivers:** Introduction to radio communication, Radio transmitters: AM Transmitters, SSB Transmitters, FM Transmitters, Superheterodyne receiver, Single and Independent Side Band Receivers, Slope detection, stereo FM multiplex reception	
UNIT–IV	**xx Hrs.**
Broadband Communication Systems: Multiplexing, Short and medium haul systems, Long haul systems. **Introduction to Fiber Optic Technology:** History of fiber optics, introduction to light, The Optical fiber and fiber cables, Fiber optic components and systems.	
Reference Books *	
1. George Kennedy, Bernard Davis, S R M Prasanna, "Electronic Communication Systems", Tata McGraw Hill Education Private Limited, New Delhi, 5th Edition 2. B. P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press, 4th Edition, 2010 3. Simon Haykin, "Digital communications", John Wiley, 2014	
Course Outcomes**	
After completion of the course student will be able to 1. **Understand and analyze communication systems and amplitude modulation techniques.** 2. **Visualize angle and pulse modulation systems.** 3. **Explain different digital communication systems and radio transmitters/receivers.** 4. **Categorize broadband and optical fiber communication systems.**	

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO2	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO3	3	3	1	0	1	1	1	0	0	0	0	0	3	0	0
CO4	2	2	1	0	1	1	2	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC532N	Digital Electronics and Microcontrollers	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Combinational Logic Circuits: Definition of combinational circuit, design procedure, half adder, full adder, half subtractor, full subtractor, parallel adder, decoder, encoder, comparator (1& 2 bit), multiplexer, demultiplexer.	
UNIT–II	**xx Hrs.**
Microprocessors and Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, Z80 and 8051, 4-bit to 32-bit microcontrollers. 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, basics of input output port	
UNIT–III	**xx Hrs.**
8051 Instructions and Programming: addressing modes, types of instructions, instruction set, and data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, programs using all the above instructions and concepts.	
UNIT–IV	**xx Hrs.**
Programming peripherals in assembly: Timer and counter programming (mode 1). Serial Port Programming: Basics of serial communication, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts.	

Reference Books *

1. Donald D Givone, “Digital principle and design”, Tata McGraw Hill edition, 2002
2. Kenneth J. Ayala, “The 8051 Micro controller Architecture, Programming & Applications”, Penram International, 2nd Edition,1996
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, “The 8051 Micro controller and Embedded Systems”, Pearsons Education, 2nd edition, 2007. John M Yarbrough, “Digital logic applications and design”, Thomson learning, 2001.
4. Thomas L. Floyd, “Digital fundamentals”, 9th edition, PHI.
5. Dr.Uma Rao and Dr. Andhe Pallavi, “The 8051 microcontroller architecture, programming and applications”, Pearson Education, 2010.
6. David Calcutt, Fredcwon, “8051 microcontroller”, Elsevier, 1st Edition, 2004.

Course Outcomes**

After completion of the course student will be able to

1. **Proficient in defining, classifying, and analyzing combinational circuits and demonstrate the ability to design and implement various basic combinational circuits effectively.**
2. **Acquire a comprehensive understanding of microprocessors and microcontrollers and capable of analyzing the architecture and general features of the 8051 microcontroller,**

including its programming model, pin description, oscillator, clock, registers, and memory organization.

3. **Develop programming skills in writing assembly programs that involve data manipulation, arithmetic operations, logical functions, jump, call instructions, and bit- addressable instructions.**
4. **Gain expertise in programming timers and counters for timekeeping and event counting, serial port communication, enabling data transmission and reception in various applications and handling interrupts for event-driven programming.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		1	1	1							3	
CO2	3	2	1		1	1	1							3	
CO3	3	2	2		2	2	1	2	1	1	1	2		3	
CO4	3	2	2		2	1	1	2	1	1	1	2		3	

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII
Internship

Course Code:	21UEC510I	CIE Marks	70
Teaching Hours/Week (L:T:P)	--	SEE Marks	30
Credits	02	Hours	30 Min/Student

I. Internship:

Students need to meet following criteria to successfully complete the internship course.

II. Course objectives:

This objective of the course are

- Enhance student's knowledge of a particular area(s) of Electronics and Communication Engineering.
- Experience integration of theory and practice existing in IT Industries.
- Develop systematic work culture and skills necessary for successful professional career.
- Build the abilities such as working in diverse areas, self learning, lifelong learning and technical documentation and reporting.

III. Components of Internship

1. Student's Diary/ Daily Log

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated based on the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches, and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

2. Internship Report

The Internship report will be evaluated based on following criteria:

- Originality.
- Internship certificate from the industry.

- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course

IV. Course outcomes:

After completion of the course the student will be able to:

1. Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation.
2. Solve simple real time problems associated in their field of internship.
3. Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.
4. Document and present technical matter to fellow colleagues effortlessly.

V. Evaluation:

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation through seminar presentation
3. Viva-voce at the Institute.

Evaluation Through Seminar Presentation/Viva-Voce at The Institute

The student has to give a seminar based on his/her training, before an expert committee constituted by theconcerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analysed along with the Internship Report

Evaluation Criteria

Summary of Internship Evaluation	
Guide at the Industry	
Evaluation Criteria	**Marks**
Quality of Work	10
Ability to Learn	10
Initiative and Creativity	10
Character Traits	10
Dependability	10
Organizational Fit	10
Response to Supervision	10
Total (A)	**70**
Department Committee(Faculty Advisor+External+HoD/Nominee)	
Demonstration of experience	10
Report	10
Presentation	10
Total (B)	**30**
Total Score (A+B)	**100**

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) andProgramme Specific Outcomes (PSO)

No	Programme Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
The students will be able to:																
1	Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
2	Solve simple real time problems associated in their field of internship.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
3	Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
4	Document and present technical matter to fellow colleagues effortlessly.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**

Evaluation of Internship – Grading Rubrics for Industry

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement	Meets Expectations	Excellent	
	0-4	5-7	8-10	
Internship Evaluation Dimensions – Grading Criteria				
Quality of Work	Work was done in a careless manner and was of erratic quality; Work assignments were usually late and required review; Made numerous errors	With a few minor exceptions, adequately performed most work requirements; Most work assignments submitted in a timely manner; Made occasional errors	Thoroughly and accurately performed all work requirements; Submitted all work assignments on time; Made few if any errors	10
Ability to Learn	Asked few questions and rarely sought out additional information Unable or slow to understand new concepts, ideas, and work assignments; Unable or unwilling to recognize mistakes and was not receptive to making needed changes and improvements	Asked relevant questions and sought out additional information from appropriate sources; Acceptable understanding of new concepts, ideas, and work assignments; Willing to take responsibility for mistakes and to make needed changes and improvements	Consistently asked relevant questions and sought out additional information from appropriate sources; Quickly understood new concepts, ideas, and work assignments; Always willing to take responsibility for mistakes and to make needed changes and improvements	10

Initiative and Creativity	Had little observable drive and required close supervision; Showed little interest in meeting standards; Did not seek out additional work and frequently procrastinated in completing assignments; suggested no new ideas or options	Worked without extensive supervision; Found problems to solve and sometimes asked for additional work assignments; Set his/her own goals and, tried to exceed requirements; offered some creative ideas	A self-starter; Consistently sought new challenges and asked for additional work assignments; Regularly approached and solved problems independently; Frequently proposed innovative and creative ideas, solutions, and/or options	10
Character Traits	Regularly exhibited a negative attitude; Dishonest and/or showed a lack of integrity on several occasions; Unable to recognize and/or was insensitive to ethical and diversity issues; Displayed significant lapses in ethical and professional behavior	Except in a few minor instances, demonstrated a positive attitude; Regularly exhibited honesty and integrity in the workplace; Usually aware of and sensitive to ethical and diversity issues on the job; Normally behaved in an ethical and professional manner	Exceptionally positive attitude; Consistently exhibited honesty and integrity in the workplace; Keenly aware of and deeply sensitive to ethical and diversity issues on the job; Always behaved in an ethical and professional manner	10

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement	Meets Expectations	Excellent	
	0-4	5-7	8-10	
Internship Evaluation Dimensions – Grading Criteria				
Dependability	Generally unreliable in completing work assignments; Did not follow instructions and procedures promptly or accurately; Careless, and work needed constant follow-up; required close supervision	Generally reliable in completing tasks; Normally followed instructions and procedures; Usually attentive to detail, but work had to be reviewed occasionally; Functioned with only moderate supervision	Consistently reliable in completing work assignments; Always followed instructions and procedures well; Careful and extremely attentive to detail; Required little or minimum supervision	10

Organizational Fit	Unwilling or unable to understand and support the organization's mission, vision, and goals; Exhibited difficulty in adapting to organizational norms, expectations, and culture; Frequently seemed to disregard appropriate authority and decision-making channels	Adequately understood and supported the organization‟s mission, vision, and goals; Satisfactorily adapted to organizational norms, expectations, and culture; Generally functioned within appropriate authority and decision-making channels	Completely understood and fully supported the organization‟s mission, vision, and goals; Readily and successfully adapted to organizational norms, expectations, and culture; Consistently functioned within appropriate authority and decision- making channels	10
Response to Supervision	Rarely sought supervision when necessary; Unwilling to accept constructive criticism and advice; Seldom implemented supervisor suggestions; Unwilling to explore personal strengths and areas for improvement	Sought supervision when necessary; Receptive to constructive criticism and advice; Implemented supervisor suggestions in most cases; Willing to explore personal strengths and areas for improvement	Actively sought supervision when necessary; Always receptive to constructive criticism and advice; Successfully implemented supervisor suggestions when offered; Always willing to explore personal strengths and areas for improvement	10

Evaluation of Internship – Grading Rubric for Department Evaluation Committee/Faculty				
Evaluation Dimensions	**Performance Rating**			Maximum **Score**
	Needs Improvement	**Meets Expectations**	**Excellent**	50
	0-4	**5-7**	**8-10**	
Internship Evaluation Dimensions – Grading Criteria				
Demonstration of experience	Offers little in the way of illustrating experiences Failsto adequately address how the experiences relate to the competencies.	Addresses the Activities and experiences, but not so clearly and concisely	Well addressed activities and experiences as well as relating them to the program competencies.	10

Report	Unedited and difficult to read It is littered with grammatical and typographical errors, demonstrating little effort to producing a quality report. No reference is made to practical application. Lacks evidence and internship experience	Well-written for the most part but still has somewhat detracting errors that could have been fixed with additional editing prior to submission. Key concepts related to the selected evidence and internship experience are inaccurate or incomplete. Some helpful practical applications are included.	Has been carefully edited and is free or nearly free of any grammatical or typographical errors. Well-organized report is easy to read and understand and stands alone as a quality piece of writing. An accurate and complete reflection of key concepts related to the selected evidence and internship experience Practical applications are included to illuminate issues.	10
Presentation	Information is lacking/unclear and communicated in such a way that the audience cannot understand the purpose of the evidence work and internship experiences.	Information is presented in a clear manner but still lacks prac tical experience	Information is communicated in a thorough manner and ideas are expressed in such a way that the audience can clearly understand the evidence work and internship experiences.	10

SUBJECT CODE: 21UBT523C	Environmental Studies	Credits: 01
L:T:P – 1-0-0		CIE Marks: 50
Total Hours/Week: 01		SEE Marks: 50

UNIT-I	04 Hrs.

Natural Resources: Human activities and their impacts. **Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel. **Non renewable Energy**: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT–II	04 Hrs.

Environmental Pollution: Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves.

Sustainable future: Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, clean development mechanism (CDM).

UNIT–III	03 Hrs.

Current Environmental Issues of concern: 03 hours Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication, Environmental policy legislation rules & regulations

UNIT–IV	04 Hrs..

Fundamentals of Waste management: 04 hours Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment, Bioremediation, Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).

Reference Books *

1. Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005
2. Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006
3. Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006
4. Meenakshi "Environmental Science & Engineering" Pranticce Hall of India, 2006

Course Outcomes**

After completion of the course student will be able to

1. **Ability to recognize natural resources and its uses.**
2. **Able to understand pollution and its effects on environment and to implement sustainable future in the work place.**
3. **Ability to understand current environmental issues.**
4. **Able to apply the waste management techniques in various fields**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	-	-	-	2	3	-	-	-	-	3	1	-	-
CO2	2	-	-	-	-	-	3	-	-	-	-	3	1	-	-
CO3	-	2	-	-	-	2	2	-	-	-	-	3	1	-	-
CO4	-	-	-	1	-	2	2	1	-		-	3	1	-	1

SUBJECT CODE: 21UHS521C	**Quantitative Aptitude and Professional Skills**	**Credit: 02**
L:T:P - 2 : 0: 0		**CIE Marks: 50**
Total Hours/Week:02		**SEE Marks: 50**

Course Objectives:

1. To develop and augment written English language vocabulary and comprehension skills
2. To augment the ability to understand and analyse a problem and find its solution through analysis of data given
3. To fine-tune the quantitative analysis and problem-solving skills

UNIT-I	**08 Hrs.**
Vocabulary Development: Vocabulary Building Techniques, Root Words, Antonyms & Synonyms, Sentence Completion, Error Detection & Correction, Reading Comprehension	
UNIT–II	**08 Hrs.**
Numbers, Proportion & Finance: Number System, Factors & Multiples, The God of Math – Linear Equations, Ratio-Proportion-Variation, Percentages, Profit & Loss, Interest, Averages & Alligations	
UNIT–III	**07 Hrs.**
Time & Probability: Time & Work, Time Speed, & Distance, Permutations & Combinations, Probability	
UNIT–IV	**07 Hrs.**
Verbal, Analytical, and Visual Reasoning: Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning, Analytical Puzzles, Mathematical, Arrangement & Classification Puzzles	

Reference Books

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018
5. George J Summers, "The Great Book of Puzzles & Teasers", Jaico Publishing House, 1989
6. Shakuntala Devi , "Puzzles to Puzzle You", Orient Paper Backs, New Delhi, 1976
7. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", Sultan Chand and Sons, New Delhi, 2018
8. Cambridge Advanced Learner's Dictionary, Cambridge University Press. Kaplan's GRE guide

Course Outcomes

After active participation in this course, the student will have

CO1: Enhanced his/her vocabulary and learnt techniques to augment it further

CO2: Learned the techniques to augment his/her verbal ability

CO3: Understood step-by-analysis of the given problem and learnt to develop a method for solving it

CO4: Enhanced and augmented his/her ability to work with quantitative problems

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1							2	3		1		
CO2		1							2	3				
CO3		2	2	3								1		
CO4		1		2							2	1		

SUBJECT CODE: 21UEC601C	Information Theory and Coding	Credits: 03
L:T:P - 3 :0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Information theory: Introduction, measure of information, average information content of symbols in long independent sequences, average information content of symbols in long dependent sequences, Markov statistical model for information source, entropy and information rate of Markov source.

Source Coding: Properties, Shannon's encoding algorithm, Shannon-Fano encoding algorithm, Huffman Coding.

UNIT–II	10 Hrs.

Communication channels: Discrete communication channels, entropy functions and equivocation, mutual information, properties of mutual information, rate of information transmission over a discrete channel, capacity of a discrete memory less channel, Shannon's theorem on channel capacity, channel efficiency and redundancy, symmetric/uniform channel, binary symmetric channel, binary erasure channel. Shannon-Hartley law and its implications.

UNIT–III	10 Hrs.

Error control coding: Introduction, types of errors, examples of error control coding, methods for controlling errors, types of codes. **Linear Block Codes:** Matrix description of LBC, encoding circuit for (n, k) linear block codes, syndrome and error correction, syndrome calculation circuit, Hamming weight, Hamming distance and minimum distance of LBC, error detection and correction capability of LBCs, standard array.

UNIT–IV	10 Hrs.

Binary Cyclic Codes: Algebraic structure of cyclic codes, encoding using (n, k) bit shift register, syndrome calculation, error detection and correction.

Convolution codes: Connection pictorial representation, time and transform domain approach, systematic convolution codes, **Structural properties of convolution codes:** State diagram, code tree, trellis diagram.

Reference Books *

1. P.S. Satyanarayana,2004, Concepts of information theory and coding (2nd edition)Dynaram**.**
2. Bernard Sklar,2002, Digital communication fundamentals and applications (2nd edition) Pearson education.
3. K. Sam Shanmugam, 1996, Digital and analog communication systems**,** John Wiley.
4. Simon Haykin,2003, Digital communication**,** John Wiley.

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate the basic information theory concepts, entropy, need of coding and working of
2. different types of source coding techniques.
3. Derive channel capacity expression for different types of discrete communication channels and describe entropy functions, equivocation, mutual information of communication channel.
4. Design an encoder, decoder, and error correction circuit for linear block code.

5.	Design an encoder, decoder and error correction circuit for cyclic code and demonstrate encoding of convolutional codes, also verify its structural properties using code tree and trellis diagram.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

****** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	0	1	1	1	0	0	0	0	0	3	0	0
CO2	3	2	1	0	0	1	0	0	0	0	0	0	3	0	0
CO3	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0
CO4	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC602C	Electromagnetic Theory	Credits: 03
L:T:P - 2 : 2 : 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	10 Hrs.
Coulomb's Law and electric field intensity: Introduction to coulomb's law, field intensity,field due to continuous volume charge distribution, Field of a line charge & field of sheet charge, Electric flux density Gauss law and divergence: Electric flux density, Gauss law, Application of Gauss law for symmetrical charge distribution (point charge, Coaxial cable)and differential volume element, Divergence, Maxwell's first equation, vector operator delland divergence theorem.	
UNIT–II	**10 Hrs.**
Energy and potential: Energy expended in moving a point charge in an electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, potential field of system of charges, potential gradient, Energy density in an Electrostatic Field. Conductors, dielectrics and capacitance: Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples (Parallel plate capacitor, Dielectric boundary normal to plates).	
UNIT–III	**10 Hrs.**
Poisson's and Laplace's equations: Poisson's and Laplace's equations. Uniqueness theorem, examples of the solution of Lapalce and poisson's equations. The steddy Magnetic Field:Biot-savart's law, Ampere's Circuital Law, curl, stokes theorem, magnetic flux density, scalar and vector magnetic potentials.	
UNIT–IV	**10 Hrs.**
Time varying fields and Maxwell's equations: Faraday's Law, Displacement Current, Maxwell's equation in point and integral form, retarded potentials. Uniform Plane Wave: Wave Propagation In free space an Dielectrics, Poynting's Theorem and wave power, Plane wave in boundaries and in dispersive media: Reflection Uniform Plane Wave At normal incidence, SWR.	

Reference Books *

1. WilliamHHaytJr,JohnABuck,"EngineeringElectronics",TataMcGraw-Hill,7th edition, 2006
2. JohnKraussandDanielAFleisch,"Electromangeticswithapplication",McGraw- Hill, 5th edition, 1999
3. DavidKCheng,"FiledandwaveElectromangetics"PearsoneducationAsia,2nd edition,-1989, Indian Reprint-2001.

Course Outcomes**

After completion of the course student will be able to

1. Understand the concept of scalar, vectors, Coulombs law, Electric filed intensity,Gauss law and its applications, divergence and analyze the problems based on the mentioned laws
2. Understand potential due to charges, potential gradient, continuity equation, boundary conditions and capacitance and Analyze the problems based on the mentioned laws
3. Understand Poisson's, Laplaces equation and its application, Uniqueness theorem, Biot-savart's law, ampere's law, stokes theorem and Curl with respect to magnetic fields and analyze the problems related to the mentioned laws
4. Understand about time varying fields, Maxwell's equation, retarded potential, wave propagation in free space, Poynting's theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR) and analyze the problems based on the mentioned laws.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2	2	2	1	0	0	0	0	3	0	0
CO2	3	2	3	2	1	2	2	1	0	0	0	0	3	0	0
CO3	3	2	3	2	2	2	2	1	0	0	0	0	3	0	0
CO4	3	3	3	3	3	3	3	1	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC603C	Computer Networks	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Layered Tasks,OSIModel,LayersinOSImodel,TCP/IPSuite,Addressing,DataLinkControl: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC, PPP.	
UNIT–II	**10 Hrs.**
MultipleAccesses:Randomaccess,Controlledaccess,Channelization,WiredLAN,Ethernet,IEEE standards,StandardEthernet.Changesinthestandards,FastEthernet,GigabitEthernet,Connecting LANs,BackboneandVirtualLANs	
UNIT–III	**10 Hrs.**
NetworkLayer,Logicaladdressing,Ipv4addresses,Ipv6addresses,Ipv4andIpv6Transitionfrom Ipv4 to Ipv6, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols.	
UNIT–IV	**10 Hrs.**
Transport layer Process to process Delivery, UDP, TCP, Application Layer: Domain name system,NameSpace,DomainNameSpace,DistributionofNameSpace,DNSintheInternet,Resolution, DNS messages, Types of Records, Registrars, Dynamic Domain Name System, Encapsulation.	

Reference Books *

1.Data Communication and Networking,"BehrouzA.Forouzan",4th Edition,TMH,India,2006.
2.AndrewS.Tanenbaum,"Computer Networks",Prentice-Hall,2010.
3.William Stallings,"DataandComputerCommunications",Prentice-Hall,2007.

Course Outcomes**

After completion of the course student will be able to

1. **Master the terminology and concepts of the OSI reference model and the TCP/IP reference model**
2. **Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks**
3. **Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.**
4. **Become familiar with Widely-used Internet protocols lichas TCP/IP,UDP,etc.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

SUBJECT CODE: 21UEC604L	Computer Networks Laboratory	Credits: 01
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

Sl.No.	LISTOF EXPERIMENTS
1.	Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool
2.	Study of network components/devices:i)NICii)Hubiii)Switch
3.	Connecting computers on Local Area Network(LAN)
4.	Study of packet tracer
5.	Configuration of different network topologies using packet tracer
6.	Configuration of switch and establishing LAN using packet tracer
7.	Creation of Virtual LAN(VLAN)using packet tracer
8.	Configuration Of Basic Routing Using Packet Tracer
9.	Configuration of a network using Routing Information Protocol(RIP)using packet tracer
10.	Configuration of a network using Open Shortest path First(OSPF)using packet tracer
11.	Configuration of DHCP using packet tracer
12.	Configuration of NAT using CISCO packet tracer

Course Outcomes**

After completion of the course student will be able to

1. To Apply the concepts of Data Communication and Networking
2. To do Internetworking & devices
3. To Develop New Routing techniques
4. Practically Know The Functionality of devices using RIP, OSPF, DHCP,and NAT

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

	SUBJECT CODE: 21UEC605L	**Advanced Communication Laboratory**	**Credits: 01**
	L:T:P - 0 : 0 : 2		CIE Marks: 50
	Total Hours/Week: 02		SEE Marks: 50

Sl.No.	**LIST OF EXPERIMENTS**
1.	Verification Of The Sampling Theorem
2.	Generation and detection of ASK signal
3.	Generation and detection of FSK signal
4.	Generation and detection of PSK signal
5.	Study of radiation pattern of DIPOLE antenna
6.	Study of radiation pattern of HORN antenna
7.	Study of radiation pattern of YAGI-UDA antenna
8.	Measurement of frequency and wavelength of a microwave source
9.	Study the mode characteristics of Reflex klystron
10.	Measurement of coupling factor, insertion loss and directivity of a Directional Coupler
11.	Study of Magic Tee and its characteristics
12.	Study of V-I characteristics of Gunn diode and Gunn diode as an oscillator
13.	To Study the characteristics of low pass and high pass microstrip filter
14.	To Study the characteristics of band pass and band stop microstrip filters
15.	To study the characteristics of ring resonator in microstrip
16.	To study and plot the radiation pattern of microstrip patch antenna

Course Outcomes**

After completion of the course student will be able to

1.Design and test the digital modulation techniques and analyze the waveforms
2.Determine The Radiation Pattern Of Different Antennas
3.Determine the characteristics and response of microwave devices
4.Determine the characteristics of micro strip antennas and devices and compute the parameters associated with it

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO2	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO3	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO4	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0

SUBJECT CODE: 21UEC606E	Biomedical Signal Processing	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction to Biomedical Signal: The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis.

Neurological Signal processing: Brain and its potentials, Electrophysiological origin ofBrain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Autoregressive (AR)method, Recursive Estimation of AR parameters, Spectral error measure, Adaptive segmentation.

UNIT–II	10 Hrs.

Filtering for Removal of Artifacts: Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, Time domain filters with application: Synchronized averaging, moving-average filters. Frequency domain filters with examples: removal of high frequency noise by Butterworth low pass filters, removal of low frequency noise by Butterworth high pass filter, removal of periodic artifacts by notch and comb filters. Optimal filtering: Weiner filter.

UNIT–III	10 Hrs.

Signal Averaging: Basics of signal averaging, Signal averaging as a digital filter, A typical average, Software for signal averaging, Limitations of signal averaging.

DataAcquisitionandclassificationofsleepstages,TheMarkovmodelandMarkovchains,DynamicsofSleep-wakeTransitions,HypnogramModelParameters.

CardiologicalSignalProcessing:ECGParametersandtheirestimation

UNIT–IV	10 Hrs.

Adaptive Interference/Noise Cancellation: A review of wiener filtering problem, Principle Of an adaptive filter, the steepest descent algorithm, Adaptive noise canceller, Cancellation of 60Hz Interference in ECG, Canceling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles, Canceling of maternal ECG in Fetal ECG, Cancellation of higher frequency noise in electro- surgery.

ECG Data Reduction Techniques: Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.

Reference Books *

1. Rangaraj M Rangayyan,“Biomedical signal analysis- A case- study approach”, Wiley 2009.
2. D. C. Reddy, “Biomedical Signal Processing- Principles and Techniques”, Tata McGraw Hill, 2008.
3. WillisJ.Tompkins,“BiomedicalDigitalSignalProcessing”,PHI,2006.
4. AkayM,"BiomedicalSignalProcessing",Academic:Press1994.

Course Outcomes**
After completion of the course student will be able to 1.Analyze the nature of Biomedical signals and related concepts. 2.Apply filters to remove noise from biomedical signals. 3.Apply averaging technique on biomedical signals and extract the features of EEG and ECG signals. Also analyze event detection techniques for EEG and ECG signals. 4.Applydifferentfiltersfornoisecancellationandsignalcompressiontechniqueson biomedical signals.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	2	1	1	1	1	2	3	0	0
CO2	3	3	3	3	3	3	1	0	0	0	0	2	3	0	0
CO3	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0
CO4	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0

SUBJECT CODE: 21UEC607E	Computer Organization	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.	
UNIT–II	**10 Hrs.**
Input/Output Organization: Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Interface Circuits, Standard I/O Interfaces–PCI Bus and USB.	
UNIT–III	**10 Hrs.**
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size and Cost, Cache Memories–Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage. **Arithmetic:** Addition And Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers	
UNIT–IV	**10 Hrs.**
Arithmetic Cont.: Signed, Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Microprogrammed Control.	

Reference Books *

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, Tata McGraw Hill, 5th Edition, 2002
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design – The Hardware /Software Interface ARM Edition”, Elsevier, 4th Edition, 2009
3. WilliamStallings,“ComputerOrganization&Architecture”,PHI,7thEdition,2006

Course Outcomes**

After completion of the course student will be able to

1. Have thorough knowledge about structure and performance of a modern digital computer.
2. Analyze the different ways of communicating with I/O devices and standard I/O interfaces in a compute including using interrupt.
3. Analyze memory hierarchy including main memory, cache memory, virtual memory and secondary memory considering cost/performance. Different Mapping Functions of cache.
4. Implement arithmetic operations like multiplication, division and analyze the process of instruction execution of a complete instruction in the processing unit and its control.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO2	1	1	2	1	3	0	0	0	0	0	0	0	0	0	3
CO3	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO4	1	1	3	1	3	0	0	0	0	0	0	0	0	0	3

SUBJECT CODE: 21UEC608E	Digital Image Processing (Department Elective)	Credits: 03
L:T:P - 3: 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course Objectives:

1. To provide the basic knowledge on image processing concepts.
2. To develop the ability to apprehend and implement various image processing algorithms.
3. To understand various image processing steps and their applications in real time
4. To facilitate the students to comprehend the contextual need pertaining to various image processing applications.

UNIT-I	10 Hrs.

Introduction- Digital Image, its Representation & point operations: Image Representation and Image Processing Paradigm - Elements of digital image processing, Image model. Sampling and quantization-Relationships between pixels- Connectivity, Distance Measures between pixels, Color image (overview, various color models)-Various image formats bmp, jpeg, tiff, png, gif, etc. Noise in Images Sources, types. Arithmetic operations, Logical operations, Spatial operations Single pixel, neighbour hood, geometric-Contrast Stretching-Intensity slicing-Bit plane slicing Power Law transforms.

UNIT–II	10 Hrs.

Image Enhancement: Spatial and Frequency domain-Histogram processing-Spatial filtering-Smoothening spatial filters, Sharpening spatial filters; Frequency filtering-Smoothening frequency filters-Sharpening frequency filters, Selective filtering.

Image Restoration: Noise models - Degradation models-Methods to estimate the degradation-Image deblurring Restoration in the presence of noise only spatial filtering-Periodic noise reduction by frequency domain filtering-Inverse filtering-Wiener Filtering.

UNIT–III	10 Hrs.

Feature Extraction: Region of interest (ROI) selection - Feature extraction: Histogram based features - Intensity features-Color, Shape features-Contour extraction and representation-Homogenous region extraction and representation-Texture descriptors.

Image Segmentation: Discontinuity detection-Edge linking and boundary detection. Thresholding-Region oriented segmentation- Histogram based segmentation. Object recognition based on shape descriptors.

UNIT–IV	10 Hrs.

Image Coding and Compression: Lossless compression versus lossy compression-Measures of the

compression efficiency- Huffmann coding, Bit plane coding, Arithmetic coding. Wavelet Transform in image processing: Wavelet Transform in one dimensions, Wavelet transforms in two dimensions. Fast Wavelet Transform , Other Applications of Wavelet in image processing.

Reference Books *

Author/s last Name, initial (Year), Book Title (edition), Publisher
1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018. 2. William
2. K. Pratt, Digital Image Processing, 4th Edition, John Wiley, 2007.
3. Fundamentals of Digital Image Processing, Jain A.K., PHI, 1997
4. Insight into wavelets - From theory to practice, K. P. Soman and K. I. Ramchandran, PHI ,2005, Second Edition.
5. Rafael C. Gonzalez, "Digital Image processing using MATLAB", Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.

Course Outcomes**

After completion of the course student will be able to

1. Ascertain and describe the basics of image processing concepts through mathematical interpretation and operations.
2. Acquire the knowledge of various image enhancement techniques involved.
3. Demonstrate image restoration process and its respective filters required.
4. Experiment the various image segmentation and feature extraction operations.
5. Design the various image coding and compression procedures and illustrate the wavelet transform in images with its applications.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO2	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO3	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO4	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO5	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0

Assignment:

Students are required to develop programs using
Matlab. List of Programs

1. Write program to read and display digital image using MATLAB or SCILAB
    a. Become familiar with SCILAB/MATLAB Basic commands
    b. Read and display image in SCILAB/MATLAB
    c. Resize given image
    d. Convert given colour image into gray-scale image
    e. Convert given colour/gray-scale image into black & white image
    f. Draw image profile
    g. Separate colour image in three R G & B planes
    h. Create colour image using R, G and B three separate planes
    i. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
    a. Obtain Negative image
    b. Obtain Flip image
    c. Thresholding
    d. Contrast stretching
3. To write and execute programs for image arithmetic operations
    a. Addition of two images
    b. Subtract one image from other image
    c. Calculate mean value of image
    d. Different Brightness by changing mean value

4. To write and execute programs for image logical operations
    a. AND operation between two images
    b. OR operation between two images
    c. Calculate intersection of two images
    d. Water Marking using EX-OR operation
    e. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
    a. Standard MATLAB function
    b. Program without using standard MATLAB functions
6. To write and execute program for geometric transformation of image
    a. Translation b. Scaling c. Rotation d. Shrinking e. Zooming
7. To understand various image noise models and to write programs for
    a. image restoration b. Remove Salt and Pepper Noise c. Minimize Gaussian noise d. Median filter and Weiner filter
8. Write a program in MATLAB/SCILAB for edge detection using different edge detection mask
9. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

SUBJECT CODE: 21UEC609E	Embedded System	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to embedded systems, embedded system vs. general computing system, classifications, purpose of embedded system, major application areas including some novel applications. The typical embedded system: Core of embedded system, memory, sensors and actuators, communication interface, Characteristics and quality attributes of embedded systems.	
UNIT–II	**10 Hrs.**
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, architecture of ARM Cortex M3, various units in the architecture, debugging support, general purpose registers, special registers, exceptions, interrupts, stack operation, reset sequence.	
UNIT–III	**10 Hrs.**
Hardware software co-design and program modeling: fundamental issues in hardware software co-design, computational models in embedded system, hardware software trade-offs. Embedded firmware design and development: design approaches, Mixing assembly and high level language, Programming in embedded C.	
UNIT–IV	**10 Hrs.**
Real-time operating system based embedded system: operating system basics, need for RTOS, types of operating system, tasks, process and threads, multiprocessing and multitasking, task scheduling, threads, processes and scheduling : putting altogether, task communication, task synchronization, device drivers.	

Reference Books *

1. Shibu K V, "Introduction to embedded systems", Tata McGraw Hill private limited, 2010.
2. Joseph Yiu, "The definitive guide to the ARM CORTEX-M3", Newnes, Second edition.
3. Rajkamal, "Embedded systems: architecture, programming and design", Tata McGraw Hill private limited, second edition.
4. Frank Vahid, Tony Givargis, "Embedded system design: A unified hardware/software introduction", John Wiley and Sons, 2001.

Course Outcomes**

After completion of the course student will be able to

1. **Gain comprehensive knowledge about embedded systems, major application area of embedded systems and system components like memory, sensors and actuators.**
2. **Gain comprehensive knowledge about ARM-32 bit Microcontroller, architecture and other internal details.**
3. **Develop embedded applications on IDE environment and programming in embedded 'C'.**
4. **Explore one opensource RTOS and demonstrate the basic concepts of RTOS.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	0	1	1	0	0	0	0	0	0	0	3	0
CO2	3	2	2	0	1	1	0	0	0	0	0	0	0	3	0
CO3	3	3	3	0	3	3	0	0	0	0	0	0	0	3	0
CO4	3	3	3	0	3	2	0	0	0	0	0	0	0	3	0

SUBJECT CODE: 21UEC610E	Wireless Networks	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Wireless networks: Wireless network architectures, classification of wireless networks, wireless switching technology, wireless communication problems, wireless network reference model, wireless networking issues, wireless networking standards. Wireless Body Area Network(WBAN): Properties, network architecture, network components, design issues, network protocols, WBAN Technologies, WBAN Applications. Wireless Personal Area Network(WPAN): Wireless Personal Area Network, network architecture, Piconet and Scatternet, WPAN components, WPAN technologies and protocols, WPAN Applications.	
UNIT–II	**10 Hrs.**
WirelessLocalAreaNetwork(WLAN):Networkcomponents,designrequirementsofWLAN, network architecture, WLAN standards, WLAN protocols, IEEE 802.11p, WLAN Applications	
UNIT–III	**10 Hrs.**
Wireless Metropolitan Area Network (WMAN): Wireless Metropolitan area networks, WMAN network architecture ,network protocols, broadband wireless networks, WMAN Applications. Ad-hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.	
UNIT–IV	**10 Hrs.**
MAC Protocols for ad hoc wireless networks: Introduction, issues in designing a MAC protocol for Ad hoc wireless networks, design goals of a MAC protocol for Ad hoc wireless networks, classification of MAC protocols, contention based protocols with reservation mechanisms. Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. Overview of ad hoc routing protocols.	

Reference Books *

1.Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks:Concepts and Protocols", Wiley-India, First Edition, 2010

2.C.SivaRamMurthy,B.S.Manoj"AdhocwirelessNetworks",PearsonEducation,2nd Edition, 2005.

3.KavehPahlavan,P.Krishnamurthy,"PrinciplesofWirelessNetworks",Pearson Education, First Edition, 2002

4.Yi-BingLin,ImrichChlamtac,"WirelessandMobileNetworkArchitectures",John Wiley, First Edition, 2001

5.MarlynMallick,"MobileandWirelessDesignEssentials",Wiley,FirstEdition,2003

6.William C. Y. Lee, "Mobile Cellular Telecommunication – Analog and Digital Systems", McGraw Hill, 2ndEdition, 1995

Course Outcomes**

After completion of the course student will be able to

1. Understand Fundamentals Of Wireless Networks
2. Analyzeuniquecharacteristicsandvariousdesignissuesinwirelessnetworks
3. Demonstrate basic skills for different types of wireless networks design
4. Apply knowledge of various TCP/IP protocols for wireless networking**.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

SUBJECT CODE: 21UEC611N	Sensor Technology	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

Sensor Fundamentals: Introduction, Definition, Types, and Sensor Characteristics
Principles of Sensing: Capacitive, Magnetic, Inductive, Resistive, Piezoelectric, Piezoresistance, Pyroelectric, Hall effect.
I**nterfacing Electronic Circuits:** Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, A to D Converters, Bridge Circuits, Data Transmitters, Batteries for low power sensors

UNIT–II	xx Hrs.

Overview of Sensor Materials: Sensor materials and material properties, Surface Processing of materials for development of Sensors.
Sensor Technologies: Micro technology**,** Micro-Electro-Mechanical Systems Technology, Nanotechnology
Sensor Applications: Displacement Sensing, level & Velocity Sensors, Accelerometers, Tactile Sensors, Pressure Sensors, Temperature Sensors, Comb drive Sensors.

UNIT–III	xx Hrs.

Mechanical and Electromechanical sensor: Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity.
Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature,
Capacitive sensors: Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect
Case Study: Piezoelectric and Capacitive Pressure Sensors, Cantilever based DNA Sensor, CNT based Pressure Sensor.

UNIT–IV	xx Hrs.

Interfacing: Communication Basics, parallel, serial and wireless communication, Basic protocol concept, communication protocols, USB interface, Processor interfacing basics, Controller and computer based control implementations. Introduction to wireless sensor network and wireless network protocols

Reference Books *

1. Jacob Fraden, “Handbook of Modern Sensors: Physical Design & Applications”, AIP Press, Springer.
2. D. Patranabis, “Sensors & Transducers”, PHI Publication New Delhi.
3. Frank Vahid, Tony Givargis, “Embedded system Design”,JohnWieley& Sons, Inc, 2002
4. H.K.P. Neubert, “Instrument transducers”, Oxford University press.
5. E.A. Doebelin, “Measurement systems: application & design”, Mc Graw Hill

Course Outcomes**

After completion of the course student will be able to

1. Use concepts for converting a physical parameter into an electrical quantity
2. Identify appropriate sensor materials and technology while designing sensors

3.	Comprehend working principle of mechanical, strain gauge and capacitive sensors.
4.	Set up sensor data acquisition and communication strategies
5.	Suggest sensor performance improvement methodologies

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**3**	**2**			**2**		**2**				**2**	**3**	**1**	
CO2	**3**	**1**	**2**			**3**			**2**			**3**	**3**	**2**	
CO3	**3**	**3**	**3**		**2**	**2**				**1**		**2**	**3**	**2**	
CO4	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**		**1**	**2**	**3**	**3**	**3**	

	SUBJECT CODE: 21UEC612N	**Image Processing (Open Elective)**	**Credits: 03**
	L:T:P - 3:0:0		CIEMarks:50
	Total Hours/Week: 03		SEEMarks:50

Course Objectives:

1. To provide the basic knowledge on image processing concepts.
2. To develop the ability to apprehend and implement various image processing algorithms.
3. To understand various image processing steps and their applications in real time.
4. To facilitate the students to comprehend the contextual need pertaining to various image processing

UNIT-I	**10 Hrs.**
Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; image sensing and acquisition; sampling and quantization; representation of digital images, image interpolation, Basic relationship between pixels; arithmetic and logic operations.	
UNIT–II	**10 Hrs.**
Transformation and spatial filtering: Basics of intensity transformation and functions, Histogram Processing, equalization and histogram matching.Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Restoration: Image Restoration: Image Degradation/Restoration Process, Noise Models.	
UNIT–III	**10 Hrs.**
Restoration in the Presence of Noise Only-Spatial Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Color image processing: fundamentals, color models pseudo colour image processing, colour transformations.	
UNIT–IV	**10 Hrs.**
Image Compression: Fundamentals, Image Compression Models and methods: Huffman coding, Golomb coding, arithmetic coding, LZW coding JPEG, predictive coding. Digital watermarking Applications in satellite, sonar, radar, medical areas and process industries.	

Reference Books *

1. R. C. Gonzalez, R. E. Woods, “Digital Image processing”, Addison Wesley/ Pearson education, New Delhi, India, 3rd edition, 2002.
2. A. K. Jain, “Fundamentals of Digital Image processing”, Prentice Hall of India, New Delhi, 2nd Edition, 1997.
3. Rafael C. Gonzalez, “Digital Image processing using MATLAB”, Richard E. Woods and

Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.
4. S. Jayaraman, S. Esakkirajan, T.Veerakumar, “Digital Image Processing”, Tata McGraw- Hill Education.

Course Outcomes

After completion of the course student will be able to

1. Articulate the fundamentals of Digital image processing including the simple image formation and relationship between pixels
2. Application of different types of Image transformation techniques, histogram processing and application of spatial filters.
3. Analyze the significance of image restoration and processing of colour images.
4. Illustrate the image compression like lossy and loss less image compression techniques.

Assignment:

Students are required to develop programs using Matlab. List of programs:

1. Image Printing Program Based on Half toning.
2. Reducing the Number of Intensity Levels in an Image.
3. Zooming and Shrinking Images by Pixel Replication.
4. Zooming and Shrinking Images by Bilinear Interpolation.
5. Arithmetic Operations.
6. Image Enhancement Using Intensity Transformations.
7. Histogram Equalization.
8. Spatial Filtering.
9. Enhancement Using the Laplacian.

Course Articulation Matrix

Course Outcomes	CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
1.	2					3							3	3	3
2.			3		2	3	2					2		2	
3.			3						2			3	1		3
4.			3		3				3			3	3	3	3

SUBJECT CODE: 21UEC613N	Modeling and Simulation of Engineering Systems	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introduction to Systems: Introduction, types, properties of systems, LTI Systems, Stability of systems. Non linear systems **Mathematical Modeling:** Introduction, types of modeling, Abstraction, Linearity and superposition, balance and conservation laws and the system, boundary approach. Basic system elements in mechanical, electrical, fluid, magnetic and thermal systems	
UNIT–II	**xx Hrs.**
Mathematical Modeling of Basic Engineering Systems: Introduction, Differential equations of basic engineering systems, Transfer functions, Block diagram algebra, Signal flow graphs. **Lumped Parameter Models:** Mechanical systems (automobile suspension system, accelerometer), translational, rotational (simple rotational system). hydraulic systems (two tank hydraulic system), thermal systems (simple thermal system). Electrical Systems (capacitor microphone).	
UNIT–III	**xx Hrs.**
Analysis of Systems: Introduction, time domain analysis of first order and second order systems**,** Frequency response of Linear Time invariant systems: Bode plots, phase margin and gain margin, stability analysis: Routh Hurvitz criteria. Introduction to State space representation of systems	
UNIT–IV	**xx Hrs.**
Modeling and Simulation tools: Introduction, familiarization with modeling and simulation software, Simulation and analysis of mathematical models developed. Introduction to non-linear systems and linearization. Curve fitting in system modeling.	

Reference Books *

1. Mukherjee A. and Karmakar R. - „Modeling and Simulation of Engineering Systems through Bond graphs - Narosa – 2000
2. I J Nagrath, M Gopal – Control Systems Engineering, New Age International Publishers, Fifth Edition, 2007
3. O. Beucher and M. Weeks - Introduction to MATLAB and Simulink a project based Approach, Infinity Science Press LLC, 2006
4. Chi Tsong Chen – Linear System Theory and Design, Oxford University Press, 1999
5. Ken Dutton, Steve Thompson, Bill Barraclough – The Art of Control Engineering, Addison – Wesley, 1997
6. J N Kapur – Mathematical modeling, New Age International (P) Ltd. New Delhi
7. S. C. Chapra, R. P. Canale – Numerical methods for Engineers, 4th Ed., TMH, New Delhi
8. Woods Robert L. and Kent L.- „Modeling and Simulation of Dynamic Systems"- Prentice Hall – 1997
9. Frederick C. - „Modeling and Analysis of Dynamic Systems" - Wiley - 2001 - 3rd Edition

Course Outcomes**

After completion of the course student will be able to

1. Build a reduced order model of any engineering system and obtain its mathematical model
2. Visualize various factors to be considered in any engineering system design
3. Simulate the developed model Use software tools (e.g. SCILAB/XCOS) for modeling,

simulation, and analysis

4. Analyze the system using simulation results

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
CO2	3	3	3	0	0	1	2	0	0	0	0	0	3	0	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC614N	Nanotechnology	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introduction: The Canvas of nano science and nanotechnology: - Nano and nature, Evolution of various technologies of the 20th century, Beginning of Nano. Introduction to Fullerenes: Introduction to fullerenes, Synthesis & purification of fullerenes, Conductivity & superconductivity in Fullerenes, Introduction, synthesis & purification of CNTs, filling & mechanism of growth of CNTs, Electronic structure, mechanical and physical properties of CNTs, applications of CNTs.	
UNIT–II	**xx Hrs.**
Semiconductor quantum dots: Introduction, synthesis of quantum dots, electronic structure of nano crystals. Nano shells: Introduction, types of nano shells, properties and characterization. Nano sensors: Introduction, Nano sensors, Nano sensors based on quantum size effects, electrochemical sensors, Nano biosensors and smart dust.	
UNIT–III	**xx Hrs.**
Molecular Nano machines: Introduction, covalent and non-conventional approaches, molecular motors and machines, molecular devices, single molecule devices. Nano tribology: Introduction, studying tribology the nano scale, nanotribology applications. Case study: design and development of CNT based nano piezoresistive pressure sensor, Silicon nano wire- based sensors.	
UNIT–IV	**xx Hrs.**
Investigation & characterization methods in the nano scale: Electron Microscopes, Scanning Probe Microscopes, optical microscopes for nontechnology, other microscopes, X-ray diffraction, AFM. Societal implications of nano science & nontechnology: From first industrial revolution to the nano revolution, implications of nano science and nontechnology on society, nanotech and war, public perception and involment in the nano discourse, harnessing nontechnology for economic and social development.	
Reference Books *	
1. T. Pradeep,"NANO: The Essentials", McGraw-Hill Education, 2007 Edition. . 2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley-VCH, 3rdEdition, 2012 Year	
Course Outcomes**	
After completion of the course student will be able to **1. Comprehend the fundamentals of nontechnology and develop an understanding of various nano materials and synthesis technology.** **2. Understand quantum dots, nano shells, design and development of Nano sensors** **3. Comprehend the knowledge of molecular nano mechanics & Nano tribology** **4. Analyze and characterize nano devices, nanostructures and comprehend the societal implications of nanotechnology.**	

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

	Programme Outcomes (POs)	Program Specific

Course Outcomes													Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	0	0	0	0	0	0	0	3	0	2	3	1	0
CO2	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO3	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO4	3	3	1	2	3	3	3	3	0	2	2	3	3	3	0

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

Semester End Examination (SEE) Scheme of Evaluation

Semester: VI Course: Mini-Project Code: 21UEC613P Credits:02 Hours/Week:--

Mini-Project is evaluated as per the guidelines of BEC Examination Reforms Policy. It is evaluated for 50 marks by a committee comprising of 1. Mini-Project Coordinator, 2. HoD/Nominee and 3. External Examiner. The details of evaluation are as follows.

Evaluation Criteria	Very poor (2)	Poor (4)	Average (6)	Good (8)	Very good (10)	Total marks	Evaluation Committee
1. Generate information through appropriate tests to improve or revise design-GA	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedures	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement	50	Coordinator + HoD/ Nominee + External Examiner
2. Use appropriate procedures, tools and techniques to conduct experiments and collect data - GA	Not able to identify tools, techniques and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards		
3. Analyze data for trends and correlations	Not able to understand data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations		
4. Deliver effective oral presentations to technical and non-technical	Could not deliver effective presentations.	Could not deliver presentation ,but presentation was	Able to deliver fair presentation but notable to answer to the audiences	Deliver effective presentations but able to answer partially to	Deliver effective presentation and able to answer all queries of the		

audiences-IA		prepared and attempted.		the audience queries'.	audience.		
5. Present results as a team, with Smooth Integration Of Contributions from all Individual efforts – GA+ IA	No Contribution from an individual to a team	Contributions from an individual to a team is minimal	Contribution s from an individual to a team is moderate	A contribution From An individual to a team is good but not Well groomed in team.	Contribution from an individual to a team is good and results in an Integrated Team presentation.		

GA–Group Assessment **IA** –Individual Assessment

Syllabus for
B.E. VII & VIII – Semester
(For students admitted to I year in 2021-22)

SUBJECT CODE: 21UEC701C	Microwaves and Antennas	Credits: 03
L:T:P - 3 : 0 : 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction to microwaves: Microwave frequencies, IEEE microwave frequency bands. **Microwave transmission lines and rectangular waveguides**: Introduction, transmission line equations, characteristic and input impedances, reflection and transmission coefficients, standing wave and SWR. Introduction to rectangular waveguides, TE and TM modes in rectangular waveguides. **Microwave vacuum tube device:** Introduction, reflex klystron oscillator (mechanism of oscillation, mode of oscillation, power output and efficiency, mode curve), two cavity klystron amplifier (mechanism of operation).	
UNIT–II	**10 Hrs.**
Microwave network theory and passive devices: Introduction, S-matrix representation of multi-port network, properties of S-matrix, matched terminations, rectangular to circular waveguide transition, attenuators, precision phase shifter, waveguide tees, E-plane tee, H-plane tee, magictee, applications of magic tee, faraday rotation isolator, four-port circulator, 2-hole directional coupler. **Microwave application**: Microwave radar systems (radar equation, pulsed radar, CW doppler radar, FMCW radar).	
UNIT–III	**10 Hrs.**
Fundamental Parameters of Antennas: Introduction, radiation pattern, radiation power density, radiation intensity, beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, polarization, effective height, input impedance, antenna radiation efficiency, maximum directivity and maximum effective area, Friis transmission equation. **Antenna arrays**: Array of two point sources, broad side array, end fire array, n-isotropic array, pattern multiplication. binomial and Chebyshev arrays, phased array.	
UNIT–IV	**10 Hrs.**
Antenna Aperture: aperture concept, types of aperture, maximum effective aperture of short dipole and half wave dipole. **Antenna practice:** Yagi-Uda antenna, turnstile antenna, log periodic antenna, helical antenna, rhombic antenna, horn antenna, parabolic reflector antennas, micro strip antenna and their feed systems.	
Reference Books *	

1. AnnapurnaDas,SisirK.Das,"MicrowaveEngineering",TMH,2nd Ed,NewDelhi,2009.
2. SamuelY.Liao,"MicrowaveDevicesandCircuits",PearsonEducation,3rd Ed,NewDelhi, 2003.
3. JohnD.Krauss,RonaldJ.Marhefka,AhmadSKhan,"AntennasandWave Propagation", McGraw-

Hill, 5thEd, New Delhi, 2017.
4. ConstantineA.Balanis,"AntennaTheory:AnalysisandDesign",JohnWiley,4thEd, New Delhi, 2016.
5. K.D.Prasad,"Antenna& Wave Propogation",Satyaprakshan,5thEd,NewDelhi2009.
6. MerrillI.Skolnik,"IntroductiontoRadarSystems",TMH,3rdEd,NewDelhi,2001.
7. P.E.Collins,"AntennasandRadioPropagation",McGraw-Hill,NewDelhi,1985
8. EdwardC.Jordan,KeithG.Balmain,"ElectromagneticwavesandRadiatingsystems",
9. PHINewDelhi,1993.

Course Outcomes**

After completion of the course student will be able to

1. **Acquire the knowledge of transmission line theory, rectangular waveguides and describe microwave vacuum tube device.**
2. **Analyze microwave passive devices with scattering parameters, and apply microwave application in radar systems.**
3. **Compute basic antenna parameters using radiation patterns, analyzeand design antenna arrays.**
4. **Analyze The Importance Of Antenna Aperture, explain the working principle of different antennas and their usage in real time field.**

***Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	0	0	1	1	0	0	0	0	0	3	0	0
CO2	3	2	1	0	0	1	1	0	0	0	0	0	3	0	0
CO3	3	2	2	0	0	1	1	0	0	0	0	0	3	0	0
CO4	3	2	2	0	0	1	1	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC707E	Speech Signal Processing	Credits: 03
L:T:P –3-0-0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Digital representation of speech signal. Waveform representation and parametric representation. Sampling rate conversion. Introduction, the process of speech production and classification and basics of phonetics, phonetic description of phonemes, the acoustic theory of speech production, digital models for speech – vocal tract, radiation, excitation the complete model.	
UNIT–II	**10 Hrs.**
Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, voiced/unvoiced/silence detection. Pitch period estimation (Rabiner and Gold method), short time autocorrelation function, short time average magnitude difference function, u/v/speech/silence detection.	
UNIT–III	**10 Hrs.**
Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, linear filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (Vocoders), phase vocoder, channel vocoder.	
UNIT–IV	**10 Hrs.**
Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse cepstum transformation, the complex cepstrum of speech, cepstral vocoder, processing applications of cepstral analysis.	

Reference Books *

Textbook:

1. L.R.RabinerandR.W.Schafer**,**"DigitalProcessingofSpeechSignals,"Pearson Education (Asia) Pte. Ltd., 2004.

ReferenceBook:

1. D.O'Shaughnessy,"SpeechCommunications:HumanandMachine,"UniversitiesPress, 2001.
2. B.GoldandN.Morgan,"SpeechandAudioSignalProcessing:processingand perception of speech and music' Pearson Education, 2003.

Course Outcomes**

After completion of the course student will be able to

1. Explain the speech production and perception mechanism
2. Characterize and analyze speech signals in Time domain
3. Characterize and analyze speech signals in Frequency domain
4. Analyze speech signal using homomorphic transformation and LPC

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	0	1	1	0	0	0	0	0	0	3	0	0
CO2	3	3	2	0	1	1	0	0	0	0	0	0	3	0	0
CO3	3	2	1	0	1	1	0	0	0	0	0	0	3	0	0
CO4	3	3	1	0	1	1	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC703E	Machine Learning	Credits: 03
L:T:P –3-0-0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction: What is Machine Learning? Python: Introduction, Data Types, Conditional statements, loops, functions, scikit-learn. Essential Libraries and Tools: Jupyter Notebook, Numpy, Pandas, Scipy, matplotlib, A First Application: Classifying Iris Species.	
UNIT–II	**10 Hrs.**
Supervised Learning: Classification and Regression, Generalization, Overfitting, and Underfitting, Supervised Machine Learning Algorithms: Some Sample Datasets, k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Neural Networks (Deep Learning).	
UNIT–III	**10 Hrs.**
Unsupervised Learning and Preprocessing: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Preprocessing and Scaling, Dimensionality Reduction, Feature Extraction, and Manifold Learning, Clustering: k-Means Clustering, Agglomerative Clustering	
UNIT–IV	**10 Hrs.**
DimModel Evaluation and Improvement: Cross-Validation, Evaluation Metrics and Scoring. Working with Text Data: Types of Data Represented as Strings, Example Application: Sentiment Analysis of Movie Reviews, Representing Text Data as a Bag of Words: Applying Bag-of-Words to a Toy Dataset, Bag-of-Words for Movie Reviews, Stopwords.	

Reference Books *

Textbooks:

1. Andreas C. Müller & Sarah Guido, "Introduction to Machine Learning with Python", Oreilly Publication, 1st Edition, 2016
2. Core Python Programming by Dr. R.NageswawaRao, Dreamtech press, 2nd Edition 2018.
3. Gourishankar S. Veena A, "Introduction to Python Programming", CSC Press, 1st edition,2019

Reference Books:

1. Tom Mitchell," Machine Learning", McGraw- Hill, 2nd Edition, 2013.
2. EthemAlpaydin," Introduction to Machine Learning", MIT press, Cambridge, Massachusetts, London, 2nd
3. Edition, 2010
4. MiroslavKubat," An Introduction to Machine Learning", Springer, 2nd Edition, 2017

5. Christopher Bishop, “Pattern Recognition and Machine Learning”,Springer,2006
6. Kevin Murphy, “Machine Learning -aProbabilisticPerspective”,MITPress,2012.
7. Joachims, “Learning to Classify Text using Support Vector Machine s”,Kluwer,2002
8. Ian Good fellow and YoshuaBengio and Aaron Courville,“DeepLearning”,AnMIT Press book.

E-Resources:

1. Introduction to Machine Learning(IIT Madras)
2. https://nptel.ac.in/courses/106106139/
   Introduction to Machine Learning(IIT Kharagpur)https://nptel.ac.in/courses/106105152/

Course Outcomes**

After completion of the course student will be able to

1. **Explain Various Machine Learning Algorithms.**
2. **Apply machine learning algorithm to solve problems of moderate complexity.**
3. **Analyze performance of algorithms by varying some parameters**
4. **To Formulate Machine Learning Model For The Simple Problem**

***Books to be listed as per the format with decreasing level of coverage of syllabus**
****** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	2	2									1		1
CO2	1	3	3	2	3								2		2
CO3	1	3	3	3	3								3		3
CO4	1	3	3	3	3								3		3

SUBJECT CODE: 21UEC704E	**Micro Electro Mechanical Systems**	**Credits: 03**
L:T:P – 3-0-0		**CIE Marks: 50**
Total Hours/Week: 03		**SEE Marks: 50**

UNIT-I	**10 Hrs.**
Introduction to MEMS Technology: Basic definitions, history and evolution of MEMS. Feynman's vision, microelectronics and MEMS, microsensors, microactuators and microsystems, Types of MEMS, Applications of MEMS in various disciplines. Commercial MEMS products. Multiphysics-Multiengineering aspects of MEMS: Introduction to design, modeling and simulation, optimization, fabrication, reliability and packaging of MEMS. Scaling issues in microsystems, examples and numerical problems based on scaling laws.	
UNIT–II	**10 Hrs.**
Design and Working Principles of MEMS: Transduction principles in microdomain- Biomedical sensor & biosensor and DNA sensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces.Mechanical sensors and actuators – beams and cantilevers, accelerometers. Electrostatic sensors and actuators – parallel plate capacitors, comb drive sensor and actuator. Optical MEMS – DLP mirror; construction and working.	
UNIT–III	**10 Hrs.**
Modeling and Simulation of MEMS: Basic modeling elements in mechanical systems, electrical systems, microfluidic systems, thermal systems, magnetic domain and electrostatic systems. Measurement tools in microsystems: AFM, SEM and optical inferometry. Characterization methods. Simulation of MEMS: Need for simulation, FEM, MEMS design and realization tools – ANSYS/Multiphysics, CoventorWare, COMSOL. AFM as a measurement tool in microsystems. Case Studies: Microcantilever based sensor, electrothermal actuator, electrostatic actuator.	
UNIT–IV	**10 Hrs.**
Microfabrication/Micromachining: Overview of micro fabrication, silicon wafer extraction and cleaning, structural and sacrificial materials in microfabrication, lithography, deposition, doping, etching, Introduction to MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.	
Reference Books *	

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan, K. N. Bhat, V. K. Atre, "Micro and smart systems", Wiley, India, 2010.
2. N. P. Mahalik, "M EMS", Tata McGraw-Hill, 2007.
3. Tai, Ran Hsu,"MEMS and microsystems: design and manufacture", TMH, 2002.
4. James J. Allen, "Micro Electro Mechanical System design", CRC Press, Taylor & Francis Group, 2005.
5. Chang Liu, "Foundations of MEMS", Pearson education international, 2007.

Stephen D. Senturia, “Microsystem design”, Springer International edition, 2001.

Course Outcomes**

After completion of the course student will be able to

1. **Comprehend the fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.**
2. **Design and understand the working principle of various microsensing and actuating devices.**
3. **Mathematically model and simulate the various types of micro-systems**
4. **Comprehend the various steps involved in microfabrication and micromachining of micro devices, structures and systems.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	1	0	0	1	0	0	0	2	0	3	3	0
CO2	3	3	3	3	0	0	2	0	0	0	3	0	3	3	0
CO3	3	2	2	2	3	0	0	0	0	0	3	0	3	3	1
CO4	3	2	2	3	0	0	0	0	0	0	3	0	3	3	0

SUBJECT CODE: 21UEC718E	VLSI Testing	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 40hrs		SEE Marks: 50

UNIT-I	10 Hrs.

Fault Modelling: Importance of Testing, Testing during the VLSI Lifecycle, Challenges in the VLSI Testing: Test Generation, Fault Models, Levels of Abstraction in VLSI Testing, Historical Review of VLSI Test Technology, Fault and Defect modeling: Functional Faults, Structural Faults, Structural Gate Level Faults: Recognizing Faults, Stuck-Open Faults, Stuck-at-0 Faults, Stuck at-1 Faults, Fault Collapsing.

Fault Simulation and Test Generation: Fault Simulation: Serial, Parallel, Deductive, Concurrent, Combinational Test Generations, ATPG for Combinational Circuits, D-Algorithm, Testability Analysis, SCOAP measures for Combinational Circuits

UNIT–II	10 Hrs.

Design for Testability: Introduction. Testability Analysis, Design for Testability Basics: Ad Hoc Approach, Structured Approach, Scan Cell Designs, Scan Design Rules, Scan Architectures, Scan Design Flow, Special Purpose Scan Designs, RTL Design for Testability.

UNIT–III	10 Hrs.

Built-in Self-Test: BIST Design Rules, Test Pattern Generation, Exhaustive Testing, Pseudo-Random Testing, Pseudo-Exhaustive Testing, Delay Fault Testing, Output Response Analysis, Logic BIST Architectures, BIST Architectures for Circuits with and without Scan Chains.

Boundary scan and Core based Testing : Digital Boundary Scan (IEEE Std. 1149.1): Test Architecture and Operations, On-Chip Test Support with Boundary Scan, Board and System-Level Boundary-Scan Control Architectures.

UNIT–IV	10 Hrs.

Test Compression and Compaction: Test Stimulus Compression: Code-Based Schemes, Linear-Decompression-Based Schemes, Test **Response** Compaction.
Fault Diagnosis: Dictionary based and Adaptive fault diagnosis.

Reference Books *

Textbooks:

1. Z. Navabi, “Digital System Test and Testable Design”, Springer, 2011.
2. Laung-Terng Wang, Cheng-Wen Wu, and Xiaoqing Wen, “VLSI Test Principles and Architectures”, The Morgan Kaufmann, 2013

Course Outcomes**

After completion of the course student will be able to

1. Model different fault models. Simulate faults and generate test patterns for combinational circuits.
2. Analysis and design for testability.
3. Recognize the BIST techniques for improving testability and understand boundary scanbased test architectures.
4. Analyse and apply the test vector compression techniques for memory reduction and fault Diagnosis.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1		3								**3**		
CO2	1	1	1		3								**3**		
CO3	1	1	1		3								**3**		
CO4	1	1	1		3								**3**		

SUBJECT CODE: 21UEC706E	**Advanced Tools for VLSI Design**	**Credits: 03**
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 40hrs		SEE Marks: 50

UNIT-I	**10 Hrs.**
Data Structures and Basic Algorithms: Basic Terminology, Complexity Issues and NP-hardness Basic Algorithms, Basic Data Structures, Graph Algorithms for Physical design	
UNIT–II	**10 Hrs.**
Partitioning: Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms, Simulated Annealing and Evolution, Other Partitioning Algorithms **Floor planning and Pin Assignment:** Floor planning, Chip planning, Pin Assignment, Integrated Approach	
UNIT–III	**10 Hrs.**
Placement: Problem Formulation, Classification of Placement Algorithms, Simulation Based Placement Algorithms, Partitioning Based Placement Algorithms, Other Placement Algorithms, Performance Driven Placement, Recent Trends. **Global Routing:** Problem Formulation, Classification of Global Routing Algorithms, Maze Routing Algorithms, Line-Probe Algorithms, Shortest Path Based Algorithms	
UNIT–IV	**10 Hrs.**
Global Routing(Continued..): Steiner Tree based Algorithms, Integer Programming Based Approach, Three-Layer Channel Routing Algorithms **Clock and Power Routing:** Clock Routing, Power and Ground Routing	
Reference Books *	

Textbooks:

1. Naveed A. Sherwani, “Algorithms For VlsiPhysical Design Automation”, Kluwer Academic Publishers
2. Andrew B. Kahng, Jens Lienig, Igor L. Markov, JinHu, “VLSI Physical Design: From Graph Partitioning to Timing Closure”, Springer, 2011.
3. H. Yosuff and S.M. Sait, “VLSI Physical Design Automation – Theory and Practice”, Cambridge India, 2010.
4. Sung Kyu Lim, “Practical Problems in VLSI Physical Design Automation”, Springer India, 2011.

Reference Books:

1. S. Sridhar, “Design and Analysis of Algorithms”, Paperback – OUP, 2014.
2. John Okyere Attia, “PSPICE and MATLAB for Electronics: An Integrated Approach”, CRC Press, 2010.
3. Ganesh M. Magar, Swati R. Maurya Rajesh K. Maurya, “Graph Theory & Applications”, Technical Publications, 2016.

Brian Christian and Tom Griffiths, “Algorithms to Live By: The Computer Science of Human Decisions”, William Collins, 2017.

Course Outcomes**

After completion of the course student will be able to

1. Formulate the graphs for the given problems, Calculate and analyse the computational complexity of physical design algorithms Partition a given design.
2. Express and change the floorplans in an abstract manner and use computer algorithms to make large and optimized floorplans
3. Make optimized placements on the silicon chip and perform complex routing using algorithms and computer codes.
4. Design clock trees to distribute the clock signals on the chip while satisfying various constraints like clock skew and wire length.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1		3								**3**		
CO2	1	1	1		3								**3**		
CO3	1	1	1		3								**3**		
CO4	1	1	1		3								**3**		

SUBJECT CODE: 21UEC702E	Multimedia Communication	Credits: 03
L:T:P –3-0-0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction to Multimedia: Introduction, Multimedia and hypermedia, World Wide Web, overview of multimedia software tools, Graphics and Image Data Representations: Graphics image data types, popular file formats, color in image and video: color science, color models in images, color models in video.	
UNIT–II	**10 Hrs.**
Fundamental Concepts in Video and Digital Audio: Types of video signals, analog video, digital video, digitization of sound, quantization and transmission of audio. Basics of Digital Audio: Digitization of sound, Musical Instrument Digital Interface, quantization and transmission of audio.	
UNIT–III	**10 Hrs.**
Lossless compression algorithm: Run-Length coding, variable length coding, dictionary based coding, arithmetic coding, lossless image compression, Lossy compression algorithm: Quantization, transform coding, Wavelet-based coding, embedded zero tree of Wavelet coefficients Set Partitioning in Hierarchical Trees(SPIHT). Basic Video Compression Techniques: Introduction Video Compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.	
UNIT–IV	**10 Hrs.**
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of multimedia data transmission, multimedia over IP, multimedia over ATM networks, transport ofMPEG-4, Media-on Demand (MOD).	

Reference Books *

Textbook:

1. Ze-NianLi,MarkS.Drew,''Fundamentals of Multimedia'',PHI/PEA.

Reference Books:

1. Parag Havaldar, Gerard Medioni,''Multimedia Systems'',Cengage,2009.
2. ColinMoock, SPDO,''Essentials Action Script3.0'',Reilly,2007.
3. Steinmetz, Nahrstedt, ''Multimedia Applications'',Springer.
4. Chapman, JennyChapmanNigel,''DigitalMultimedia'',Wiley Dreamtech.

5. SteveHeath,''Multimedia &CommunicationsTechnology'',Elsevier.

Course Outcomes**

After completion of the course student will be able to

1. Explain the concepts multimedia information representation and use the different markup language for its communication.
2. Explain the needs of video and audio signal processing multimedia communication.
3. Apply The different information coding techniques image and video compression techniques
4. Explain The Various Standard Protocols used for multimedia communication.

***Books to be listed as per the format with decreasing level of coverage of syllabus**
****** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	0	1	0	0	1	0	1	0	0	1	1		1		1
CO2	0	1	0	1	1	0	0	0	1	1	1		1		1
CO3	1	1	0	0	1	0	0	0	0	1	1	1	1	1	1
CO4	1	1	0	0	1	0	1	0	0	1	1		1		1

SUBJECT CODE: 21UEC717E	Multirate Signal Processing	Credits: 03
L:T:P:–3:0:0		CIE Marks: 50
Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs
Fundamentals of multirate systems: Basic multirate operations, interconnection of building blocks, polyphase representation, multistage implementation, applications of multirate systems, special filters and filter banks, noble identities and their proof.	
UNIT–II	**10 Hrs**
Multirate filter banks: Maximally decimated filter banks, Errors created in QMF bank, alias free QMF system, power symmetric QMF banks, M channel filter banks, poly-phase representation, perfect reconstruction systems, alias free filter banks, tree structured filter banks, trans-multiplexers.	
UNIT–III	**10 Hrs**
Para-unitary perfect reconstruction filter banks: Lossless transfer matrices, filter bank properties induced by para-unitariness, two channel paraunitary lattices, M-channel FIR Para-unitary QMF banks, transform coding.	
UNIT–IV	**10 Hrs**
Linear phase perfect reconstruction QMF banks: Necessary conditions, lattice structures for linear phase FIR –PR, QMF banks, formal synthesis of linear phase FIR –PR ,QMF lattice. Cosine modulated filter banks: Pseudo QMF bank and its design.	

Reference Books

1. P. P. Vaidyanathan, ‒ Multirate systems and filter banks||, Pearson Education(Asia) Pvt, Ltd, 2004.
2. Gilbert Strang and Truong Ngujen, ‒ Wavelets and filter banks||, Wellesley Cambridge Press, 1996.
3. N.J.Fliege, ‒Multirate Digital Signal Processing||, John Wiley & sons, USA, 2000.

Course Outcomes**

After completion of the course student will be able to

1. Sample a signal at different rate and do transform domain analysis.
2. Design maximally decimated, QMF, polyphase, perfect reconstruction and tree structured filter banks.
3. Design Para-unitary perfect reconstruction, M-channel FIR para-unitary QMF filter banks.
4. Design linear phase perfect reconstruction, QM, cosine modulated and pseudo QMF filter banks.

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	2	1	1	1	2	1	-	1	3	1	-
CO2	3	3	3	2	1	1	1	1	2	1	-	1	3	1	-
CO3	3	3	3	2	1	1	1	1	2	1	-	1	3	1	-
CO4	3	2	3	3	2	1	1	1	2	1	-	1	3	1	-

SUBJECT CODE: 21UEC710E	Wavelets	Credits: 03
L:T:P:–3:0:0		CIE Marks: 50
Hours/Week: 03		SEE Marks: 50

UNIT- I	10 Hrs

Fundamentals of Linear Algebra: Vector spaces, Bases, Orthogonality, Orthonormality, Projection, Functions and function spaces, Orthogonal functions, Orthonormal functions, Orthogonal basis functions.

Short Time Fourier Transform (STFT): Limitations of Fourier domain signal processing, Signal representation with continuous and discrete STFT, concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, Why wavelet transform?

Self Study Component: Comparison between STFT and wavelet transform.

UNIT– II	10 Hrs

Introduction to Wavelet Transform: The origins of wavelets, Wavelets and other wavelet like transforms, History of wavelet from Morlet to Daubechies via Mallat, Different communities and family of wavelets, Different families of wavelets within wavelet communities.

Continuous Wavelet Transform: Wavelet transform-A first level introduction, Continuous time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Continuous versus discrete wavelet transform

Self Study Component: Wavelet packet decomposition**.**

UNIT– III	10 Hrs

Discrete Wavelet Transform: Haar scaling functions and function spaces, Translation and scaling of $\phi(t)$, Orthogonality of translates of $\phi(t)$, Function space V0 , Finer Haar scaling functions, Concepts of nested vector spaces, Haar wavelet function, Scaled and translated Haar wavelet functions, Orthogonality of $\phi(t)$ and $\psi(t)$, Normalization of Haar bases at different scales, Refinement relation with respect to normalized bases, Support of a wavelet system, Daubechies wavelets, Plotting the Daubechies wavelets.

Self Study Component: Image compression using wavelets.

UNIT– IV	10 Hrs

Designing Orthogonal Wavelet Systems-A Direct Approach: Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Condition-1: Unit area under scaling function, Condition-2: Orthonormality of translates of scaling functions, Condition-3: Orthonormality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system coefficients,

Constraints for Daubechies' 6 tap scaling function.
Self Study Component: Multi-resolution Analysis (MRA) using wavelets.

Reference Books *

1. K. P. Soman, K. I. Rmachandran, N. G. Resmi, "Insight into Wavelets: From Theory to Practice" (Third Edition), PHI Learning Pvt. Ltd., 2010.
2. A.N. Akansu and R.A. Haddad, "Multiresolution signal Decomposition: Transforms, Subbands and Wavelets", Academic Press, Oranld, Florida, 1992.
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Prentice Hall, 2007.
4. Rafael C. Gonzalez, Richard E. Woods "Digital Image Processing" (Third Edition), Pearson International Edition, 2009.
5. C. S. Burrus, Ramose and A. Gopinath, "Introduction to Wavelets and Wavelet Transform", Prentice Hall Inc.

Web links and Video Lectures (e-Resources):

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.html

Course Outcomes**

After completion of the course student will be able to

1. Compute STFT and time-frequency resolution.
2. Decompose a signal into different bands using different wavelets.
3. Plot different wavelets and do analysis.
4. Design Daubechies orthogonal wavelet system coefficients.

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	2	1	1	1	2	1	-	1	3	1	-
CO2	3	3	3	2	1	1	1	1	2	1	-	1	3	1	-
CO3	3	3	3	2	1	1	1	1	2	1	-	1	3	1	-
CO4	3	2	3	3	2	1	1	1	2	1	-	1	3	1	-

SUBJECT CODE: 21UEC712E	Operating Systems	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 40hrs		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction: What Operating System Do, User View, System View, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.

System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure.

Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.

Multithreaded Programming: Overview, Multicore Programming, Multithreading Models.

UNIT–II	10 Hrs.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling.

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT–III	10 Hrs.

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual-Memory Management: Background, Demand Paging, Page Replacement, Allocation of Frames.

File system: File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing.

UNIT–IV	10 Hrs.

Implementing File-Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Mass-Storage Structure: Overview ofMass-Storage Structure. Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management.

System Protection and Security: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, The Security Problem, Program Threats.

Reference Books *

Textbook:

1. Abraham Silberschatz , Peter B. Galvin, Greg Gagne," **Operating System Concepts**", 9 th edition, Wiley India, 2016 .

Reference Books:

1. Dhananjay M. Dhamdhere," **Operating Systems-A Concept Based Approach**", 3rd edition, Tata McGraw-Hill, 2012.
2. P.C.P.Bhatt," **Operating Systems**",2nd edition, PHI,2007.
3. William Stallings," **Operating Systems: Internals and Design Principles**",6th edition, Pearson, 2009.

Course Outcomes**

After completion of the course student will be able to

1. Describe the operating system structure, operations, services, design, thread and various features of process including scheduling, creation, termination, communication and explore inter process communication .
2. Discuss various CPU scheduling algorithms , several tools used to solve process synchronisation problems and also number of different methods for preventing or avoiding deadlocks.
3. Explore various memory management techniques and aspects related to file system.
4. Describe file system implementation, mass storage structure and protection

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	3	2							3		
CO2	3	2	3	-	3	1							3		
CO3	3	2	3	-	3	-							3		
CO4	2	1	1	-	3	1							3		

SUBJECT CODE: 21UEC715E	IC Technology	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 40hrs		SEE Marks: 50

UNIT-I	10 Hrs.

Crystal Growth and Silicon Wafer Preparation: Introduction, Semiconductor Silicon Preparation, Silicon Wafer Preparation Stages, Crystalline Materials, Unit Cells, Poly and Single Crystals, Crystal Orientation, Crystal Growth, Czochralski Method, Liquid-Encapsulated Czochralski, Float Zone, Crystal and Wafer Quality, Point Defects, Dislocations, Growth Defects, Wafer Preparation, End Cropping, Diameter Grinding, Crystal Orientation, Conductivity, and Resistivity Check, Grinding Orientation Indicators, Wafer Slicing, Wafer Marking, Rough Polish, Chemical Mechanical Polishing, Backside Processing, Double-Sided Polishing ,Edge Grinding and Polishing, Wafer Evaluation, Oxidation, Packaging, Wafer Types and Uses.

Overview of Wafer Fabrication and Packaging: Introduction, Goal of Wafer Fabrication, Wafer Terminology, Chip Terminology, Basic Wafer-Fabrication Operations, Layering, Patterning, Circuit Design, Reticle and Masks, Doping, Heat Treatments, Example Fabrication Process, Wafer Sort, Packaging.

Contamination Control: Introduction, The Problem Contamination-Caused Problems, Contamination Sources, General Sources Air Clean Air Strategies Cleanroom Workstation Strategy Tunnel or Bay Concept Micro-and Mini-Environments Temperature, Humidity, and Smog. Cleanroom Construction, Construction Materials Cleanroom Elements Personnel-Generated Contamination Process Water Process Chemicals Equipment. Cleanroom Materials and Supplies, Cleanroom Maintenance, Wafer Surface Cleaning, Particulate Removal Wafer Scrubbers High-Pressure Water Cleaning Organic Residues Inorganic Residues Chemical-Cleaning Solutions General Chemical Cleaning Oxide Layer Removal Room Temperature and Ozonated Chemistries Water Rinsing Drying Techniques Contamination Detection.

UNIT–II	10 Hrs.

Oxidation: Introduction, Silicon Dioxide Layer Uses, Surface Passivation DopingBarrier Surface Dielectric Device Dielectric (MOS Gates) Device Oxide Thicknesses, Thermal Oxidation Mechanisms, Influences on the Oxidation Rate Thermal Oxidation Methods Horizontal Tube Furnaces Temperature Control System Source Cabinet Vertical Tube Furnaces Rapid Thermal Processing High-Pressure Oxidation Oxidant Sources, Oxidation Processes, Preoxidation Wafer Cleaning, Postoxidation Evaluation, Surface Inspection Oxide Thickness Oxide and Furnace Cleanliness Thermal Nitridation.

The Ten-Step Patterning Process-Surface Preparation to Exposure: Introduction, Overview of the Photomasking Process, Ten-Step Process, Basic Photoresist Chemistry, Photoresist, Photoresist Performance Factors, Resolution Capability Adhesion Capability Process,Latitude Pinholes Particle and Contamination Levels Step Coverage Thermal Flow Comparisonof Positive and Negative Resists. Physical Properties of Photoresists, Solids Content Viscosity Surface Tension Index of Refraction Storage and Control of Photoresists Light and Heat Sensitivity Viscosity Sensitivity Shelf Life Cleanliness. Photomasking Processes Surface Preparation to Exposure, Surface Preparation, Particle Removal Dehydration Baking Wafer Priming Spin Priming Vapor Priming, Photoresist Application (Spinning).The Static Dispense Spin Process Dynamic Dispense Moving-Arm Dispensing Manual Spinners Automatic Spinners Edge Bead Removal Backside Coating.

UNIT–III	10 Hrs.

Soft Bake, Convection Ovens Manual Hot Plates In-Line, Single-Wafer Hot Plates Moving-BeltHot Plates Moving-Belt Infrared Ovens Microwave Baking Vacuum Baking, Alignment and Exposure, Alignment and Exposure Systems Exposure Sources Alignment Criteria Aligner Types Post exposure Bake, Advanced Lithography.

The Ten-Step Patterning Process-Developing to Final Inspection: Introduction, Development Positive Resist Development Negative Resist Development Wet Development Processes Dry (or Plasma) Development , Hard Bake, Hard-Bake Methods Hard-Bake Process Develop Inspect Develop Inspect Reject Categories Develop Inspect Methods Causes for Rejecting at the Develop Inspection Stage. Etch, Wet Etching, Etch Goals and Issues Incomplete Etch Overetch and Undercutting Selectivity Wet-Spray Etching Silicon Wet Etching Silicon Dioxide Wet Etching Aluminum-Film Wet Etching Deposited-Oxide Wet Etching Silicon Nitride Wet Etching Vapor Etching. Dry Etch, Plasma Etching Etch Rate Radiation Damage Selectivity Ion-Beam Etching Reactive Ion Etching. Resist Effects in Dry Etching, Resist Stripping, Wet Chemical Stripping of Nonmetallized Surfaces Wet Chemical Stripping of Metalized Surfaces Dry Stripping Post–Ion Implant and Plasma Etch Stripping, New Stripping Challenges Final Inspection Mask Making

Doping: Introduction, The Diffusion Concept, Formation of a Doped Region and Junction, The N-P Junction Doping Process Goals Graphical Representation of Junctions Concentration versus Depth Graphs Lateral Diffusion, Same-Type Doping Diffusion, Process Steps Deposition, Lateral Diffusion Same-Type Doping

UNIT–IV	10 Hrs.

Dopant Sources Drive-In Oxidation, Oxidation Effects Introduction to Ion Implantation Concept of Ion Implantation. Ion-Implantation System, Implant Species Sources. Ionization Chamber Mass Analyzing or Ion Selection Acceleration Tube Wafer Charging Beam Focus Neutral Beam Trap Beam Scanning EndStation and Target Chamber Ion-Implant Masks Dopant Concentration in Implanted Regions Crystal Damage Annealing and Dopant Activation Channeling Evaluation of Implanted Layers Uses of Ion Implantation. The Future of Doping.

Layer Deposition: Introduction, Film Parameters, Chemical Vapor Deposition Basics, Basic CVD System Components CVD Process Steps CVD System Types, Atmospheric-Pressure CVD Systems Horizontal-Tube Induction-Heated APCVD Barrel Radiant-Induction-Heated APCVD Pancake Induction-Heated APCVD Continuous Conduction-Heated APCVD Horizontal Conduction-Heated APCVD Low-Pressure Chemical Vapor Deposition Horizontal Conduction-Convection-Heated LPCVD Ultra-High Vacuum CVD Plasma-Enhanced CVD (PECVD) High-Density Plasma CVD Atomic Layer Deposition Vapor-Phase Epitaxy Molecular Beam Epitaxy Metalorganic CVD Deposited Films Deposited Semiconductors Epitaxial Silicon Polysilicon and Amorphous Silicon Deposition SOS and SOI Gallium Arsenide on Silicon Insulators and Dielectrics Silicon Dioxide Doped Silicon Dioxide Silicon Nitride High-k and Low-k Dielectrics Conductors

Metallization: Introduction, Deposition Methods Single-Layer Metal Systems Multilevel Metal Schemes Conductors Materials Aluminum Aluminum-Silicon Alloys Aluminum-Copper Alloy Barrier Metals Refractory Metals and Refractory Metal Silicides Plugs Sputter Deposition Copper Dual-Damascene Process Low-k Dielectric Materials The Dual-Damascene Copper Process Barrier or Liner Deposition Seed Deposition Electrochemical Plating Chemical-Mechanical Processing CVD Metal Deposition Doped Polysilicon CVD Refractory Deposition Metal-Film Uses MOS Gate and Capacitor Electrodes Backside Metallization Vacuum Systems Dry Mechanical Pumps Turbomolecular Hi-Vac Pumps.

Reference Books *

Text Books

1. Peter Van Zant, Microchip Fabrication, A Practical Guide to Semiconductor Processing, Sixth Edition, McGraw Hill

Reference Books

1. S.K.Gandhi, VLSI Fabrication principles, Wiley.
2. S.M. Sze, VLSI Technology, II edition, McGraw Hill.
3. W.R. Runyan, Silicon Semiconductor Technology, McGraw Hill

Course Outcomes**

After completion of the course student will be able to

1. Understand the basic steps of fabrication, wafer preparation, Crystal growth and packaging.
2. Understands the effect of contaminations on device processing, device performance.
3. Understands the uses of formation and process of silicon dioxide growth, Photoresist, wet etching and dry etching
4. To learn different types oxidation such as Chemical vapor Deposition, and LPCVD of poly silicon. Oxidation, Kinetics of oxidation.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	1			

SUBJECT CODE: 21UEC705E	Satellite Communication	Credits: 03
L:T:P –3-0-0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Overview of Satellite Systems: Frequency Allocations for Satellite Services. INTELSAT 4, U.S.Domsats 9 ,Polar Orbiting Satellites 12,Argos System 18, Cospas-Sarsat.

Orbits and Launching Methods: Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, The subsatellite point, Predicting satellite position, Local Mean Solar Time and Sun-Synchronous Orbits, Problems. Launches and Launch Vehicles, Expendable Launch Vehicles (ELVs),Placing Satellites into Geostationary Orbit, Orbital Effects in Communications Systems Performance.

UNIT–II	10 Hrs.

The Geostationary Orbit: Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Problems.

RadioWavePropagation:AtmosphericLosses,IonosphericEffects,RainAttenuation,Other Propagation Impairments,

Polarization: Antenna Polarization, Polarization of Satellite Signals, Cross-Polarization Discrimination, Ionospheric Depolarization, Rain Depolarization, Ice Depolarization.

UNIT–III	10 Hrs.

The Space Segment: The Power Supply, Attitude Control, Spinning Satellite stabilization, Momentum Wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier Communications Subsystems: Description of the Communications System, Transponders, Satellite Antennas, Basic Antenna Types and Relationships, Example Global Beam Antenna Example Regional Coverage Antenna, Satellite Antennas in Practice, Equipment Reliability and Space

UNIT–IV	10 Hrs.

Low Earth Orbit and Non-Geostationary Satellite Systems: Orbit Considerations, Coverage Frequency & Considerations, Delay Throughput Considerations, System Considerations

Operational NGSO Considerations Designs,

Satellite Navigation and the Global Positioning System:Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS NavigationMessage,GPSSignalLevels,TimingAccuracy,GPSC/ACodeAccuracy, Differential GPS.

Reference Books *

Textbook:

1. DennisRoddy,"Satellite Communications",4th edition,McGraw-Hill International Edition, 2010.

ReferenceBooks:

1. TimothyPratt,CharlesBostianandJeremyAllnutt,"SatelliteCommunications",2nd edition, John Wiley & Sons, 2003.
2. WilburL.Pritchard,Hendri.Suyderhoud,RoberA.Nelson,"SatelliteCommunication System Engineering", Prentice Hall, Second edition 1993.

Course Outcomes**

After completion of the course student will be able to

1. **How to describe the motion of satellite in the orbit.**
2. **Describe the concepts of subsystems, link design, rain fading and link availability.**
3. **Explain modulation techniques and the performance of satellite communication systems**
4. **Analyze the design requirements and the performance of satellite communication systems.**

***Books to be listed as per the format with decreasing level of coverage of syllabus**

****** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO2	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO3	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC709C	Human Resource Management	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Course Objectives:
The objectives of this course are to:

1. **Examine** the fundamental principles of Human Resource Management and its evolving role in modern business environments, focusing on the functions of HRM and effective procurement strategies
2. **Evaluate** training and development methods, performance appraisal techniques, and career development strategies in human resource management, emphasizing their impact on organizational effectiveness.
3. **Analyze** variable compensation structures also examining the importance of industrial relations and collective bargaining processes in maintaining a harmonious work environment.
4. E**xamine** the complexities of International Human Resource Management (IHRM) and its impact on global business operations, focusing on international staffing, compensation strategies, and labor relations.

UNIT-I	10 Hrs.
Introduction: Nature of Human Resource Management (HRM), importance of human resource management, functions of human resource management, The changing environment of HRM and role of HRM in changing business scenario. **Procurement:** Job, job analysis, job description and job specifications, Man power Planning demand and supply forecasting, recruitment, methods of recruitment, Employees testing and selection, types of psychological tests and interviews, placement and induction.	
UNIT–II	**10 Hrs.**
Development: Operative training and management development, methods of training and development. **Performance Appraisal:** Traditional and modern Methods. **Career Development:** career anchors, career development programme and the modern career problems. **Compensation:** Factor affecting compensation policy, job evaluation, methods of job evaluation.	
UNIT–III	**10 Hrs.**
Variable Compensation: Individual & group, supplementary compensation-fringe benefits and current trends in compensation.**Integration:** Human relation, importance of industrial relations, causes and effects of Industrials disputes, Machinery for settlement of industrial disputes in India, Role of trade unions in maintaining relations. **Collective Bargaining:** concept, features, process and advantages. **Maintenance and separation:** Employee safety, health and welfare, Provisions under factory Act, 1948, Turnover, Retirement and Layoff.	
UNIT–IV	**10 Hrs.**

International HRM: The growth of international business, HR and the international business challenge, effect of inter country difference on HRM, international staffing, international compensation and appraisal, international labor relations and Information Technology and HR.

Reference Books *

Textbooks :

1. Flippo Edwin B, "Personnel Management", 6th Edition, McGraw Hills 2000.
2. Dresler Garry, "Human Resource Management", 8th Edition, Pearson Education, New Delhi 2002.

Reference Book:

1. Memoria C B, "Personnel Management (Management of HRM)", Himalaya Publication, New Delhi 1999.

Course Outcomes**

A student who successfully completes this course should be able to:

1. **Analyze** job roles and specifications, conduct manpower planning, and effective recruitment and selection methods, including various psychological tests and interviews
2. **Compare** traditional and modern performance appraisal methods, **design** effective training and development programs, and **assess** compensation policies and job evaluation methods
3. **Evaluate** compensation trends and fringe benefits, **assess** the role of trade unions in industrial relations, and effective collective bargaining strategies to address workplace issues
4. **Analyze** the influence of inter-country differences on HR practices and **design** effective international HR strategies that address staffing, compensation, and labor relations challenges

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o

CO1: **Analyze** job roles and specifications, conduct manpower planning, and effective recruitment and selection methods, including various psychological tests and interviews	0	0	0	0	0	3	3	3	3	3	3	3	0	0	0
CO2: **Compare** traditional and modern performance appraisal methods, **design** effective training and development programs, and **assess** compensation policies and job evaluation methods	0	0	0	0	0	3	3	3	3	3	3	3	0	0	0
CO3: **Evaluate** compensation trends and fringe benefits, **assess** the role of trade unions in industrial relations, and effective collective bargaining strategies to address workplace issues	0	0	0	0	0	3	3	3	3	3	3	3	0	0	0
CO4: **Analyze** the influence of inter-country differences on HR practices and **design** effective international HR strategies that address staffing, compensation, and labor relations challenges.	0	0	0	0	0	3	3	3	3	3	3	3	0	0	0