MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : EC

Programme Name : B.E.-Electronics and Communication Engineering

Regulation : R-2016

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(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

Ph. No.: 04287-220837

Email: principal@mec.edu.in.

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

INSTUTION VISION &MISSION

INSTUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards

INSTUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTUTIONMOTTO

Rural upliftment through Technical Education

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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To empower the electronics and communication engineering students on basics and advanced technologies in both theoretical and experimental practices with research attitude and ethics

DEPARTMENT MISSION

- To impart need based education in electronics and communication engineering to meet the requirements of academic, industry and society
- To establish the state-of-art laboratories to prepare the students for facing the challenges ahead
- To prepare the students for employment, higher education and research oriented activities

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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Electronics and Communication Engineering Graduates should be able to

PEO1: Pursue as an engineer with necessary conceptual, analytical and theoretical knowledge in the domain of electronics and communication engineering

PEO2: Acquire the practical knowledge through basics and advanced laboratories in the field of electronics and communication engineering

PEO3: Demonstrate the leadership skills through entrepreneurship, employment and higher studies and to practice ethical values for the benefit of society and environment

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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
3. **Design/Development 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.
4. **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.
5. **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.

6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering 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.
12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Design and analyze electronic circuits and systems for various applications

PSO2: Apply the acquired knowledge and analytical skills for modeling and simulation of advanced communication systems

PSO3: Ascertain the use of software and hardware tools for developing variety of electronics and communication systems

MUTHAYAMMAL ENGINEERING COLLEGE (AUTONOMOUS)

RASIPURAM-637408.

GROUPING OF COURSES

B.E. –ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation-2016

1. Humanities and Social Sciences (HS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			Credit
					L	T	P	
1.	16SHA01	Technical English	HS	5	3	2	0	4
2.	16SHA02	Communicative English	HS	7	3	0	4	5
3.	16SHA03	Business English	HS	5	3	2	0	4
4.	16SHA04	Basics of Japanese	HS	5	3	2	0	4
5.	16SHA05	Functional Japanese	HS	5	3	2	0	4
6.	16SHA06	Basics of German	HS	5	3	2	0	4
7.	16SHA07	Functional German	HS	5	3	2	0	4
8.	16SHA08	Principles of Management and Engineering Ethics	HS	3	3	0	0	3

2. Basic Sciences (BS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			Credit
					L	T	P	
1.	16SHB01	Matrices, Calculus& Ordinary Differential Equations	BS	5	3	2	0	4
2.	16SHB02	Complex Variables ,Laplace Transforms & Vector Calculus	BS	5	3	2	0	4
3.	16SHB03	Transforms & Partial Differential Equations	BS	5	3	2	0	4
4.	16SHB04	Probability & Random Processes	BS	5	3	2	0	4
5.	16SHB05	Probability and Queuing Theory	BS	5	3	2	0	4
6.	16SHB06	Numerical Methods	BS	5	3	2	0	4
7.	16SHB07	Statistics and Numerical Methods	BS	5	3	2	0	4
8.	16SHB08	Discrete Mathematics	BS	5	3	2	0	4
9.	16SHB09	Operations Research	BS	5	3	2	0	4

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10.	16SHB21	Engineering Physics	BS	6	2	0	4	4
11.	16SHB22	Material Science	BS	3	3	0	0	3
12.	16SHB23	Physics for Electrical Engineering	BS	3	3	0	0	3
13.	16SHB24	Physics for Mechanical Engineering	BS	3	3	0	0	3
14.	16SHB31	Engineering Chemistry	BS	6	2	0	4	4
15.	16SHB32	Environmental Science and Engineering	BS	3	3	0	0	3

3. Engineering Sciences (ES)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	
1.	16ECC01	Fundamentals of Computing and Programming	ES	6	2	0	4	4
2.	16ECC02	Advanced C Programming	ES	6	2	0	4	4
3.	16ECC03	Basics of Civil and Mechanical Engineering	ES	4	4	0	0	4
4.	16ECC04	Basics Electrical and Electronics Engineering	ES	3	3	0	0	3
5.	16ECC05	Engineering Graphics	ES	4	0	0	4	2
6.	16ECC06	Engineering Practices for Electrical Sciences	ES	4	0	0	4	2
7.	16ECC07	Electrical Drives and Control	ES	5	3	0	2	4
8.	16ECC08	Engineering Mechanics	ES	5	3	2	0	4
9.	16ECC09	Microprocessor and Microcontrollers	ES	5	3	0	2	4
10.	16ECC10	Object Oriented Programming	ES	6	2	0	4	4
11.	16ECC11	Data Structures	ES	6	2	0	4	4
12.	16ECC12	Electron Devices	ES	6	2	0	4	4
13.	16ECC13	Circuit Theory	ES	6	2	0	4	4
14.	16ECC14	Digital Principles and System Design	ES	6	2	0	4	4
15.	16ECC15	Fundamentals of Nano Technology	ES	3	3	0	0	3

4. Professional Core (PC)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1	16ECD01	Signals and Systems	PC	5	3	2	0	4

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2	16ECD02	Digital Electronics	PC	5	3	0	2	4
3	16ECD03	Electromagnetic Fields	PC	3	3	0	0	3
4	16ECD04	Analog Electronics - I	PC	5	3	0	2	4
5	16ECD05	Analog Electronics -II	PC	5	3	0	2	4
6	16ECD06	Linear Integrated Circuits	PC	5	3	0	2	4
7	16ECD07	Communication Theory	PC	3	3	0	0	3
8	16ECD08	Transmission Line and Waveguides	PC	5	3	2	0	4
9	16ECD09	Digital Signal Processing	PC	5	3	0	2	4
10	16ECD10	Digital Communication	PC	5	3	0	2	4
11	16ECD11	Computer Architecture and organization	PC	3	3	0	0	3
12	16ECD12	Embedded System	PC	5	3	0	2	4
13	16ECD13	Antennas and Wave Propagation	PC	3	3	0	0	3
14	16ECD14	VLSI Design	PC	5	3	0	2	4
15	16ECD15	Computer Networks	PC	3	3	0	2	4
16	16ECD16	Digital Image Processing	PC	3	3	0	0	3
17	16ECD17	RF and Microwave Engineering	PC	5	3	0	2	4
18	16ECD18	Optical Fiber Communication	PC	5	3	0	2	4
19	16ECD19	Electromagnetic Interference And Compatibility	PE	3	3	0	0	3
20	16ECD20	Cellular Mobile Communication	PC	3	3	0	0	3
21	16ECD21	Control Systems	PC	5	3	0	2	4

5. Professional Electives (PE)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16ECE01	Radar and Navigational Aids	PE	3	3	0	0	3
2.	16ECE02	High Speed Networks	PE	3	3	0	0	3
3.	16ECE03	Wireless Sensor Networks	PE	3	3	0	0	3
4.	16ECE04	Biomedical Engineering	PE	3	3	0	0	3
5.	16ECE05	Bio Signal and Image Processing	PE	3	3	0	0	3
6.	16ECE06	Telecommunication Switching Systems	PE	3	3	0	0	3

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7.	16ECE07	Cognitive Radio Networks	PE	3	3	0	0	3
8.	16ECE08	RF MEMS	PE	3	3	0	0	3
9.	16ECE09	Soft Computing	PE	3	3	0	0	3
10.	16ECE10	Nano Electronics	PE	3	3	0	0	3
11.	16ECE11	Wireless Communication	PE	3	3	0	0	3
12.	16ECE12	Satellite Communication	PE	3	3	0	0	3
13.	16ECE13	Television and Video Engineering	PE	3	3	0	0	3
14.	16ECE14	Optoelectronic Devices	PE	3	3	0	0	3
15.	16ECE15	Mobile Ad-Hoc Networks	PE	3	3	0	0	3
16.	16ECE16	Internet and JAVA Programming	PE	3	3	0	0	3
17.	16ECE17	Architecture and Programming	PE	3	3	0	0	3
18.	16ECE18	Pattern Recognition and AI Techniques	PE	3	3	0	0	3
19.	16ECE19	Biometrics	PE	3	3	0	0	3
20.	16ECE20	Embedded Solutions Engineering	PE	3	3	0	0	3

6. Employability Enhancement Courses (EEC)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16ECF01	Project Work Phase - I	EEC	6	0	0	6	3
2.	16ECF02	Project Work Phase -II	EEC	30	0	0	30	15
3.	16ECF03	Comprehension	EEC	4	0	0	4	2
4.	16ECF04	Design Project	EEC	4	0	0	4	2
5.	16ECF05	Technical Seminar	EEC	4	0	4	0	2

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Department	ECE
Programme	BE

SEMESTER – I

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16SHA02	Communicative English	3	0	4	5	7
2.	16SHB01	Matrices, Calculus& Ordinary Differential Equations	3	2	0	4	5
3.	16SHB21	Engineering Physics	2	0	4	4	6
4.	16SHB32	Environmental Science and Engineering	3	0	0	3	3
5.	16ECC01	Fundamentals of Computing and Programming	2	0	4	4	6
6.	16ECC13	Circuit Theory	2	0	4	4	6
7.	16ECC06	Engineering Practices for Electrical Sciences	0	0	4	2	4
TOTAL Credits						**26**	

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Department	ECE
Programme	B.E

SEMESTER –II

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16SHA01	Technical English	3	2	0	4	5
2.	16SHB02	Complex Variables ,Laplace Transforms & Vector Calculus	3	2	0	4	5
3.	16SHB22	Material Science	3	0	0	3	3
4.	16SHB31	Engineering Chemistry	2	0	4	4	6
5	16ECC02	Advanced C Programming	2	0	4	4	6
6	16ECC12	Electron Devices	2	0	4	4	6
7	16ECC05	Engineering Graphics	0	0	4	2	4
TOTAL Credits						**25**	

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Department	ECE
Programme	BE

SEMESTER – III

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16SHB03	Transforms & Partial Differential Equations	3	2	0	4	5
2.	16ECD01	Signals and Systems	3	2	0	4	5
3.	16ECC11	Data Structure	2	0	4	4	6
4.	16ECD02	Digital Electronics	3	0	2	4	5
5.	16ECD03	Electromagnetic Fields	3	0	0	3	3
6.	16ECD04	Analog Electronics – I	3	0	2	4	5
TOTAL Credits						**23**	

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Department	ECE
Programme	BE

SEMESTER - IV

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16SHB04	Probability &Random Processes	3	2	0	4	5
2.	16ECD05	Analog Electronics –II	3	0	2	4	5
3.	16ECC09	Microprocessor and Microcontrollers	3	0	2	4	5
4.	16ECD06	Linear Integrated Circuits	3	0	2	4	5
5.	16ECD07	Communication Theory	3	0	0	3	3
6.	16ECD21	Control Systems	3	0	2	4	5
TOTAL Credits						**23**	

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Department	ECE
Programme	BE

SEMESTER - V

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16ECD08	Transmission Line and Waveguides	3	1	0	4	5
2.	16ECD09	Digital Signal Processing	3	0	2	4	5
3.	16ECD10	Digital Communication	3	0	2	4	5
4.	16ECD11	Computer Architecture and organization	3	0	0	3	3
5.	16SHA08	Principles of Management and Engineering Ethics	3	0	0	3	3
6.	16ECE16	Elective –I (Internet and JAVA programming)	3	0	0	3	3
7.	16ECE04	Elective –II (Biomedical Engineering)	3	0	0	3	3
TOTAL Credits						**24**	

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Department	ECE
Programme	BE

SEMESTER –VI

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16ECD12	Embedded Systems	3	0	2	4	5
2.	16ECD13	Antennas and Wave Propagation	3	0	0	3	3
3.	16ECD14	VLSI Design	3	0	2	4	5
4.	16ECD15	Computer Networks	3	0	2	4	5
5.	16ECE12	PE –III (Satellite Communication)	3	0	0	3	3
6.	16 ECE14	PE-IV (Opto Electronic Devices)	3	0	0	3	3
TOTAL Credits						**21**	

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Department	ECE
Programme	BE

SEMESTER – VII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16ECD17	RF and Microwave Engineering	3	0	2	4	5
2.	16ECD18	Optical Fiber Communication	3	0	2	4	5
3.	16ECE02	Elective V (High speed Networks)	3	0	0	3	3
4.	16ECE11	Elective VI (Wireless Communication)	3	0	0	3	3
5.	16CSE09	Open Elective I (Advanced Computer Architecture)	3	0	0	3	3
6.	16EED01	Open Elective II (Measurement and Instrumentation)	3	0	0	3	3
7.	16MEE023	Open Elective III (TOTAL Quality Management)	3	0	0	3	3
8.	16ECF01	Project Work-I	0	0	6	3	6
TOTAL Credits						**26**	

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Department	ECE
Programme	BE

SEMESTER – VIII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
3.		Project Work Phase -II	0	0	30	15	30
TOTAL Credits						**15**	

TOTAL Credits to be earned for the Award of Degree: 183

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16ECC12 **ELECTRON DEVICES** **L T P C**
2 0 4 4

COURSE OBJECTIVES

- To know about the basics of PN junction and semiconductor diodes
- To know about the basics and characteristics of BJT.
- To know about the basics and characteristics of FET.
- To know about the biasing of BJT and FET.
- Be familiar with the theory, construction, and operation of Display Devices and Special diodes.

COURSE OUTCOMES

16ECC12.CO1 Explain the construction and operation of semiconductor diodes
16ECC12.CO2 Analyze the characteristics of BJT
16ECC12.CO3 Analyze the characteristics of FET
16ECC12.CO4 Explain the biasing techniques of BJT and FET
16ECC12.CO5 Explain the construction and principle of special purpose diodes

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD01.CO1	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO2	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO3	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO4	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO5	x	x	x	x	x	x			x		x	x	x	x	X

UNIT I **PN JUNCTION AND SEMICONDUCTOR DIODES** 6

Energy band structure of conductors, semiconductors and Insulators-Classification of semiconductors-conductivity of semiconductors-Drift and diffusion currents-Continuity Equation-Energy band structure of PN junction diode-Diode current equation-Transition or space charge capacitance-Diffusion capacitance-Effect of temperature on PN junction diodes-Diode switching characteristics-PN diode and Zener diode applications.

UNIT II **BIPOLAR JUNCTION TRANSISTORS** 6

Transistor current components-Ebermoll's model of transistor-Transistor as an amplifier-CE, CB and CC configurations: Analysis of cut-off and saturation regions- Transistor switching times-maximum voltage rating.

UNIT III **FIELD EFFECT TRANSISTORS** 6

Operation and Characteristics of JFET,FET as a Voltage variable resistor, Metal oxide semiconductor field effect transistor(MOSFET)-Enhancement and Depletion mode MOSFET-Characteristics of n-MOS and p-MOS- CMOS characteristics-Inverted TFET-Operation and Characteristics.

UNIT IV **BIASING OF BJT AND FET** 6

DC operating point and Load line-Q point-Bias Stability, Transistor biasing methods: Fixed bias-Collector to base bias-Self biasing, Bias compensation methods, Thermistor and sensistor compensation techniques, thermal runaway,thermal stability, FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing enhancement and depletion MOSFET.

UNIT V **DISPLAY DEVICES AND SPECIAL DIODES** 6

Photo emissitivity and photo-conductivity-Construction and characteristics of LCD, LED, Photoconductive cell, photo voltaic cell, photo diode, solar cell, photo transistors, plasma display ,numeric displays, opto couplers and LASER diodes-Theory and Characteristics of Schottky diode, Tunnel diode and Varactor diode, SCR,TRIAC,LDR.

TOTAL: 30

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LIST OF EXPERIMENTS:

1. Characteristics of PN and Zener diode
2. Design of rectifiers
3. Characteristics of CE configuration
4. Characteristics of CB configuration
5. Characteristics of JFET
6. Design of BJT amplifier
7. Characteristics of LED and LDR
8. Characteristics of SCR

TOTAL: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jacob Millman, Christos Halkias & Satyabrata Jit, Millman's	Electronic Devices and Circuits	McGraw Hill	2008
2.	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson education	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Allen Mottershead	Electronic Devices and Circuits	Prentice Hall of India	2008
2.	Douglas.A.Pucknell, Kamran Eshraghian	Basic VLSI Design, Principles and Application	PHI	2009
3.	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Electronic Devices and Circuits	Tata McGraw Hill	2008
4.	Donald A. Neamen	Semiconductor Physics and Devices	McGraw Hill Educatioin	2017
5.	S. M. Sze	Semiconductor Devices: Physics and Technology	Wiley	2016

WEB URLs:

1. nptel.ac.in/courses/108105066/PDF/L-2(DK)(PE)%20((EE)NPTEL).pdf
2. nptel.ac.in/courses/.../IIT%20Kharagpur/.../PDF/L-3(DK)(PE)%20((EE)NPTEL).pdf
3. textofvideo.nptel.iitm.ac.in/117106091/lec19.pdf
4. http://www.radio-electronics.com
5. http://textofvideo.nptel.iitm.ac.in/122106025/

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16ECC13 **CIRCUIT THEORY** L T P C

2 0 4 4

COURSE OBJECTIVES

- To introduce DC and AC electric circuits and its analysis.
- To impart knowledge on solving circuits using network theorems.
- To introduce the concept of resonance circuits and transient response.
- To introduce concept of Phasor diagrams
- To analysis of three phase circuits.

COURSE OUTCOMES

16ECC13.CO1 Explain circuits behavior using Ohms law and Kirchhoff's laws
16ECC13.CO2 Explain AC circuits using phasor techniques under steady state conditions
16ECC13.CO3 Utilize the concepts of network theorem to improve the stability of the system
16ECC13.CO4 Develop circuit representations quantitatively in Laplace domain
16ECC13.CO5 Elaborate the circuit concepts to Three Phase Circuits

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECC13.CO1	x	x	x	x	x	x			x		x		x	x	X
16ECC13.CO2	x	x	x	x	x	x			x				x		
16ECC13.CO3	x	x	x	x	x	x			x				x		
16ECC13.CO4	x	x	x	x	x	x			x				x		
16ECC13.CO5	x	x	x	x	x	x			x				x		

UNIT I DC CIRCUITS 6

Basic circuit elements - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division - Kirchhoff's laws - Source transformation - Star-Delta conversion - Mesh and nodal analysis.

UNIT II AC CIRCUITS 6

Introduction to AC circuits- Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - Series RL, RC and RLC circuits - Power - Power factor

UNIT III NETWORK THEOREMS FOR DC AND AC CIRCUITS 6

Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Compensation theorem-Millman's Theorem.

UNIT IV RESONANCE CIRCUITS AND TRANSIENT RESPONSE 6

Series and parallel resonance - Quality factor and bandwidth - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input.

UNIT V THREE PHASE CIRCUITS 6

Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits.

TOTAL: 30 Hrs

LIST OF EXPERIMENTS: **30**

1. Verification of Kirchhoff's voltage and current laws.
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem

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4. Verification of Norton 's theorem
5. Verification of Maximum Power Transfer Theorem.
6. Study of CRO and measurement of sinusoidal voltage and frequency.
7. Determination of time constant of series R-C electric circuits.
8. Determination of frequency response of series RLC circuits.
9. Determination of frequency response of parallel RLC circuits.
10. Calibration of single phase energy meter.
11. Determination of power in three phase circuits by two-watt meter method.

TOTAL: 60 Hrs

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William H. Hayt	Engineering Circuits Analysis	Tata McGraw Hill publishers	2003.
2.	Joseph A	Electric circuits	Tata McGraw-Hill	2001.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paranjothi SR	Electric Circuits Analysis	New Age International Ltd	1996.
2.	Sudhakar A and Shyam Mohan SP	Circuits and Network Analysis and Synthesis	Tata McGraw Hill	2007.
3.	Chakrabati A	Circuits Theory (Analysis and synthesis)	Dhanpath Rai & Sons	1999.
4.	Charles K.	Fundamentals of Electric Circuits	McGraw Hill	2003.

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5. http://nptel.ac.in/courses/108105053/18

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16ECD01 **SIGNALS AND SYSTEMS** **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To understand the basic properties of signal & systems and the various methods of classification.
- To learn Laplace Transform &Fourier transform and their properties.
- To Learn Continuous Time LTI System.
- To know Z transform & DTFT and their properties.
- To characterize LTI systems in the Time domain and various Transform domains.

COURSE OUTCOMES

16ECD01.CO1 Classify the given system is linear/causal/statics
16ECD01.CO2 Interpret to represent the CT signal in Fourier series and transformers
16ECD01.CO3 Analyze the capability of LTI system in time domain and frequency domain
16ECD01.CO4 Estimate frequency components present in a deterministic DT signal
16ECD01.CO5 Analyze the magnitude and phase response of LTI system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD01.CO1	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO2	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO3	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO4	x	x	x	x	x	x			x		x	x	x	x	X
16ECD01.CO5	x	x	x	x	x	x			x		x	x	x	x	X

UNIT I **SIGNALS AND SYSTEMS** **9**

Signals-Classification of signals- Continuous –time and Discrete time signals, Deterministic and random signal, even and odd signals, periodic and periodic signals, energy and power signals, Basic Continuous –time and Discrete time signals- Unit step, Unit impulse, Unit Ramp, Exponential, sinusoidal ,Exponentially damped sinusoidal signals, Pulse signals, Transformation of independent variables, Basic operations on signals-amplitude scaling ,addition, multiplication, differentiation and integration, Representation of signals in terms of impulses, Systems- Classification of systems - Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non causal, Stable & Unstable.

UNIT II **ANALYSIS OF CONTINUOUS TIME SIGNALS** **9**

The Laplace Transform : The region of convergence for Laplace Transforms, The Inverse Laplace Transform, Properties of the Laplace Transform, Fourier series analysis-spectrum of Continuous -Time (CT) signals, Continuous- time Fourier Transform : Representation of A periodic signal , The Fourier transform for periodic signals, Properties of the continuous- time Fourier transform, The convolution property, The multiplication property, Application of Fourier Transform, the relationship between Laplace transform and Fourier transform.

UNIT III **LINEAR TIME INVARIANT SYSTEMS** **9**

Continuous –time LTI systems: Block diagram representation-impulse response, Convolution integrals, Properties of Linear Time Invariant Systems, Casual LTI systems Described by differential equations, Fourier and Laplace transforms in Analysis of CT systems

UNIT IV **ANALYSIS OF DISCRETE TIME SIGNALS** **9**

DTFT– Properties of DTFT, Application of DTFT, Discrete Time Fourier series – Definition, properties ,Sampling theorem, Z Transform- The region of convergence for Z transform, The inverse Z transform, Properties of Z Transform, the unilateral Z transform , Geometric evaluation of the Fourier transform from the pole zero plot, The relationship between Z transform and DTFT.

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UNIT V LINEAR TIME INVARIANT- DISCRETE TIME SYSTEMS 9

Casual LTI system described by difference equation, solving differential equation using Z transform, Block diagram representation-Impulse response - Convolution sum, Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems

TOTAL: 45+30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Alan V. Oppenheim, Alan S. Willsky	Signals and Systems	Pearson Education	2015.
2.	P. Ramakrishna Rao	Signals and Systems	McGraw Hill	2013

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P Lathi	Signals and Systems	B S Publisher	2001
2.	Nagrath ,Sharan	Signals and Systems	McGraw Hill	2009
3.	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Signals and Systems	Tata McGraw Hill	2011
4.	D.GaneshRao,SathishTunga	Signals and Systems	Pearson	2011
5.	S.Haykin, B.Van Veen	Signals and Systems	John Willey &Sons,New York	1999

WEB URLs

1. www.youtube.com/watch?v=oJpUbfwvzKA
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3. www.youtube.com/watch?v=ghz_puTV168
4. www.youtube.com/watch?v=wG6VUnkrO90
5. www.youtube.com/watch?v=AkBaDKYmQQI

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16ECD02 **DIGITAL ELECTRONICS** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- To outline the formal procedures for the analysis and design of sequential circuits
- To illustrate the concept of synchronous and asynchronous sequential circuits
- To introduce the concept of Different Logic Families and programmable logic devices.

COURSE OUTCOMES

16ECD02.CO1 Demonstrate method for simplification of Boolean expressions
16ECD02.CO2 Design combinational logic circuits
16ECD02.CO3 Design Sequential logic circuits
16ECD02.CO4 Analyze state machines for the given specifications
16ECD02.CO5 Design logic families and Implement digital circuit in programmable logic devices

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD02.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD02.CO2	x	x	x	x	x	x			x		x	x	x		
16ECD02.CO3	x	x	x	x	x	x			x		x	x	x		
16ECD02.CO4	x	x	x	x	x	x			x		x	x	x		
16ECD02.CO5	x	x	x	x	x	x			x		x	x	x		

UNIT I BASIC CONCEPTS OF DIGITAL SYSTEMS 9

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method.

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder - Code converters.

UNIT III SEQUENTIAL CIRCUITS 9

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter – Johnson Counters- Serial adder / Subtractor.

UNIT IV SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Hazards and Races, Hazard free combinational circuits

UNIT V LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – TTL & CMOS Logic and their characteristics – Tristate gates - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) ,Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA,PAL.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS:

1. Design and implementation of Combinational logic functions
2. Design and implementation of Adders and Subtractors
3. Design and implementation of Code Converters
4. Design and implementation of Parity Generator and Checker
5. Design and implementation of Magnitude Comparator
6. Design and implementation of Multiplexer and De-multiplexer
7. Design and implementation of Encoders and Decoders
8. Design and implementation of Asynchronous Counters
9. Design and implementation of Synchronous Counters
10. Design and implementation of Shift registers

TOTAL: 60 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	2013.
2.	Donald D.Givone,	Digital Principles and Design	Tata Mc-Graw Hill Publishing company limited, New Delhi	2002

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	2011
2.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	2003
3.	Leach D, Malvino A P &Saha	Digital Principles and Applications	Tata McGraw-Hill Publishing Company	,2014
4.	John F. Wakerly,	Digital Design Principles and Practices	Pearson Education	2007
5.	John.M Yarbrough	Digital Logic Applications and Design	Thomson – Vikas Publishing House	2002

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2. www.nptel.ac.in/video.php?subjectId=117105080
3. www.nptelvideos.in/2012/12/digital-systems-design.html
4. www.allabout circuits.com
5. www.electronicsforu.com

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I6ECD03 **ELECTROMAGNETIC FIELDS** L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of coordinate systems.
- To evaluate static electric fields.
- To evaluate static magnetic fields.
- To understand the relation between the fields under time varying situations.
- To understand the principles of propagation of electromagnetic waves.

COURSE OUTCOMES

I6ECD03.CO1	Translate one coordinate system in to another coordinate system
I6ECD03.CO2	Calculate static electric field intensity at any point
I6ECD03.CO3	Explain the concepts of Magnetostatics
I6ECD03.CO4	Apply Maxwell's equations for time varying conditions
I6ECD03.CO5	Interpret the waves propagation through different medium

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD03.CO1	x	x	x	x	x	x		x			x	x		x	x
16ECD03.CO2	x	x	x	x	x	x		x			x	x		x	x
16ECD03.CO3	x	x	x	x	x	x		x			x	x		x	x
16ECD03.CO4	x	x	x	x	x	x		x			x	x		x	x
16ECD03.CO5	x	x	x	x	x	x		x			x	x		x	x

UNIT I VECTOR ANALYSIS 9

Introduction to Co-ordinate System – Rectangular – Cylindrical and Spherical Coordinate System – Relation between Cartesian and cylindrical coordinate system, Cartesian and spherical coordinate system- Transformation of vectors from Cartesian to cylinder, Cartesian to sphere, sphere to cylinder and vice versa and problems– Definition of Curl, Divergence and Gradient – Definition of Divergence theorem and Stokes theorem

UNIT II STATIC ELECTRIC FIELDS 9

Coulomb's Law – Definition of Electric Field Intensity – Electric Field due to discrete charges – Electric field due to continuous charge distribution - Electric Field due to charges distributed uniformly on an infinite and finite line –Electric Scalar Potential – Relationship between potential and electric field –Electric Flux Density – Gauss Law – Proof of Gauss Law. Poisson's and Laplace's equation – Capacitance – Capacitance of parallel plate capacitor, Boundary conditions for electric fields.

UNIT-III STATIC MAGNETIC FIELD 9

Biot-Savart Law– Magnetic Field intensity due to infinite and finite wire carrying current– Ampere's circuital law. Magnetic flux density –Lorentz force equation – Force on a wire carrying a current placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic Vector Potential- Inductance of loops and solenoids - Magnetic boundary conditions.

UNIT-IV TIME VARYING ELECTRIC AND MAGNETIC FIELDS 9

Faraday's law – Transformer and Motional electromotive forces - Displacement current – Maxwell's equations in integral form and differential form –Maxwell's equation in phasor form - Poynting Vector and the flow of power – Poynting theorem.

UNIT-V ELECTROMAGNETIC WAVES 9

Uniform Plane Waves - Wave equations for conducting and non-conducting media - Wave equations in phasor form - Plane waves in good conductors, Plane waves in lossy dielectrics- Skin effect-Reflection of plane waves by a perfect conductor-Normal and oblique incidence-Reflection of plane waves by a perfect dielectric-normal and oblique incidence.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William H.Hayt, J A Buck	Engineering Electromagnetics	Tata McGraw-Hill	2016
2.	E.C. Jordan & K.G. Balmain	Electromagnetic Waves and Radiating Systems	Prentice Hall of India	2011

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D. Ganesh Rao, C. K. Narayanappa	Engineering Electromagnetics	Cengage India Private Limited	2016
2.	M.N.O.Sadiku	Elements of Engineering Electromagnetics	Oxford University Press	2007
3.	Clayton.R.Paul, Keith W.Whites, Syed.A.Nasar	Introduction to Electro Magnetic Fields‖	WCB/McGraw-Hill	2012
4.	Carlo G. Someda	Electromagnetic Waves	CRC Press	2010
5.	Gottapu Sasibhushana Rao	Electromagnetic Field Theory and Transmission Lines	Wiley Publishers	2012

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3. www.nptel.ac.in/courses/108106073/18
4. www.nptel.ac.in/courses/108106073/32
5. www.nptel.ac.in/courses/108106073/41

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16ECD04 **ANALOG ELECTRONICS - I** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- Design and construct amplifiers
- Construct amplifiers with active loads
- Study frequency response of all amplifiers
- Learn about Rectifiers and Power supplies
- Learn about IC MOSFET Amplifiers

COURSE OUTCOMES

16ECD04.CO1 Design simple amplifier circuits
16ECD04.CO2 Analyze the small signal equivalent circuits of JFET and MOSFET
16ECD04.CO3 Compute the frequency response of amplifier
16ECD04.CO4 Construct IC MOSFET amplifiers
16ECD04.CO5 Demonstrate Rectifiers and Power Supplies

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD04.CO1	x	x	x	x	x	x			x		x		x	x	x
16ECD04.CO2	x	x	x	x	x	x			x		x		x	x	x
16ECD04.CO3	x	x	x	x	x	x			x		x		x	x	x
16ECD04.CO4	x	x	x	x	x	x			x		x		x	x	x
16ECD04.CO5	x	x	x	x	x	x			x		x		x	x	x

UNIT I BJT AMPLIFIERS 9

CE, CB and CC amplifiers - Method of drawing small-signal equivalent circuit- Analysis of transistor amplifier Configurations-current and voltage gain, input and output impedance -Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Multistage amplifiers -Cascaded stages - Cascode Amplifier.Large signal Amplifiers – Class A, Class B and Class C Power Amplifiers

UNIT II JFET AND MOSFET AMPLIFIERS 9

Small signal analysis of JFET amplifiers- Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, - BiCMOS.Cascode amplifier.

UNIT III FREQUENCY RESPONSE OF BJT AND MOSFET AMPLIFIERS 9

Low frequency and Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency – fα and fβ unity gain and Determination of bandwidth of single stage and multistage amplifiers

UNIT IV IC MOSFET AMPLIFIERS 9

IC Amplifiers- IC biasing Current steering circuit using MOSFET- MOSFET current sources- PMOS and NMOS current sources. Amplifier with active loads - enhancement load, Depletion load and PMOS and NMOS current sources load- CMOS common source and source follower- CMOS differential amplifier- CMRR.

UNIT V RECTIFIERS AND POWER SUPPLIES 9

Rectifiers - Half-wave, full-wave and bridge rectifiers – Rectifiers with filters- C, L, and CLC filters Voltage regulators - Zener diode regulator- regulator with current limiting, Over voltage protection, Switched mode power supply (SMPS).

TOTAL: 45 Hrs

LIST OF EXPERIMENTS:

1. Frequency Response of CE amplifier
2. Frequency Response of CS amplifier

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3. Darlington Amplifier using BJT.
4. Frequency Response of Multistage amplifier
5. Power Supply circuit - Half wave rectifier and Full wave rectifier with simple capacitor filter
6. Mini Project

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Donald .A. Neamen	Electronic Circuit Analysis and Design	Tata Mc Graw Hill	2009
2.	David A.Bell	Electronic Devices and Circuits	Oxford Higher Education Press	2010

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Adel .S. Sedra, Kenneth C. Smith	Micro Electronic Circuits	Oxford University Press	2010
2.	BehzadRazavi	Design of Analog CMOS Integrated Circuits	Tata Mc Graw Hill,	2007
3.	Paul Gray, Hurst, Lewis, Meyer	Analysis and Design of Analog Integrated Circuits	John Willey & Sons	2005
4.	obert L. Boylestad and Louis Nashersky	Electronic Devices and Circuit Theory	Pearson Education / PHI	2008
5.	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj	Electronic Devices and Circuits	TMH	2007

WEB URLs

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16ECD05 **ANALOG ELECTRONICS - II** **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To understand the advantages and method of analysis of feedback amplifiers.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multivibrators, and time base generators.
- To understand the analysis and design of Tuned amplifier
- To understand and design of wave shaping circuits
- To understand the concepts of oscillators and time based generators

COURSE OUTCOMES

16ECD05.CO1 Design the feedback amplifiers
16ECD05.CO2 Describe the LC and RC oscillators
16ECD05.CO3 Explain the performance of tuned amplifiers
16ECD05.CO4 Describe the wave shaping and multivibrator circuits
16ECD05.CO5 Design the blocking oscillators and time base generators

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD05.CO1	x	x	x	x	x	x			x		x		x	x	x
16ECD05.CO2	x	x	x	x	x	x			x		x		x	x	x
16ECD05.CO3	x	x	x	x	x	x			x		x		x	x	x
16ECD05.CO4	x	x	x	x	x	x			x		x		x	x	x
16ECD05.CO5	x	x	x	x	x	x			x		x		x	x	x

UNIT I **FEEDBACK AMPLIFIERS** 9

General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies –Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem.

UNIT II **OSCILLATORS** 9

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts,Clapp, Tuned collector oscillators, RC oscillators - phase shift –Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal Oscillators, frequency stability of oscillators.

UNIT III **TUNED AMPLIFIERS** 9

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers - Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers – large signal tuned amplifiers – Class C tuned amplifier – Efficiency and applications of Class C tuned amplifier - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

UNIT IV **WAVE SHAPING AND MULTIVIBRATOR CIRCUITS** 9

Diode clippers, Diode comparator - Clampers, Collector coupled and Emitter coupled Astable multivibrator – Monostable multivibrator – Bistable multivibrators - Triggering methods for Bistable multivibrators - Schmitt trigger circuit

UNIT V **BLOCKING OSCILLATORS AND TIMEBASE GENERATORS** 9

UJT saw tooth waveform generator, Pulse transformers – equivalent circuit – response - applications, Blocking Oscillator – Free running blocking oscillator - Astable Blocking Oscillators with base timing – Push-pull Astable blocking oscillator with emitter timing, Frequency control using core saturation, Triggered blocking

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oscillator – Monostable blocking oscillator with base timing – Monostable blocking oscillator with emitter timing. Time base circuits - Voltage-Time base circuit, Current-Time base circuit – Linearization through adjustment of driving waveform.

TOTAL: 45 Hrs

LIST OF EXPERIMENTS:

1. Frequency response of feedback amplifier circuit-current series
2. Frequency response of feedback amplifier circuit- voltage shunt
3. Transistor based design of RC phase Shift Oscillator circuit
4. Transistor based design of Wein Bridge Oscillator circuit
5. Design of Astable and Monostable Multivibrators
6. Design of Clippers and Clampers
7. Spice Simulation of single tuned and Double Tuned Amplifier
8. Spice Simulation of Schmitt Trigger circuit with Predictable hysteresis
9. Spice Simulation of Monostable Multivibrator with emitter timing and base timing
10. Spice Simulation of Voltage and Current Time base circuits

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sedra and Smith	Micro Electronic Circuits	Oxford University Press	2011
2.	Robert L. Boylestad and Louis Nasheresky	Electronic Devices and Circuit Theory	Pearson Education / PHI	2008

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David A. Bell	Electronic Devices and Circuits	Oxford University Press	2008
2.	Millman J. and Taub H	Pulse Digital and Switching Waveforms	TMH	2000
3.	Millman and Halkias. C	Integrated Electronics	TMH	2007
4.	Floyd	Electronic Devices	Pearson Education	2002
5.	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj	Electronic Devices and Circuits	TMH	2007

WEB URLs

1. www.nptel.ac.in/courses/117106088/1
2. www.nptel.ac.in/courses/117106088/14
3. www.nptel.ac.in/courses/117106088/17
4. www.nptel.ac.in/courses/117101106/23
5. www.nptel.ac.in/courses/117101106/24

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16ECC09 **MICROPROCESSORS AND MICROCONTROLLERS** **L T P C**
3 0 2 4

COURSE OBJECTIVES

To study the basic concept of 8085 microprocessor

- To study the basic concept of 8051 microcontroller
- To Introduce PIC microcontroller and Programming in 8085 and 8051
- To understand the basic concept of interfacing
- To Study the Applications of Processors and Controllers

COURSE OUTCOMES

16ECC09 .CO1 Explain the architecture of 8085 microprocessor
16ECC09 .CO2 Identify the ports of 8081 microcontroller
16ECC09 .CO3 Explain the architecture of PIC Microcontroller.
16ECC09 .CO4 Examine the interfacing of peripheral devices
16ECC09 .CO5 Design controlling circuits for home appliances

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD09.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO2	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO3	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO4	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO5	x	x	x	x	x	x			x		x	x	x	x	x

UNIT I **8085 PROCESSOR** 9

Basics of Microprocessor - Architecture of 8085 - Pin Diagram - Instruction Set - Addressing Modes – Interrupts of 8085 - Timing diagram – Memory Organization.

UNIT II **8051 CONTROLLER** 9

Basics of Microcontroller - Architecture of 8051 - I/O Ports of 8051 - Pin Diagram - Instruction Set - Addressing Modes of 8051 - Timing Diagram.

UNIT III **PROGRAMMING AND ADVANCED CONTROLLERS** 9

Basic programing (ALP) of 8085 and 8051 - Loop Structures, counting and Indexing with programing concepts – Subroutine and its programing – PIC microcontroller Concepts - 16C6X Architecture – 16C7X Architecture.

UNIT IV **PROGRAMMING AND INTERFACING OF 8085 & 8051** 9

Interfacing: Architecture, configuration and interfacing, with ICs: Programmable Peripheral Interface (PPI) 8255 - programmable interrupt controller (PIC) 8259 - Programmable Interval Timer (PIT) 8254 - DMA Controller 8237 - USART 8251 - keyboard display controller 8279.

UNIT V **APPLICATIONS OF PROCESSORS AND CONTROLLERS** 9

Key board and display interface - stepper motor control - Washing Machine Control - LED Control, servo motor Control with 8085 & 8051.

TOTAL: 45 Hrs

LIST OF EXPERIMENTS:

1. Programming with 8085 –Addition and Subtraction.
2. Calculate the sum of series of numbers.
3. Programming with 8085- Multiplication and Division.
4. Programming with 8085-Ascending and Descending Order.
5. Programming with 8085- Maximum and Minimum Number in A Group of Data.
6. Code Conversion ASCII/Binary/BCD.
7. Interfacing A/D with 8085 Microprocessor.

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8. 8-Bit Addition and Subtraction Using 8051.
9. 8-Bit Multiplication and Division Using 8051.
10. Parallel Port Programming With 8051-Stepper Motor Control.
11. Keil C Programming

TOTAL: 30 Hrs

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Soumitra Kumar Mandal	Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051	McGraw Hill Education	2013
2.	Furber,S,	ARM System on Chip Architecture	Addison Wesley trade Computer Publication	2000

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muhammad Ali Mazidi & Janice GilliMazidi, R.D.Kinely	The 8051 Micro Controller and Embedded Systems	PHI Pearson Education	2003
2.	N.Senthil Kumar, M.Saravanan, S.Jeevananthan	Microprocessors and Microcontrollers	Oxford	2013
3.	M. Rafiquzzaman	Microprocessors Theory and Applications	Prentice Hall	2001
4.	R.S. Gaonkar	Microprocessor Architecture Programming and Application	New Delhi	2013
5.	Michael McRoberts	Beginning Arduino	Apress Publications	2013

Web URLs
1. www.nptel.ac.in/courses/106108100/
2. www.youtube.com/watch?v=liRPtvj7bFU&noredirect=1
3. www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
4. www.freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers/2
5. www.youtube.com/watch?v=pA6K5NgWTow

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16ECD06 **LINEAR INTEGRATED CIRCUITS** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To Demonstrate the IC fabrication steps and basic building blocks of linear integrated circuits.
- To Design and analyze the linear and non-linear applications of operational amplifiers.
- To Illustrate the operating principle of PLL, Data Converters and various special function ICs.
- To design waveform generating circuits
- To design simple filter circuits for particular application and to gain knowledge in designing a stable voltage regulators

COURSE OUTCOMES

16ECD06.CO1 Explain the Circuit Fabrication Process and internal structure of operational amplifiers
16ECD06.CO2 Design real time operational amplifiers applications
16ECD06.CO3 Design comparator and waveform generators using operational amplifier
16ECD06.CO4 Classify the functioning of PLL and Data converters
16ECD06.CO5 Design the special function ICs and its application in modern electronic equipment

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD06.CO1	x	x	x	x	x	x			1		x		x	x	x
16ECD06.CO2	x	x	x	x	x	x			x		x		x	x	x
16ECD06.CO3	x	x	x	x	x	x			x		x		x	x	x
16ECD06.CO4	x	x	x	x	x	x			x		x		x	x	x
16ECD06.CO5	x	x	x	x	x	x			x		x		x	x	x

UNIT I **IC FABRICATION AND OPERATIONAL AMPLIFIER** **9**

Introduction to Integrated Circuits- Classification of ICs- Basic IC Fabrication Planar Process-Fabrication of Diode and BJT - Operational Amplifier: Basic Information of Op-Amp, Ideal Op Amp-Operational Amplifier Internal Circuit- Differential Amplifier- Analysis of current sources-Widlar-Wilson Current Sources .

UNIT II **CHARACTERISTICS OF OP- AMP AND APPLICATIONS** **9**

Characteristics of Op- Amp - DC Characteristics, AC Characteristics - Frequency Response- Frequency Compensation - Slew Rate- Applications: Closed Loop Op Amp Configuration - Inverting and Non inverting Amplifiers- Inverter- Voltage Follower-Summing Amplifier, Averaging Circuits - Subtractor- Differential Amplifier- Multiplier- Differentiator- Integrator- Instrumentation amplifier, Precision rectifier- V/I & I/V Converter.

UNIT III **COMPARATOR AND WAVEFORM GENERATORS** **9**

Comparators - Open Loop Op Amp Configuration - Inverting , Non Inverting Comparator- Applications of Comparator- Regenerative Comparator (Schmitt trigger)- Multivibrators - Astable, Monostable-Principles of Sine wave Oscillator- RC Phase Shift, Wien Bridge Oscillator.

UNIT IV **PHASE LOCKED LOOP AND DATA CONVETER** **9**

Block Diagram of PLL- Principles-Types- Phase Detector- Voltage Controlled Oscillator-IC 566 and IC 565 Internal Block Diagram- PLL Applications - Data Converter - Sample and Hold circuits D/A Techniques: Binary Weighted Resistor- R-2R and Inverted R-2R Ladder DAC- A/D converter: Flash - Counter - Successive Approximation Converter -Single Slope- Dual Slope.

UNIT V **SPECIALIZED IC APPLICATIONS** **9**

555 Timer Internal Architecture- Astable and Monostable Multivibrators using 555 Timer - Applications- Voltage regulators, Fixed and Adjustable Voltage Regulators, Dual Power supply - Universal Active Filter- Switched Capacitor Filter.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS:

Design and Testing of

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Schmitt Trigger using op-amp.
5. Phase shift and Wien bridge oscillators using op-amp.
6. Astable and monostable multivibrators using NE555 Timer.
7. Mini Projects.

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sergio Franco	Design with operational amplifiers and analog integrated circuits	3rd Edition, Tata McGraw-Hill	2007
2.	D.Roy Choudhry, Shail Jain	Linear Integrated Circuits	New Age International Pvt. Ltd	2000

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramakant A.Gayakwad	OP-AMP and Linear IC's	Prentice Hall of India	2002
2.	David L.Terrell	Op Amps-Design, Application, and Troubleshooting	Elsevier publications	2005
3	Sergio Franco	Design with operational amplifiers and analog integrated circuits	3rd Edition, Tata McGraw-Hill	2002
4	Taub and Schilling	Digital Integrated Electronics	McGraw-Hill	1997
5	William D.Stanely	Operational Amplifiers with Linear Integrated Circuits	Pearson Education	2004

Web URLs:

1. www.nptel.ac.in/courses/117107094/
2. www.youtube.com/watch?v=clTA0pONnMs
3. www.youtube.com/watch?v=7beZocF34AU
4. www.youtube.com/watch?v=7xVSL93ZZq8
5. www.youtube.com/watch?v=xki9taCqsWY

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16ECD07 **COMMUNICATION THEORY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the basic building blocks of communication systems.
- To provide various Amplitude modulation and demodulation systems.
- To provide various Angle modulation and demodulation systems.
- To provide some depth analysis in noise performance of various receiver.
- To study some basic information theory with some channel coding theorem.

COURSE OUTCOMES

16ECD07.CO1 Explain the basic building blocks of communication systems
16ECD07.CO2 Analyze the performance of amplitude modulation techniques
16ECD07.CO3 Demonstrate knowledge of angle modulation techniques
16ECD07.CO4 Compare noise performance of receivers
16ECD07.CO5 Explain the concepts of information theory

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD07.CO1	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECD07.CO2	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECD07.CO3	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECD07.CO4	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECD07.CO5	x	x	x	x	x	x	x		x		x	x	x	x	x

UNIT I INTRODUCTION **9**

Elements Communication Systems, Modulation–Types of modulation– Need for Modulation – Electromagnetic Spectrum –Communication Channels. Principles of Amplitude modulation - Mathematical Representation, Waveforms – Spectrum – Bandwidth –Phasor representation, Power Relations.

UNIT II AMPLITUDE MODULATION **9**

Types of AM Signal - Generation of AM Signal – DSBFC- Class A and Class C Modulators, DSBSC- Balanced Modulator , Ring Modulator, FET push-pull balanced modulator, SSBSC- Filter Method, Phase Shift Method, Third Method - Demodulation of AM Signal -Envelope Detector – Coherent Detection. AM Transmitter – Low Level and High Level - Receiver Characteristics-TRF, Super heterodyne Receiver.

UNIT III ANGLE MODULATION **9**

Basic Principles – Types of Angle Modulation: Frequency Modulation, Phase Modulation – Mathematical Representation - Waveforms – Spectrum – Bandwidth – Power - Relationship between FM and PM - Narrowband and Wideband FM - Phasor Representation. Generation of FM signal – Direct FM Modulators –Varactor diode modulator, FM Reactance modulator-Direct and Indirect FM Transmitters-Demodulation of FM Signals: Tuned Circuit Frequency Discriminators –Balanced slope detector, Foster-Seely Discriminator –PLL – FM receiver.

UNIT IV NOISE PERFORMANCE OF AM AND FM **9**

Noise – Types : External and Internal Noise – Signal-to-Noise Ratio-White noise, Noise Equivalent Bandwidth, Narrowband Noise : Mathematical Representation, Noise in AM receivers, Noise in FM Receivers - Pre-emphasis and De-emphasis – Capture effect - Threshold effect-Performance Comparison of AM and FM Systems

UNIT V INFORMATION THEORY **9**

Uncertainty, Information and entropy, Source coding theorem, Shannon-Fano coding, Huffman coding, Discrete Memory less Channel, Mutual Information, Channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Information capacity theorem.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon Haykin	Communication Systems	JohnWiley& Sons	2001
2.	Herbert Taub, Donald L Schilling and GoutamSaha,	Principles of Communication Systems	McGraw Hill	2013

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.P.Lathi, ZhiDing.	Modern Digital and Analog Communication Systems	Oxford University Press	2009
2.	John G. Proakis, MasoudSalehi,	Communication Systems Engineering	Pearson Education,	2008
3.	Ferrel G. Stremler,	Introduction to Communication Systems	Prentice-Hall	2001
4.	W. Tomasi,	Electronic Communication Systems	Prentice-Hall	2001
5.	George. Kennedy and Bernard Davis	Electronic Communication Systems	Tata McGraw-Hill	1999.

WEB URLs

1. www.nptel.ac.in/courses/117102059
2. www.nptel.ac.in/courses/117102059/1
3. www.nptel.ac.in/courses/117102059/8
4. www.nptel.ac.in/courses/117102059/15
5. www.nptel.ac.in/courses/117102059/35

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16ECD08 TRANSMISSION LINES AND WAVE GUIDES **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To introduce the concept of transmission lines
- To give knowledge on the transmission line at Radio frequencies
- To understand wave propagation in guided system
- To impart knowledge on the propagation of waves through wave guides
- To become familiar with circular waveguides and cavity resonators

OUTCOMES

16ECD08.CO1 Calculate the parameters of a transmission lines
16ECD08.CO2 Use Smith chart for impedance matching
16ECD08.CO3 Analyse the nature of Guided wave propagation
16ECD08.CO4 Demonstrate the characteristics of TE and TM wave in a rectangular waveguide
16ECD08.CO5 Select proper technique for exciting desired modes in a waveguide

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD08.CO1	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD08.CO2	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD08.CO3	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD08.CO4	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD08.CO5	x	x	x	x	x	x	x		x	x	x	x	x	x	x

UNIT I TRANSMISSION LINE THEORY 9

Transmission line parameters- General solutions of transmission line –Wavelength , velocity of propagation - Waveform distortion – The distortion less line ,Reflections on a line not terminated in Z0 - Reflection coefficient - Calculation of current, voltage, power delivered and efficiency of transmission - Open and short circuited lines - Reflection factor and reflection loss.

UNIT II TRANSMISSION LINES AT RADIO FREQUENCIES 9

Line of zero dissipation - Constants for the line of zero dissipation - Voltages and currents on the dissipation less line- Standing Waves, Nodes, Standing wave Ratio - Input impedance of the dissipation less line - Input impedance of open and short circuited lines, Impedance transformation using Quarter wave line - Impedance matching by stubs: Single stub matching, double stub matching - Smith chart and its application – Single stub matching using Smith chart.

UNIT III GUIDED WAVES 9

Guided waves: Waves between parallel planes – Transverse Electric waves and Transverse Magnetic waves – Characteristics of Transverse Electric and Transverse Magnetic Waves – Transverse Electromagnetic waves – Velocities of propagation –Wave impedance.

UNIT IV RECTANGULAR WAVEGUIDES 9

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – Characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide, Wave impedances– Excitation of modes.

UNIT V CIRCULAR WAVEGUIDES AND RESONATORS 9

Transverse Electric and Transverse Magnetic waves in Circular guides - Dominant mode in Circular waveguide – Method of excitation of modes in circular waveguide – Resonators, Rectangular cavity resonators, Unloaded Q factor of rectangular cavity resonator for TE_{101} mode.

TOTAL: 45+15 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John D Ryder	Networks, Lines and Fields	Prentice Hall India	2010
2.	E. C. Jordan and K.G. Balmain	Electromagnetic Waves and Radiating Systems	Prentice Hall India	2006

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.S.N Raju	Electromagnetic Field Theory and Transmission Lines	Pearson Education	2005
2.	Umesh Sinha	Transmission Lines and Networks	Satya Prakashan (Tech. India), New Delhi	2010
3.	R. Shevgaonkar	Electromagnetic Waves	Mcgraw Hill Education	2005
4.	B. Somanathan Nair	Transmission lines & Waveguides	Sanguine Technical Publishers	2006.
5.	Simon Ramo, John R. Whinnery, Theodore Van Duzer	Fields and Waves in Communication Electronics	John Wiley	1994

WEB URLs

1. www.nptel.ac.in/downloads/117101057
2. www.nptel.ac.in/video.php?subjectId=117101056
3. www.antenna-theory.com/tutorial/txline/transmission5.php
4. www. http://maritime.org/doc/neets/mod10.pdf
5. www.amanogawa.com/archive/transmissionpdf.com

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16ECD09 **DIGITAL SIGNAL PROCESSING** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn discrete Fourier transform and its properties
- To know the characteristics of IIR and FIR filters
- To learn the design of infinite and finite impulse response filters for filtering undesired signals
- To understand Finite word length effects
- To study the concept of Multirate and adaptive filters

COURSE OUTCOMES

16ECD09 .CO1 Analyze DFT & FFT techniques in signal processing
16ECD09 .CO2 Design IIR filters in Digital Signal Processing
16ECD09 .CO3 Design FIR filters in Digital Signal Processing
16ECD09 .CO4 Analyze binary fixed point and floating-point representation of numbers arithmetic operation
16ECD09 .CO5 Design multi rate signal processing of signals through systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD09.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO2	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO3	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO4	x	x	x	x	x	x			x		x	x	x	x	x
16ECD09.CO5	x	x	x	x	x	x			x		x	x	x	x	x

UNIT I DISCRETE FOURIER TRANSFORM 9

Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms.

UNIT II IIR FILTER DESIGN 9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

UNIT III FIR FILTER DESIGN 9

Structures of Finite Impulse Response Filter – Linear phase Finite Impulse Response Filter –Fourier series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling Method.

UNIT IV FINITE WORDLENGTH EFFECTS 9

Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error - Overflow error – Round off noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling.

UNIT V DSP APPLICATIONS 9

Multirate signal processing: Decimation, Interpolation, Cascading Sample Rate Converters , Efficient Transversal Structure for Decimator, Efficient Transversal Structure for Interpolator – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization – Subband Coding - Channel Vocoders

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS:

1. Generation of sequences (functional & random) & correlation
2. Linear and Circular Convolutions
3. Spectrum Analysis using DFT
4. Ffilter design

DSP Processor Based Implementation

5. Study of architecture of Digital Signal Processor
6. Convolution
7. FFT Implementation
8. Waveform generation
9. Implementation of Filter Design
10. Mini Project

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John G. Proakis& Dimitris G.Manolakis	Digital Signal Processing Principles Algorithms & Applications	Pearson Education / Prentice Hall	2007
2.	Emmanuel C..Ifeachor, &Barrie.W.Jervis	Digital Signal Processing	Pearson Education, Prentice Hall	2002

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.P.Lathi, ZhiDing. Sanjit K. Mitra	Digital Signal Processing, A Computer Based Approach	Tata Mc Graw Hill	2007
2.	A.V.Oppenheim, R.W. Schafer and J.R. Buck	Discrete-Time Signal Processing	Pearson	2004.
3.	Andreas Antoniou	Digital Signal Processing, Tata Mc Graw Hill, 2006.	Prentice-Hall	2001
4.	A. V. Oppenheim and R. W. Schafer Edition	Discrete-Time Signal Processing	Tata Mc Graw Hill	2007
5.	R. E. Crochiere and L. R. Rabiner	Multirate Digital Signal Processing	Prentice Hall,	2007

WEB URLs:

1. www.nptel.ac.in/courses/117102060/
2. www.nptel.ac.in/courses/108105055/
3. www.nptelvideos.in/2012/12/digital-signal-processing.html
4. www.nptelvideos.in/2012/11/digital-signal-processing.html
5. www.youtube.com/watch?v=6dFnpz_AEyA

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16ECD10 **DIGITAL COMMUNICATION** L T P C
3 0 2 4

COURSE OBJECTIVES

- To know the principles of sampling & quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various Band pass signaling schemes
- To know the fundamentals of channel coding

COURSE OUTCOMES

16ECD10.CO1 Demonstrate the Concept of Sampling and quantization
16ECD10.CO2 Design and implement the various wave form coding schemes
16ECD10.CO3 Explain the Base band transmission system using Nyquist criterion
16ECD10.CO4 Analyze the spectral characteristics of band pass signaling schemes and their noise performance
16ECD10.CO5 Compare different types of error control coding

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD10.CO1	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD10.CO2	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD10.CO3	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD10.CO4	x	x	x	x	x	x	x		x	x	x	x	x	x	x
16ECD10.CO5	x	x	x	x	x	x	x		x	x	x	x	x	x	x

UNIT I SAMPLING & QUANTIZATION 9

Low Pass Sampling – Aliasing - Signal Reconstruction– Pulse Amplitude Modulation - Pulse Code Modulation - Quantization - Uniform & Non-Uniform Quantization - Quantization Noise - Quantization Noise Ratio - Logarithmic Companding of Speech Signal - Time Division Multiplexing.

UNIT II WAVEFORM CODING 9

Prediction Filtering - Differential Pulse Code Modulation – Adaptive Differential Pulse Code Modulation - Delta Modulation, Signal to Noise Ratio, Slope Overload Distortion, Granular Noise - Adaptive Delta Modulation - Comparison of Digital Pulse Modulation Systems - Linear Predictive Coding.

UNIT III BASEBAND TRANSMISSION 9

Line Codes - Power Spectral Density of Line Codes Integrate and Dump Receiver – Optimum Receiver – Matched Filter- Coherent Reception - Intersymbol Interference – Nyquist criterion for Distortionless Transmission, Ideal Solution, Raised Cosine Spectrum – Pulse Shaping – Correlative Coding, Duobinary Encoder, Modified Duobinary Encoder – M ary Schemes – Eye pattern – Equalization.

UNIT IV DIGITAL MODULATION SCHEME 9

Geometric Representation of signals - Generation, Detection, Power Spectral Density & Bit Error Rate of Coherent BPSK, BFSK & QPSK – QAM - Comparison of Digital Modulation Systems – Synchronization, Modes of Synchronization, Carrier Synchronization, Costas Loop for Carrier Synchronization, Frame and Bit Synchronization, Closed Loop Bit Synchronization, Early Late Bit Synchronization.

UNIT V ERROR CONTROL CODING 9

Need for Error Detection and Correction, Overview of Error Control Systems, ARQ System, Random and Burst Errors, Definitions of Code Word, Code Rate, Code Vectors, Code Efficiency - Linear Block codes - Hamming codes - Cyclic codes - Convolutional Codes, Graphical Representaion for Convolutional Encoding - Vitterbi Decoder.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS:

1. Signal Sampling and reconstruction
2. PAM and PWM Generation and detection
3. Time Division Multiplexing
4. AM Modulator and Demodulator
5. FM Modulator and Demodulator
6. Pulse Code Modulation and Demodulation
7. Delta Modulation and Demodulation
8. Line coding schemes
9. Communication link simulation
10. FSK, PSK and QPSK schemes (Simulation)

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. Haykin	Digital Communications	John Wiley	2013
2.	Bernard Sklar	Digital Communication, Fundamentals and Applications	Pearson Education	2014

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.P.Lathi, ZhiDing.	Modern Digital and Analog Communication Systems	Oxford University Press	2012
2.	H P Hsu, Schaum	Analog and Digital Communications	TMH	2011
3.	J.G Proakis	Digital Communication	Tata Mc Graw Hill Company	2006.
4.	Leon W. Couch	Digital and Analog Communication Systems,	Pearson Education	2008
5.	A.F Molisch	Wireless Communication	John Wiley & Sons Ltd	2009

WEB URLs

1. www.nptel.ac.in/courses/117101051
2. www.nptel.ac.in/courses/117101051/2
3. www.nptel.ac.in/courses/117101051/3
4. www.nptel.ac.in/courses/117101051/10
5. www.nptel.ac.in/courses/117101051/12

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16ECD11 **COMPUTER ARCHITECTURE AND ORGANIZATION** L T P C
3 0 0 3

COURSE OBJECTIVES

- Brief the historical development of computing machines
- Understand the arithmetic algorithms and circuits needed to process data.
- Focus on concepts of pipelining to speed up the data processing
- Explain the organization of main memory, cache memory and virtual memory mechanisms and examine the design of I/O system
- Distinguish the approaches to control unit design – hardwired and micro programmed

COURSE OUTCOMES

16ECD11.CO1 Describe the central processing unit focusing on instruction set design
16ECD11.CO2 Apply arithmetic algorithms and interpret the processed data
16ECD11.CO3 Appraise the control unit design and I/O system design
16ECD11.CO4 Recognize the principal memory technologies from a hierarchical view point
16ECD11.CO5 Explain the system organization of a pipelined and superscalar processor cache memory

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD11.CO1	x	x	x	x		x					x	x			x
16ECD11.CO2	x	x	x	x		x					x	x			x
16ECD11.CO3	x	x	x			x					x	x			x
16ECD11.CO4	x	x	x	x		x					x	x			x
16ECD11.CO5	x	x	x	x		x					x	x			x

UNIT I INTRODUCTION 9

Computing and Computers, Evolution of Computers, VLSI Era, System Design- Register Level, Processor Level, CPU Organization, and Data Representation, Fixed –Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types. Addressing modes

UNIT II DATA PATH DESIGN 9

Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth's algorithm, non restoring division algorithm, Floating Point Arithmetic, Coprocessor, Modified booth's Algorithm.

UNIT III CONTROL DESIGN 9

Introduction to Control Design-Control Transfer- Hardwired Control, Micro programmed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, and Superscalar Processing.

UNIT IV MEMORY ORGANIZATION 9

Random Access Memory: Static RAM, Dynamic RAM, Serial - Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory.

UNIT V SYSTEM ORGANIZATION 9

Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, vectored interrupts, pipeline interrupts, IOP organization, multiprocessors, fault tolerance, RISC and CISC architecture.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John P.Hayes	Computer architecture and Organisation	Tata McGraw-Hill	1998
2.	V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky	Computer Organisation	McGraw-Hill Inc	2002.

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parhami	Computer Architecture	Oxford Press BEH	2005
2.	P.Pal Chaudhuri	Computer organization and design	Prentice Hall of India	2007
3.	Miles J. Murdocca and Vincent P. Heuring	Principles of Computer Architecture	Prentice Hall	2000
4.	William Stallings	Computer Organization and Architecture	Computer Organization and Architecture	2006
5.	Vincent P. Heuring, Harry F. Jordan,	Computer System Architecture	Pearson Education	2005

WEB URLs:

1. www.nptel.ac.in/courses/106103068/
2. www.en.wikiversity.org/wiki/Computer_architecture_and_organization
3. www.gradeup.co/introduction-of-computer-organization-and-architecture-i-490c999
4. www.tutorialspoint.com/computer_organization/index.asp
5. www.nptel.ac.in/courses/106103068/

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16ECD12 **EMBEDDED SYSTEM** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To study the overview of Embedded System Architecture.
- To study about the ARM Architecture.
- To learn various embedded communication protocols.
- To learn the Real Time operating System Concepts.
- To Study about applications of Embedded System.

COURSE OUTCOMES

16ECD12.CO1 Describe hardware and software architectures of Embedded Systems
16ECD12.CO2 Explain the Architecture of ARM Processor
16ECD12.CO3 Explain the various Communication Protocols
16ECD12.CO4 Identify the Real Time Operating System and operations
16ECD12.CO5 Demonstrate the applications of Embedded Processor

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD12.CO1	x	x	x	x	x	x	x	x	x		x	x	x	x	x
16ECD12.CO2	x	x	x	x	x	x	x	x	x		x	x	x	x	x
16ECD12.CO3	x	x	x	x	x	x	x	x	x		x	x	x	x	x
16ECD12.CO4	x	x	x	x	x	x	x	x	x		x	x	x	x	x
16ECD12.CO5	x	x	x	x	x	x	x	x	x		x	x	x	x	x

UNIT I ARCHITECTURE OF EMBEDDED SYSTEMS 9

Architecture of Embedded Systems -Categories of embedded systems – specialties of embedded systems – Recent trends in embedded systems –Hardware architecture –Software architecture –Communication software – Process of generation of executable image –development/testing tools.

UNIT II ARM ARCHITECTURE 9

Advanced RISC Machine – Architecture Inheritance – ARM Programming Model – ARM Development Tools – 3 and 5 stages Pipeline ARM Organization – ARM Instruction Execution and Implementation – ARM Co-Processor Interface - Thumb bit in the CPSR – Thumb programmer's model

UNIT III EMBEDDED COMMUNICATION PROTOCOLS 9

Serial/Parallel Communication - Serial communication protocols - UART - RS232 standard - Serial Peripheral Interface - Inter Integrated Circuits – Ethernet - Universal serial Bus - Controller Area Network - Parallel communication protocols – ISA / PCI Bus protocols, Internet of Things- Overview and Architecture.

UNIT IV REAL-TIME OPERATING SYSTEM CONCEPTS 9

Architecture of the Kernel– Foreground/Background Systems- Critical Sections of Code-Resources- Shared Resources- Multitasking- Tasks- Context Switches- Kernels- Schedulers-Non-Preemptive Kernels- Preemptive Kernels-Task Priorities-Static Priorities-Dynamic Priorities-Priority Inversion- Mutual Exclusion- Deadlock-Event Flags- Inter task Communication- Message Mailboxes- Message Queues- Interrupts- Interrupt Latency-Interrupt Response- Interrupt Recovery- RTOS: RT Linux - VX Works - µCOS.

UNIT V APPLICATIONS 9

Working Principle, State Diagram, Architecture, Digital camera-washing machine-cell phones-home security systems-finger print identifiers-cruise control- printers -Automated teller machine-Washing machine-Software Modem-Audio Player.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS

1. Interface Switches and LED's
2. Interface Switches
3. Interface LCD and Display "Hello World"
4. Interface 4*4 Matrix Keyboard
5. Interface Stepper Motor
6. Interface 7 Segment Display using I2C
7. Interfacing Analog to Digital Converter
8. Interface Digital to Analog Converter
9. Implementing Real Time Clock
10. Mini Project

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raj Kamal,	Embedded Systems Architecture programming and Design	TMH	2011
2.	Prasad.K.V.K.K.	Embedded Real-Time Systems: Concepts, Design & Programming	Dream tech press	2011

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wayne Wolf	Computers as Components - Principles of Embedded Computing System Design	Morgan Kaufman Publishers	2013
2.	Steve Furber,	ARM System on Chip Architecture	Addison- Wesley Professional	2000
3.	Andrew N.Sloss, Dominic Symes, Chris Wright	ARM System Developer's Guide Designing and Optimizing System Software	Morgan Kaufmann Publishers, Elsevier	2004
4.	A.P.Godse&A.O.Mulani	Embedded Systems	Technical publications	2009
5.	B.Kanth Rao,	Embedded Systems	PHI Learning Private Limited	2011

WEB URLs

1. http://www.nptel.ac.in/courses/108102045/
2. http://freevideolectures.com/Course/2341/EmbeddedSystems
3. nptel.ac.in/courses/108105057/Pdf/Lesson-3.pdf
4. nptel.ac.in/downloads/108105057/
5. nptel.ac.in/courses/108102045/5

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16ECD13 **ANTENNA AND WAVE PROPAGATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce antenna fundamentals and basic terminologies
- To study antenna arrays
- To give a thorough understanding of aperture and slot antennas
- To understand special purpose antennas and techniques involved in the measurement of antenna parameter
- To create awareness about the different types of propagation of radio waves

COURSE OUTCOMES

16ECD13.CO1 Describe various antenna parameters
16ECD13.CO2 Design broad side and End fire arrays
16ECD13.CO3 Analyze radiation patterns of aperture and slot antennas
16ECD13.CO4 Describe special purpose antenna and antenna measurement techniques
16ECD13.CO5 Discuss radio wave propagation

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD13.CO1	x	x	x		x	x	x		x		x	x	x	x	x
16ECD13.CO2	x	x	x		x	x	x		x		x	x	x	x	x
16ECD13.CO3	x	x	x		x	x	x		x		x	x	x	x	x
16ECD13.CO4	x	x	x		x	x	x		x		x	x	x	x	x
16ECD13.CO5	x	x	x		x	x	x		x		x	x	x	x	x

UNIT I **ANTENNA FUNDAMENTALS** 9

Radiation from antenna, Basic antenna parameters – Radiation pattern, Radiation intensity, Beam area, Beam solid angle, Band width, Beam width , Directivity, Gain, Antenna aperture, Effective height, Effective aperture, Radiation Resistance, Input Impedance. Matching – Baluns, Radiation from Half wave dipole, folded dipole.

UNIT II **ANTENNA ARRAYS** 9

Antenna Arrays, Expression for electric field due to two point sources: Radiation pattern, Equal voltage with same phase (Broad-side array), Equal voltage with phase shift (End-Fire array), Different voltage with phase shift – Expression for electric field due to N element Array: Broad-side array and End-Fire array - Pattern Multiplication-Binomial array, Yagi-Uda Array.

UNIT III **APERTURE AND SLOT ANTENNAS** 9

Radiation from rectangular apertures, Horn antenna: E-Sectorial horn, H-Sectorial horn, Prymidal Horn, Horn antenna design parameters, Parabolic reflector antenna: Different types of parabolic reflectors, Spill over, Aperture blockage, Feeding mechanism of Dish antenna, Slot antennas , Microstrip patch antennas , Numerical tool for antenna analysis.

UNIT IV **SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS** 9

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log Periodic Dipole Array and its design- Reconfigurable antenna, Antenna Measurements: Antenna Test Ranges, Measurement of Gain, Measurement of Voltage Standing Wave Ratio, Measurement of Directivity.

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UNIT V PROPAGATION OF RADIO WAVES 9

Ground wave propagation: Attenuation characteristics for ground wave Sky wave propagation: Structure of the ionosphere-Critical frequency- Skip distance- Effect of earth's magnetic field- Attenuation factor for ionosphere propagation- Maximum usable frequency. Space wave propagation: Reflection characteristics of earth- Resultant of direct and reflected ray at the receiver- Duct propagation, fading and Diversity reception.

TOTAL: 45 Hrs

TEXT BOOK

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John D Kraus and Ronald J. Marhefka	Antennas for all Applications	Tata Mc Graw-Hill	2001
2.	Robert E. Collin	Antennas and Radio Propagation	Mc Graw Hill	1985

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Constantine A. Balanis	Antenna Theory: Analysis and Design	Wiley	2016
2.	Rajeswari Chatterjee	Antenna Theory and Practice	New Age International	2006
3.	Serge Drabowitch	Modern Antennas	Springer Publications	2005
4.	G.S.N.Raju	Antenna Wave Propagation	Pearson Education	2005
5.	A.R. Harish and M. Sachidanada	Antennas and Wave propagation	Oxford University Press	2007

WEB URLs

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2. www.nptel.ac.in/courses/117101056
3. www.amanogawa.com/chive/antennapdf.comar
4. www.maritime.org/doc/neets/mod10.pdf
5. www.radio-astronomy.org/library/Antenna-design.pdf

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16ECD14 **VLSI DESIGN** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn basic CMOS Circuits
- To learn CMOS process technology
- To learn techniques of chip design using programmable devices
- To learn the concepts of designing VLSI Subsystems
- To learn the concepts of modeling a digital system using Hardware Description Language

COURSE OUTCOMES

16ECD14.CO1 Explain the process of MOS fabrication methods
16ECD14.CO2 Use Lambda based design rules for Layouting simple MOS circuit
16ECD14.CO3 Apply the Lambda based design rules for subsystem design
16ECD14.CO4 Differentiate various FPGA architectures
16ECD14.CO5 Design an application using Verilog HDL

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD14.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD14.CO2	x	x	x	x	x	x			x		x	x	x	x	x
16ECD14.CO3	x	x	x	x	x	x			x		x	x	x	x	x
16ECD14.CO4	x	x	x	x	x	x			x		x	x	x	x	x
16ECD14.CO5	x	x	x	x	x	x			x		x	x	x	x	x

UNIT I **MOS TRANSISTOR THEORY** **9**

Introduction to MOSFET: Enhancement mode & Depletion mode –Characteristics -Body Effect – Fabrication: NMOS, PMOS – CMOS fabrication – P-well, N-well, Twin-Tub, SOI – BiCMOS Technology – Comparison with CMOS

UNIT II **MOS CIRCUITS AND DESIGN** **9**

Basic Electrical properties of MOS circuits – DC Equations, NMOS & CMOS inverter –Second Order Effects– Basic circuit concepts-Sheet resistance-Area Capacitances-Capacitance calculations-Inverter delays– Scaling of MOS Devices –Scaling Models and Scaling Factors MOS layers – Stick diagram – NMOS Design Style – CMOS Design style – lambda based design rules– Simple Layout examples

UNIT III **SUBSYSTEM DESIGN & LAYOUT** **9**

Switch Logic – Pass transistors and transmission gates – Two input NMOS, CMOS gates: NOT– NAND– NOR gates – Other forms of CMOS logic – Static CMOS logic-Dynamic CMOS logic – Clocked CMOS logic – Pre-charged domino CMOS logic – Structured design of simple Combinational logic design– Multiplexers – Clocked sequential circuits – Two phase clocking – D-Flip-flop-Charge storage - Dynamic register element – Dynamic shift register

UNIT IV **PROGRAMMABLE LOGIC DEVICES** **9**

Programmable Logic Devices – PLA , PAL – Finite State Machine design using PLA – Introduction to FPGA – FPGA Design flow –Architecture – FPGA devices: Xilinx XC 2000- Xilinx XC 3000 Xilinx XC 4000 – Altera cyclone III

UNIT V **VERILOG HDL DESIGN PROGRAMMING** **9**

Basic concepts: VLSI Design flow, Modeling, Syntax and Programming, Design Examples: Combinational Logic – Multiplexer, Decoder/Encoder, Comparator, Adders, Multipliers, Sequential logic- Flip Flops, Registers, and Counters, Memory- Introduction to back end tools

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS

1. Design and Simulation of combinatorial logic Circuit Using VERILOG HDL
   Basic Logic gates
   Adders – Half adder, full adder,
   Multiplexer and demultiplexer
   Encoder and Decoder
   Multiplier
2. Design and simulation of Sequential logic circuit using VERILOG HDL
   Flip-flops
   Counters
   Shift registers
3. CMOS Circuit design using Tanner tools
   CMOS inverter
   CMOS NAND and NOR Gates
   CMOS D Latch
4. Mini Project

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas A.Pucknell, K. Eshragian	Basic VLSI Design	PHI	2009
2.	Neil.H.E.Weste, KamaranEshraghian	Principles of CMOS VLSI Design	Addiso Wesley Publications	2002

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Samir Palnitkar	Verilog HDL–Guide to Digital design and synthesis	Pearson Education	2009
2.	Wayne Wolf	Modern VLSI Design	Pearson Education	2003
3.	Eugene D.Fabricius	Introduction to VLSI Design	Tata McGraw Hill	1990
4.	John P.Uyemura	Introduction to VLSI circuits and Systems	John Wiley and Sons	2005
5.	KeshabK.Parhi	VLSI Digital Signal Processing Systems, Design and Implementation	John Wiley, Indian Reprint	2007

WEB URLs

1. www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm
2. www.en.wikipedia.org/wiki/Very-large-scale_integration
3. www.hindawi.com/journals/vlsi/
4. www.nptel.ac.in/courses/117101058/
5. www.nptel.ac.in/courses/117106093/

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16ECD15 **COMPUTER NETWORKS** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the students the functions of Data link layer.
- To introduce the students the functions of Network and Transport layer.
- To introduce the students the functions of Transport and Application Layer.
- To introduce IEEE standard employed in computer networking.
- To make students to get familiarized with different protocols and network components.

COURSE OUTCOMES

16ECD15.CO1	Design an application using Verilog HDL
16ECD15.CO2	Explain data link layer protocols and LAN standards
16ECD15.CO3	Analyze routing algorithms and methods to improve QOS
16ECD15.CO4	Summarize transport layer protocols and congestion controls methods
16ECD15.CO5	Describe various application layer services

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD15.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD15.CO2	x	x	x	x	x	x			x		x	x	x	x	x
16ECD15.CO3	x	x	x	x	x	x			x		x	x	x	x	x
16ECD15.CO4	x	x	x	x	x	x			x		x	x	x	x	x
16ECD15.CO5	x	x	x	x	x	x			x		x	x	x	x	x

UNIT I NETWORK COMPONENTS 9

Introduction to networks –Topologies – Protocols and Standards–ISO/OSI model-TCP/IP- Comparison of OSI model and TCP/IP, Introduction to physical layer–Transmission Media – Coaxial Cable–Fiber Optics–Digital-to-digital line Coding.

UNIT II DATA LINK LAYER 9

LAN: Ethernet IEEE 802.3, IEEE802.5, IEEE802.11,Bridges. Error detection and correction–Forward Error Correction –Flow Control and Error control techniques - Stop and wait – Go back N ARQ – Selective repeat ARQ - sliding window techniques – HDLC.

UNIT III NETWORK LAYER 9

Internetworks – Packet Switching and Datagram approach – IP addressing methods – IPv6– Subnetting – Routing – Distance Vector Routing, Link State Routing, Quality of services (QOS) – methods to improve QOS parameters.

UNIT IV TRANSPORT LAYER 9

Overview of Transport layer– Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) - Reliable byte stream (TCP) –- Connection management -Transmission Control Protocol(TCP) – Congestion Control– RSVP

UNIT V APPLICATION LAYER AND SECURITY 9

Domain Name Space (DNS), Simple Mail Transfer Protocol (SMTP), File Transfer Protocol(FTP), HTTP, WWW Network security and cryptography: Symmetric key cryptography – Data Encryption standard & Advanced Encryption Standard, Asymmetric key cryptography.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS

1. PC to PC Communication
2. Ethernet LAN protocol
3. To create scenario and study the performance of CSMA/CD protocol through simulation
4. Token bus and token ring protocols
5. To create scenario and study the performance of token bus and token ring protocols through simulation
6. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
7. Implementation and study of stop and wait protocol
8. Implementation and study of Goback-N and selective repeat protocols
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Behrouz. A.Foruzan	Data communication and Networking	Tata McGraw-Hill	2013
2.	Andrew S.Tannenbaum	Computer Networks	PHI	2003

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James. F.Kurouse & W.Rouse	Computer networking: A Top down Approach Featuring	Addison Wesley	2009
2.	Larry. L.Peterson & Peter. S.Davie	Computer Networks	Harcourt Asia Pvt. Ltd	2007
3.	Bhushan Trivedi	Computer Networks	Oxford University Press	2012
4.	Ajit Pal	Data communication and Computer Networks	PHI Learning Private Limited	2014
5.	Chwan-Hwa (John) Wu, J. David Irwin	Introduction to Computer Networks and Cybersecurity	CRC Press	2012

WEB URLs:

1. www.nptel.ac.in/courses/106105081/1
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3. www.nptel.ac.in/courses/106105081/3
4. www.nptel.ac.in/courses/106105081/9
5. www.nptel.ac.in/courses/106105081/13

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16ECD16 DIGITAL IMAGE PROCESSING L T P C 3 0 0 3

COURSE OBJECTIVES

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- To learn Wavelets and Image compression
- Learn to represent image in form of features

COURSE OUTCOMES

16ECD16.CO1	Explain the fundamentals of image processing
16ECD16.CO2	Apply image processing enhancement techniques in both the spatial and frequency domain
16ECD16.CO3	Apply image processing segmentation and restoration techniques
16ECD16.CO4	Develop algorithms for image compression
16ECD16.CO5	Explain the image analysis techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD16.CO1	x	x	x		x				x			x		x	
16ECD16.CO2	x	x	x	x	x				x			x		x	
16ECD16.CO3	x	x	x	x	x				x			x		x	
16ECD16.CO4	x	x	x	x	x				x			x		x	
16ECD16.CO5	x	x	x	x	x				x			x		x	

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color Coordinate Systems –RGB, HSI, L*a*b* and Color conversion, Image Transforms, Introduction to Fourier Transform ,2 D DFT, DCT, Hadamard, Haar, KL Transform.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Contrast Stretching, Digital Negative, Intensity level Slicing, Bit Extraction ,log transformation, Histogram processing , Equalization and Specification, of Spatial Filtering– Smoothing- Smoothing linear filters, Non linear filters, Sharpening Spatial Filtering –Foundation, the Laplacian, Unsharp Masking and High boost filtering, Frequency Domain: Smoothing and Sharpening frequency domain filters – Ideal, Butterworth , Gaussian filters and Homomorphic filtering.

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

Image Restoration :Noise models, Degradation model , Algebraic approach to Restoration – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering ,Least Mean Square Filtering, Constrained Least Squares Restoration– Wiener filtering Segmentation: Detection of Discontinuities: Lines and Edges –Edge Linking, Hough Transform and Boundary detection – Region based segmentation- Morphological processing- erosion , dilation, Opening Image Restoration :Noise models, and Closing.

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Sub band coding - Multiresolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding , LZW, Bit-Plane Coding , Lossless Predictive Coding – Lossy Compression, Lossy Predictive Coding – Compression Standards: JPEG, MPEG, Basics of Vector quantization.

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UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors –Topological feature, Texture - Patterns and Pattern classes - Recognition based on decision –theoretic methods: Matching, optimum statically classifiers and Neural network.

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.C. Gonzalez & R.E. Woods	Digital Image Processing	Pearson education	2015.
2.	A K Jain	Fundamentals of Digital Image Processing	Pearson	2013

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins	Digital Image Processing Using MATLAB	McGraw Hill	2011
2.	Anil Jain K	Fundamentals of Digital Image Processing	PHI	2011
3.	Willliam K Pratt	Digital Image Processing	Tata McGraw Hill	2002
4.	Malay K. Pakhira	Digital Image Processing and Pattern Recognition	PHI	2011
5.	S.Sridhar	Digital Image Processing	Oxford Higher Education	2011

WEB URLs:

1. www.youtube.com/watch?v=CVV0TvNK6pk
2. www.youtube.com/wa
3. www.youtube.com/watch?v=gIQ6S8U6Vpc
4. www.youtube.com/watch?v=IcBzsP-fvPo
5. www.youtube.com/watch?v=IcBzsP-fvPo

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16ECD17 **RF AND MICROWAVE ENGINEERING** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To inculcate understanding of the basics required for circuit representation of RF networks.
- To deal with the issues in the design of microwave amplifier.
- To understand various passive and active Microwave Devices.
- To understand microwave generation methods.
- To deal with the microwave measurement techniques

COURSE OUTCOMES

16ECD17.CO1	Explain the properties of S parameter
16ECD17.CO2	Construct matching networks
16ECD17.CO3	Compute the S parameters of microwave passive devices
16ECD17.CO4	Explain the concept of various microwave signal generators
16ECD17.CO5	Use microwave test bench and measuring instruments

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD17.CO1	x	x	x		x	x		x	x		x	x	x	x	x
16ECD17.CO2	x	x	x		x	x		x	x		x	x	x	x	x
16ECD17.CO3	x	x	x		x	x		x	x		x	x	x	x	x
16ECD17.CO4	x	x	x		x	x		x	x		x	x	x	x	x
16ECD17.CO5	x	x	x		x	x		x	x		x	x	x	x	x

UNIT I **TWO PORT NETWORK THEORY** 9

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, RF behavior of Resistors, Capacitors and Inductors.

UNIT II **RF AMPLIFIERS AND MATCHING NETWORKS** 9

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR Circle, matching using discrete components, Two component matching Networks, Microstrip Line Matching Networks.

UNIT III **PASSIVE AND ACTIVE MICROWAVE DEVICES** 9

Attenuators, Phase shifters, Directional couplers, E-plane , H-Plane and Magic Tee, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal diode detector, PIN diode switch, Gunn diode oscillator.

UNIT IV **MICROWAVE GENERATION** 9

High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical Cavity, Backward wave, Crossed field amplifier and oscillator.

UNIT V **MICROWAVE MEASUREMENTS** 9

Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS

1. Reflex klystron characteristics
2. Gunn diode characteristics
3. Measurement of Frequency and Wavelength
4. Measurement of VSWR
5. Directional Coupler Characteristics.
6. Radiation Pattern of Horn Antenna.
7. Radiation Pattern of Parabolic Antenna.
8. S-parameter Measurement of Isolator ,Circulator
9. Characteristics of E plane Tee, H Plane Tee, Magic Tee
10. Measurement of Attenuation

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Reinhold Ludwig and Gene Bogdanov	RF Circuit Design: Theory and Applications	Pearson Education	2011
2.	Robert E Colin	Foundations for Microwave Engineering	John Wiley & Sons	2007

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David M. Pozar	Microwave Engineering	Wiley India (P) Ltd	2011
2.	Thomas H Lee	Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits	Cambridge University Press	2004
3.	Mathew M Radmanesh	RF and Microwave Electronics	Prentice Hall	2001
4.	Annapurna Das and Sisir K Das	Microwave Engineering	Tata Mc Graw Hill	2009
5.	Ahmad Shahid Khan	Microwave Engineering: Concepts and Fundamentals	CRC Press	2017

WEB URLs

1. www.nptel.ac.in/courses/117101119/2
2. www.nptel.ac.in/courses/117101119/6
3. www.nptel.ac.in/courses/117101119/10
4. www.nptel.ac.in/courses/117101119/15
5. www.nptel.ac.in/courses/117101119/23

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16ECD18 **OPTICAL FIBER COMMUNICATION** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

COURSE OUTCOME

16ECD18.CO1 Classify the optical fiber structures and its fabrication techniques
16ECD18.CO2 Analyze optical fiber transmission characteristics
16ECD18.CO3 Select the optical source for free space communications
16ECD18.CO4 Select the optical detectors to produce low noise Signal to Noise Ratio
16ECD18.CO5 Analyze the characteristics of optical network components

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD18.CO1	x	x	x	x	x	x		x	x		x	x	x	x	x
16ECD18.CO2	x	x	x	x	x	x		x	x		x	x	x	x	x
16ECD18.CO3	x	x	x	x	x	x		x	x		x	x	x	x	x
16ECD18.CO4	x	x	x	x	x	x		x	x		x	x	x	x	x
16ECD18.CO5	x	x	x	x	x	x		x	x		x	x	x	x	x

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Introduction, light propagation in optical fibers, ray and mode theory of light, optical fiber structure and parameters, fiber materials, fiber fabrication techniques, optical signal attenuation mechanisms, merits and demerits of guided and unguided optical signal transmissions.

UNIT II TRANSMISSION CHARACTERISTICS 9

Optical signal distortion – Group delay, material dispersion, waveguide dispersion, polarization mode dispersion, intermodal dispersion, profile dispersion, fiber types, Standard Singlemode Fibers, Dispersion Shifted Fibers, Dispersion Flattened Fibers, Polarization Maintaining Fibers, Dispersion compensation, Principles of fiber nonlinearity.

UNIT III OPTICAL TRANSMITTERS 9

Light-emitting diodes, semiconductor laser diodes , longitudinal modes, gain and index-guiding, power-current characteristics, spectral behaviour, longitudinal mode control and tunability, noise, direct and external modulation, Laser sources and transmitters for free space communication.

UNIT IV OPTICAL RECEIVERS 9

Principles of optical detection, spectral responsivity, PIN Photodiode, avalanche photodiode (APD), Light Emitters As Detectors, preamplifier types, receiver noises, Signal to Noise Ratio (SNR) and Bit Error Rate (BER), Principles of coherent detection

UNIT V OPTICAL NETWORKING PRINCIPLES AND COMPONENTS 9

power and rise time budget.WDM optical networks, SONET/SDH/FDDI optical networks, layered optical network architecture, Optical couplers, filters, isolators, switches, optical amplifiers: erbium doped fiber amplifiers, semiconductor optical amplifiers.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS

1. Fiber optic Analog and Digital Link
2. Characteristics of LED and PIN Photo diode
3. Study the characteristics of Laser Diodes
4. Measurement of connector ,bending and Propagation losses
5. Numerical Aperture determination for Fibers
6. Attenuation Measurement in Fibers
7. Observation of Eye Pattern
8. Optical Fiber Wavelength Division Multiplexing & Demultiplexing technique

TOTAL: 30 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gerd Kaiser	Optical Fiber Communications	3rd, McGraw Hill Publishers	2000
2.	Govind P. Agrawal	Fiber-Optic Communication Systems	Third Edition, John Wiley & Sons	2004

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John M. Senior	Optical Fiber Communications-Principles And Practice	Second Edition, Prentice-Hall Of India Pvt. Ltd	2007
2.	Rajiv Ramasamy& Kumar N. Sivarajan	Optical Networks – A Practical Perspective	2 Ed, Morgan Kauffman	2002
3.	Uyless Black	Optical Networks- Third Generation Transport Systems	Pearson Education Asia	2002
4.	John E. Midwinter	Optical Fibers for Transmission Pure & Applied Optics	Wiley-Blackwell	1979
5.	John Gowar	Optical Communication Systems	Prentice Hall PTR	1993

WEB URLs

1. www.freevideolectures.com/Course/3056/Advanced-Optical-Communication
2. www.freevideolectures.com/Course/2329/Wireless-Communication/14
3. www.youtube.com/watch?v=MBxFVBAzdMc
4. www.freevideolectures.com/Course/3102/Advanced-3G-and-4G-Wireless-Mobile-Communications
5. www.youtube.com/watch?v=-ymnQ5rpcYA

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16ECD19 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the basics of EMI
- To study EMI Sources
- To understand EMI problems
- To understand Solution methods in PCB
- To understand Measurement technique for emission and immunity

OUTCOMES

16ECD19.CO1 Explain the concept of EMI and EMC
16ECD19.CO2 Describe various EMI coupling methods
16ECD19.CO3 Construct filters to control EM
16ECD19.CO4 Select components for electromagnetic compatible PCBs
16ECD19.CO5 Describe EMI Standards

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD19.CO1	x	x	x				x					x		x	
16ECD19.CO2	x	x	x			x						x		x	
16ECD19.CO3	x	x	x		x	x						x		x	
16ECD19.CO4	x	x	x		x		x					x		x	
16ECD19.CO5	x	x	x			x						x		x	

UNIT I EMI/EMC CONCEPTS 9

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application

UNIT II EMI COUPLING PRINCIPLES 9

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.

UNIT III EMI CONTROL TECHNIQUES 9

Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

UNIT IV EMC DESIGN OF PCBS 9

EMI Suppression Cables-Absorptive, ribbon cables-Devices-Transient protection hybrid circuits, Component selection and mounting; PCB trace impedance; Routing; Cross talk control - Electromagnetic Pulse-Noise from relays and switches, Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS 9

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462.Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in Japan - comparisons. EN Emission and Susceptibility standards and Specifications

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. V.P. Kodali	Engineering Electromagnetic Compatibility	IEEE Publication, S. Chand & Co. Ltd.	2001
2.	Clayton R.Paul	Introduction to Electromagnetic Compatibility	John Wiley Publications	2008

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Henry W.Ott.	Noise Reduction Techniques in Electronic Systems	John Wiley & Sons	2008
2.	Bemhard Keiser	Principles of Electromagnetic Compatibility	Oxford University Press	, 2005
3.	Xingcun Colin Tong	Advanced Materials and Design for Electromagnetic Interference Shielding	CRC Press	2008
4.	David A. Weston	Electromagnetic Compatibility: Methods, Analysis, Circuits, and Measurement.	CRC Press	2016
5.	Donald G. Baker	Electromagnetic Compatibility: Analysis and Case Studies in Transportation	Wiley Publishers	2015

WEB URLs

1. www.youtube.com/playlist?list=PL8h307Ml6hQqwqzYxiGntCiBVa-mcxdOO
2. www.freevideolectures.com/Course/2271/Physics-I-Oscillations-and-Waves/15
3. www.freevideolectures.com/Course/2271/Physics-I-Oscillations-and-Waves/16
4. www.freevideolectures.com/Course/2271/Physics-I-Oscillations-and-Waves/37
5. www.freevideolectures.com/Course/2271/Physics-I-Oscillations-and-Waves/42

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16ECD20 **CELLULAR AND MOBILE COMMUNICATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To have an insight into the various wireless channel models and the diversity techniques in mobile communication.
- To understand the basic cellular system concepts.
- To gain knowledge of the various cellular mobile standards.
- To understand the basic mobile radio Concepts.
- To understand the concepts of Speech coding Techniques.

COURSE OUTCOMES

16ECD20.CO1 Explain multiple access techniques and cellular concept
16ECD20.CO2 Analyze different Mobile radio propagation models
16ECD20.CO3 Explain various modulation techniques used in Mobile communication
16ECD20.CO4 Summarize the working of GSM and CDMA Technology
16ECD20.CO5 Describe the evolution of Cellular Network Standards

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD20.CO1	x	x	x			x						x		x	
16ECD20.CO2	x	x	x			1						x		x	
16ECD20.CO3	x	x	x			x						x		x	
16ECD20.CO4	x	x	x			x						x		x	
16ECD20.CO5	x	x	x			x						x		x	

UNITI **MULTIPLE ACCESS TECHNIQUES AND CELLULAR CONCEPT** 9

Multiple Access Techniques: FDMA-TDMA-spread spectrum multiple access-CDMA- SDMA-CSMA protocols-Cellular Concept: Frequency reuse-channel assignment- handoff-Interference and system capacity-tracking and grade of service-Improving Coverage and capacity in Cellular systems

UNITII **MOBILE RADIO PROPAGATION** 9

Free space propagation model- relating power to electric field -Propagation mechanisms-reflection-Groundreflectionmodel-diffraction-scattering- link budget design using path loss models-Small scale Multipath propagation-Impulse response model of a multi-path channel-Small scale Multipath measurements-parameters of Mobile multipath channels-types of small scale fading-

UNITIII **MODULATION TECHNIQUES-DIVERSITYAND ANTENNAS** 9

Modulation Techniques: Binary frequency shift keying- Minimum Shift Keying- Gaussian MSK-Orthogonal Frequency Division Multiplexing- Diversity reception—Types of diversity-RAKE receiver-Basic combining methods-Base station and mobile station antennas.

UNITIV **SPEECH CODING** 9

Characteristicsofspeechsignals-Quantizationtechniques-AdaptiveDifferential pulse code modulation (ADPCM)-Frequency domain coding of speech Vocoders- Linear Predictive Coders-Selection of Speech Codec for Mobile Communication- GSM Codec-USDC Codec-Performance evaluation

UNITV **CELLULAR STANDARDS** 9

AMPS- GSM-Architecture-Channels and Frame structure- GPRS- EDGE- CDMA standards (IS-95)-Forward CDMA channel and reverse CDMA channel–W-CDMA- Layer architecture

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	T.S.Rappaport	Wireless Communications	Thomson Learning	2003
2.	Vijay K-Garg	Mobile and Cellular Telecommunications Analog and Digital Systems	Pearson Education	2003

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dharma Prakash Agarwal and Qing	Introduction to Wireless and Mobile Systems	Cengage Learning	2011
2.	William C.Y.Lee	Mobile and Cellular Telecommunications Analog and Digital Systems	Tata Mc Graw Hill	2006
3.	Tse & Viswanath	Cellular Communication	Cambridge University Press	2005
4.	Schiller	Mobile Communications	Pearson Education	2005
5.	Andrea Goldsmith	Wireless Communications	Cambridge University Press	2005

WEB URLs

1. www.nptel.ac.in/courses/117102062/4
2. www.nptel.ac.in/courses/117102062/
3. www.youtube.com/watch?v=whYljse4Abc
4. www.youtube.com/watch?v=QHDxbbc1GWs
5. www.nptelvideos.in/2012/12/wireless-communication.html

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16ECD21 **CONTROL SYSTEMS** **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis concepts
- To introduce compensator techniques and state variable representation of physical systems

COURSE OUTCOMES

16ECD21.CO1 Explain different types of systems and their algebraic equations
16ECD21.CO2 Predict the transient performance parameters of the system
16ECD21.CO3 Analyze the nature of stability of the system in frequency domain
16ECD21.CO4 Analyze the system response and stability in time domain
16ECD21.CO5 Analyze state variable models

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECD21.CO1	x	x	x	x	x	x			x		x	x	x	x	x
16ECD21.CO2	x	x	x	x	x	x			x		x	x	x	x	x
16ECD21.CO3	x	x	x	x	x	x			x		x	x	x	x	x
16ECD21.CO4	x	x	x	x	x	x			x		x	x	x	x	x
16ECD21.CO5	x	x	x	x	x	x			x		x	x	x	x	x

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error - Effects of P, PI, PID modes of feedback control –Time response analysis using MATLAB (only simulation).

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications – Lag, lead and lag-lead networks – Lag, lead and lag-lead compensator design using bode plots.

UNIT IV STABILITY AND COMPENSATOR DESIGN 9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion– Effects of addition of poles and zeros – Root locus construction - applications of Root locus.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – sample and Hold Circuit.

TOTAL: 45 Hrs

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LIST OF EXPERIMENTS:

1. Determination of transfer functions of DC Servomotor
2. Determination of transfer functions of AC Servomotor.
3. DC Motor Position Control Systems
4. AC Motor Position Control Systems
5. Open loop and closed loop response of first order type - 0 and type – 1 system
6. Stepper motor position control systems
7. Digital Simulation Determination of step response and impulse response for first order & second order system with unity feedback using MATLAB.
8. (i)Digital Simulation of stability analysis using Root Locus Techniques
   (ii) Digital Simulation of stability analysis using bode plot
   (iii)Digital Simulation of stability analysis using Nyquist plot
9. Digital design Lag, Lead and Lag-Lead Compensators
10. Digital design of P, PI and PID controllers
11. Synchro Transmitter and Receiver Characteristics

TOTAL: 30 Hrs

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Gopal	Control Systems, Principles and Design	Tata McGraw Hill	2012
2.	S.K. Bhattacharya	Control System Engineering	Pearson education	2013.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arthur, G.O.Mutambara	Design and Analysis of Control; Systems	CRC Press	2009
2.	Richard C. Dorf and Robert H. Bishop	Modern Control Systems	Pearson Prentice Hall	2012
3.	Benjamin C. Kuo	Automatic Control systems	PHI press	2010.
4.	K. Ogata	Modern Control Engineering	PHI press	2012
5.	S.N.Sivanandam, S.N.Deepa	Control System Engineering using Mat Lab	Vikas Publishing	2012

WEB URLs:

1. www.nptel.ac.in/courses/108101037/3
2. www.nptel.ac.in/courses/108101037/7
3. www.youtube.com/watch?v=vVFDm__CdQw
4. www.nptel.ac.in/courses/108101037/20
5. www.freevideolectures.com/Course/3116/Control-Engineering-I/10

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16 ECE01 **RADAR AND NAVIGATIONAL AIDS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of Radar and its equations
- To apply Doppler principle and describe the different types of Radar and their working
- To describe Radar signal Detection techniques and propagation related to radars
- To understand principles of navigation, in addition to approach and landing aids as related to navigation
- To illustrate principles of antennas and propagation as related to radars, also study of transmitters and receivers.

COURSE OUTCOMES

16ECE01.CO1 Explain principle of navigation and detection of targets in RADAR
16ECE01.CO2 Apply the principle of Doppler RADAR to track moving targets
16ECE01.CO3 Outline the process of RADAR signal detections
16ECE01.CO4 Use the Radio Navigation techniques
16ECE01.CO5 Analyze RADAR receiver signals

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE01.CO1	x	x	x		x				x			x			
16ECE01.CO2	x	x	x						x				x		
16ECE01.CO3	x	x	x		x						x	x		x	
16ECE01.CO4	x	x	x		x						x	x		x	
16ECE01.CO5	x	x	x		x							x	x	x	

UNIT-I **RADAR EQUATIONS** **9**

RADAR Block Diagram & operation- RADAR Frequencies- RADAR Equation- Detection of signals in Noise-RADAR cross section of targets- RADAR cross section fluctuations- transmitter power- pulse repetition frequency- system losses and propagation effects.

UNIT-II **MTI AND PULSE DOPPLER RADAR** **9**

Introduction to Doppler & MTI RADAR- Delay Line canceller- Moving Target Detector- Pulse Doppler RADAR- Non-Coherent MTE- CW RADAR- FMCW RADAR- Tracking RADAR- Mono pulse Tracking – Conical Scan and Sequential Lobing.

UNIT-III **RADAR SIGNAL DETECTION AND PROPAGATION ON WAVES** **9**

Detection criteria- automatic detection- constant false alarm rate receiver- information available from a RADAR- ambiguity diagram- pulse compression- introduction to clutter- surface clutter RADAR equation anomalous propagation and diffraction.

UNIT-IV **RADIO NAVIGATION** **9**

Adcock directional finder- automatic directional finder- hyperbolic Systems of Navigation- Loren and Decca Navigation System- Tactical Air Navigation. Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.

UNIT-V **RADAR TRANSMITTER AND RECEIVER** **9**

Linear beam power tubes- Solid state RF power sources- solid state devices used in RADAR- Magnetron crossed field amplifiers- other aspects of radar transmitter- RADAR Receiver- Receiver noise figure- super heterodyne receiver- dynamic range- RADAR Displays.

TOTAL: 45 Hrs

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TEXTBOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Merrill I. Skolnik	Introduction to Radar Systems	Tata Mc Graw-Hill-3rd edition	2003
2.	N.S.Nagaraja	Elements of Electronic Navigation Systems	Tata Mc Graw-Hill-2nd edition	2000

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peyton Z. Peebles	Radar Principles	John Wiley	2004
2.	J.C Toomay	Principles of Radar	Prentice Hall of India Pvt., Ltd., New Delhi	2004
3.	Roger J. Sullivan	Radar Foundations for Imaging and Advanced Topics	SciTech Publishing Inc	2004
4.	Sen & Bhattacharya	Radar Systems and Radio Aids to Navigation	Khanna publishers	2005
5.	Brookner	RADAR Technology	Artech Hons	1986

WEB URLs:

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2. www.nptel.ac.in/courses/101108056/module6/lecture11.pdf
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5. www.vssut.ac.in/lecture_notes/lecture1428280600.pdf

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16 ECE02 **HIGH SPEED NETWORKS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To have an insight into the various ISDN and Broadband ISDN techniques in High speed Networks.
- To understand the Packet switching Networks and ATM concepts.
- To gain knowledge of the various Frame Relay
- To know the advanced Network Architecture standards.
- To gain knowledge of Bluetooth Technology.

COURSE OUTCOMES

16ECE02.CO1 Describe ISDN and B-ISDN architecture and protocols
16ECE02.CO2 Analyze packet switched networks and ATM
16ECE02.CO3 Explain the concept of congestion control in frame relay protocol
16ECE02.CO4 Summarize integrated and differentiated services
16ECE02.CO5 Discuss about Bluetooth protocol stacks

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE02.CO1	x	x	x	x	x	x		x	x			x	x	x	x
16ECE02.CO2	x	x	x	x	x	x		x	x			x	x	x	x
16ECE02.CO3	x	x	x	x	x	x		x	x			x	x	x	x
16ECE02.CO4	x	x	x	x	x	x		x	x			x	x	x	x
16ECE02.CO5	x	x	x	x	x	x		x	x			x	x	x	x

UNIT I **ISDN AND BROADBAND ISDN** **9**

ISDN – overview – interfaces and functions – Layers and services – Signaling System 7 –Broadband ISDN architecture and Protocols.

UNIT II **PACKET SWITCHED NETWORKS AND ATM** **9**

FDDI – DQDB – SMDS: Internetworking with SMDS, ATM: Main features – addressing –signaling and routing – ATM header structure –adaptation layer – management and control –ATM switching and transmission

UNIT III **FRAME RELAY** **9**

Frame Relay Protocols and services – Congestion control – Internetworking with ATM –Internet and ATM – Frame relay via ATM.

UNIT IV **ADVANCED NETWORK ARCHITECTURE** **9**

IP forwarding architectures overlay model – Multi Protocol Label Switching (MPLS) – integrated services in the Internet – Resource Reservation Protocol (RSVP) – Differentiated services.

UNIT V **BLUE TOOTH TECHNOLOGY** **9**

The Blue tooth module – Protocol stack Part I: Antennas – Radio interface – Base band – The Link controller – The Link Manager – The Host controller interface The Blue tooth module – Protocol stack Part II: Logical link control and adaptation protocol – RFCOMM – Service discovery protocol – Wireless access protocol.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jean Warland	High Performance Communication Networks	Pearson education	2002
2.	SumitKasera	ATM Networks	Tata McGraw - Hill	2002

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William Stallings	ISDN and Broadband ISDN with Frame Relay and ATM	Pearson education	2002
2.	Leon Gracia	Communication Networks	Tata McGraw	2017
3.	Jennifer Bray	Charles Sturman	Prentice Hall	2007
4.	John. C. Bellamy	Digital Telephony	John Wiley & Sons	2000
5.	Behrouz Forouzan	Introduction to Data Communication and Networking	Tata Mc-Graw Hill	1996

WEB URLs

1. nptel.ac.in/courses/106105081/1
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3. nptel.ac.in/courses/106105080/pdf/M5L5.pdf
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16ECE03 **WIRELESS SENSOR NETWORKS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To be aware of the Challenges of Wireless Sensor Networks.
- To be aware of the Architecture of Wireless Sensor Networks.
- To get familiarized with different MAC protocols in Wireless Sensor Networks.
- To get familiarized with different network Components in Wireless Sensor Networks.
- To provide advanced knowledge of wideband wireless communication techniques

COURSE OUTCOMES

16ECE03.CO1 Recognize the significances of sensor network mechanisms
16ECE03.CO2 Describe the wireless sensor networks architecture
16ECE03.CO3 Analyze the communication protocols of wireless sensor networks
16ECE03.CO4 Explain the concept of localization and positioning in wireless sensor networks
16ECE03.CO5 Evaluate the Quality of Service parameters of wireless sensor networks

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE03.CO1	x	x	x						x			x		x	
16ECE03.CO2	x	x	x		x				x			x		x	
16ECE03.CO3	x	x	x		x				x			x		x	
16ECE03.CO4	x	x	x		x				x			x		x	
16ECE03.CO5	x	x	x		x				x			x		x	

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Wireless sensor networks: definition, advantages, characteristics features, applications, constraints and challenges, required mechanisms - Field uses - enabling technologies, Characteristics of Wireless channel, Emerging technologies for wireless networks, Sensor Networks Applications.

UNIT II WIRELESS SENSOR NETWORK ARCHITECTURES 9

Single - Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles and service interfaces, Gateway Concepts.

UNIT III COMMUNICATION PROTOCOLS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols, Low Duty Cycle Protocols and Wakeup Concepts – Schedule-based protocols, The Mediation Device Protocol, Address and Name Management, Assignment of MAC Addresses, Time synchronization, Routing Protocols- Attribute-based or Data-centric Routing Protocols – SPIN - Hierarchical Routing Protocols - Low Energy Adaptive Clustering Hierarchy - Power-Efficient Gathering in Sensor Information Systems - Threshold Sensitive Energy Efficient Sensor Network Protocol, Geographic Routing - Greedy Algorithms - Geographic Adaptive Fidelity

UNIT IV LOCALIZATION AND POSITIONING 9

Properties of localization and positioning - Possible approaches - Single-hop localization - Positioning in multi-hop environments, Topology Control - Controlling topology in flat networks – Power Control - Hierarchical networks by dominating sets and clustering - Combining hierarchical topologies and power control - Adaptive node activity

UNIT V TRANSPORT LAYER AND QUALITY OF SERVICE 9

Coverage and deployment - Reliable data transport - Single packet delivery - Block delivery - Congestion control and rate control, Advanced application support, Security and Application-specific support, Sensor network programming Challenges, ns2 Simulators.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Holger Karl & Andreas Willig	Protocols And Architectures for Wireless Sensor Networks	John Wiley	2005
2.	Feng Zhao & Leonidas J. Guibas	Wireless Sensor Networks- An Information Processing Approach	Wireless Sensor Networks- An Information Processing Approach	2007

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Waltenegus Dargie, Christian Poellabauer	Fundamentals of wireless sensor networks : Theory and Practice	John Wiley	2010
2.	Sunil Gupta and Dr. Harsh K. Verma	Wireless Sensor Networks	Katson	2014
3.	Robert Faludi	Building Wireless Sensor Networks	O'Reilly	2011
4.	S. Swapna Kumar	A Guide to Wireless Sensor Networks	Lakshmi Publications	2013
5.	Shuang-Hua Yang	Wireless Sensor Networks	Springer	2013

WEB URLs

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3. www.nptel.ac.in/courses/114106035/37
4. www.nptel.ac.in/courses/117104118/
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16ECE04 **BIO MEDICAL ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Understand the Human physiology and components of biomedical system
- To get exposed to electro physiological parameter measurements
- To get exposed to non-electro physiological parameter measurements
- To know about medical imaging and biotelemetry systems
- To Understand the principle of operation of Therapeutic equipments

COURSE OUTCOMES

16ECE04.CO1 Explain Human physiology and components of biomedical system
16ECE04.CO2 Discuss the electro physiological parameter measurements
16ECE04.CO3 Describe the non - electro physiological parameter measurements
16ECE04.CO4 Operate of medical imaging and biotelemetry systems
16ECE04.CO5 Explain the principles of operation of Therapeutic equipments

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE04.CO1	x	x	x			x			x		x	x	x	x	x
16ECE04.CO2	x	x	x			x			x		x	x	x	x	x
16ECE04.CO3	x	x	x			x			x		x	x	x	x	x
16ECE04.CO4	x	x	x			x			x		x	x	x	x	x
16ECE04.CO5	x	x	x			x			x		x	x	x	x	x

UNIT I **PHYSIOLOGY AND TRANSDUCERS** 9

Cell and its structure - Resting and Action Potential - Nervous system: Functional organization of the nervous system - Structure of nervous system, neurons - synapse - transmitters and neural communication - Cardiovascular system - respiratory system , Basic components of a biomedical system .Transducers - selection criteria – Piezo electric, ultrasonic transducers ,Temperature measurements , Fibre optic temperature sensors.

UNIT II **ELECTRO – PHYSIOLOGICAL MEASUREMENTS** 9

Electrodes - Limb electrodes-floating electrodes - pregelled disposable electrodes - micro- needle and surface electrodes - Amplifiers: Preamplifiers- differential amplifiers- chopper amplifiers -Isolation amplifier. Physiological measurements-ECG, EEG, EMG, ERG - Lead systems and recording methods-Typical waveforms. Electrical safety in medical environment: shock hazards-leakage current.

UNIT III **NON-ELECTRICAL PARAMETER MEASUREMENTS** 9

Measurement of blood pressure -Cardiac output -Heart rate-Heart sounds-Pulmonary function measurements – spirometer -Photo Plethysmography- Body Plethysmography-Blood Gas analyzers - pH of blood - measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT IV **MEDICAL IMAGING AND BIOTELEMETRY** 9

Radio graphic and fluoroscopic techniques -Computer tomography-Magnetic Resonance Imaging - Ultrasonography-A mode, B mode ,M mode- Endoscopy-Thermography-Different types of biotelemetry systems and patient monitoring-Wireless Telemetry, single channel, multichannel, multi patient and implantable telemetry systems.

UNIT V **ASSISTING AND THERAPEUTIC EQUIPMENTS** 9

Pacemakers-External and internal pacemakers-Defibrillators-DC defibrillator, implantable defibrillators-Ventilators -Nerve and muscle stimulators -TENS-Surgical diathermy machine, safety aspects in Electro surgical units- Heart Lung machine- Audiometers-Dialysers-Lithotripsy.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.S.Khandpur	Hand Book of Bio-Medical instrumentation	Tata McGraw Hill Publishing Co Ltd	2004
2.	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer	Bio-Medical Instrumentation and Measurements	Pearson Education	2002

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.Arumugam	Bio-Medical Instrumentation	Anuradha Agencies	2003.
2.	L.A. Geddes and L.E.Baker	Principles of Applied Bio-Medical Instrumentation	John Wiley & Sons	1975
3.	J.Webster	Medical Instrumentation	John Wiley & Sons	1995
4.	William R Hendee, E. Russell Ritenour	Medical Imaging Physics	John Wiley & Sons	2002
5.	Paul Suetens	Fundamentals of Medical Imaging	Cambridge University press	2009

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2. www.nptel.ac.in/courses/108102041/
3. www.nptel.ac.in/courses/103105054/
4. www.technicalsymposium.com/alllecturenotes_biomed.html
5. www.nptelvideos.in/2012/11/biochemical-engineering.html

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16ECE05 **BIO SIGNAL AND IMAGE PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand various bio signals to acquainted and methods of capturing them.
- To understand various the biomedical systems and will be able to analyze analog signals.
- Know the different compression techniques of bio signals.
- To study the various image processing algorithms and techniques.
- To explore the applications of image processing.

COURSE OUTCOMES

16ECE05.CO1 Discuss different types of bio medical signal and its spectral components
16ECE05.CO2 Test filter performance on bio medical signals
16ECE05.CO3 Identify physiological interferences and artifacts affect in bio signals
16ECE05.CO4 Apply image processing enhancement techniques in both the spatial and frequency domain
16ECE05.CO5 Describe the principle of operation of Therapeutic equipments

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE05.CO1	x	x	x		x				x					x	
16ECE05.CO2	x	x	x		x				x					x	
16ECE05.CO3	x	x	x		x				x					x	
16ECE05.CO4	x	x	x	x	x				x			x		x	
16ECE05.CO5	x	x	x	x					x			x		x	

UNIT I **INTRODUCTION TO BIO- SIGNALS AND THEIR ACQUISITION** **9**

Origin of bio-signal, action potential, nerve and muscle cells and their electrical activity, electrical activity of the heart, genesis of ECG, ECG lead systems, electrical activity of the brain, EEG signal and its acquisition, EMG signals and its acquisition. Sources of contamination and variation of bio signals.

UNIT II **ANALOG SIGNAL PROCESSING OF BIO-SIGNALS** **9**

Biomedical instrumentation systems, biomedical transducers, electrodes and their characteristics, instrumentation amplifier, isolation amplifier, active filters(commonly used topologies), ADC, aliasing effect, anti-aliasing filters, grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding with reference to Biomedical equipment.

UNIT III **DIGITAL SIGNAL PROCESSING OF BIO-SIGNALS** **9**

Review of FIR, IIR Filters, Weiner filters, adaptive filters, Model-based spectral analysis, AR, Eigen analysis spectral analysis, Time-frequency methods: Spectrogram, Wigner-Ville and other methods, Principal Component Analysis, Independent Component Analysis, Continuous Wavelet Transform, and Discrete Wavelet transform, Electrocardiogram: Signal analysis of event related potentials, morphological analysis of ECG waves, Envelope extraction and analysis of activity, application- Normal and Ectopic ECG beats, Phonocardiography

UNIT IV **MEDICAL IMAGE PROCESSING** **9**

Algorithms, Thresholding, Contrast Enhancement, SNR, Characteristics, Filtering, Histogram Modeling, Medical Image Visualization, Image Compression Models - Variable length coding, Huffman coding, Lossless predictive coding, Lossy predictive coding

UNIT V **APPLICATIONS OF MEDICAL IMAGING** **9**

Validation, Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Malmivuo & Robert	Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields	Oxford University Press, New York	1995
2.	John L Semmlow	Signals and Systems for Bioengineers	Academic Press	2012

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John L Semmlow	Biosignal and Biomedical Image Processing MATLAB-Based Applications-2nd Edition	Marcel Dekker, Inc	2008
2.	Rafel C Gonzalez, Richard E Woods	Digital Image Processing	Wesley Publishing Company, New Delhi,	2014
3.	Scott E Umbahgh	Digital Image Processing and Analysis	CRC Press	2010
4.	William R Hendee, E. Russell Ritenour	Medical Imaging Physics	John Wiley & Sons, Inc., New York	2003
5.	Paul Suetens	Fundamentals of Medical Imaging	Cambridge University press	2017

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3. www.nptel.ac.in/courses/108105091/1
4. www.nptel.ac.in/courses/108105091/2
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16ECE06 TELECOMMUNICATION SWITCHING NETWORKS L P T C 3 0 0 3

COURSE OBJECTIVES

- To introduce fundamentals functions of a telecom switching Systems
- To provide statistical modeling of telephone traffic and characteristics of blocking and queuing system
- To learn the various switching networks
- To introduce the concepts of Digital Switching Systems
- To study signaling, packet switching and networks.

COURSE OUTCOMES

16ECE06.CO1 Describe the Basic Switching concepts of telecommunication
16ECE06.CO2 Analyze fundamental telecommunication traffic models
16ECE06.CO3 Summarize the significance of switching networks
16ECE06.CO4 Explain the concepts of digital switching
16ECE06.CO5 Explain the signaling and packet switching techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE06.CO1	x	x	x						x			x			
16ECE06.CO2	x	x	x						x			x			x
16ECE06.CO3	x	x	x						x			x			x
16ECE06.CO4	x	x	x						x			x			x
16ECE06.CO5	x	x	x						x			x			x

UNIT I SWITCHING SYSTEMS 9

Evolution of Telecommunications; Basics of a Switching System; Functions of a Switching System; Crossbar Switching-Principle of Crossbar Switching; Crossbar Switch Configurations; Cross-Point Technology; Crossbar Exchange Organization; A General Trunking; Electronic Switching; Digital Switching Systems.

UNIT II TRAFFIC ENGINEERING 9

Congestion – Network traffic load and Parameters – Traffic measurement – Lost-call system – Grade of Service and Blocking probability – Modeling switching systems – Incoming traffic and service time characterization – Blocking models and loss estimates – Queuing systems – Simulation models.

UNIT III SWITCHING NETWORKS 9

Single Stage Networks; Gradings-Principle; Two Stage Networks; Three Stage Networks; Four Stage Networks – Gradings – Link systems – Grades of service of link systems – Application of graph theory to link systems – Use of expansion – Call packing – Rearrangeable networks – Strict-sense non-blocking networks – Sectionalized switching networks.

UNIT IV DIGITAL SWITCHING SYSTEMS 9

Space and time switching – Time-division switching networks – Grades of service of time-division switching networks— hybrid time and space division multiplexes – Non-blocking networks – Synchronization – Call-processing functions – Common control – Reliability, availability and security – Stored program control.

UNITV SIGNALING AND PACKET SWITCHING 9

Customer line signaling – FDM carrier systems – PCM signaling – Inter-register signaling – Common-channel signaling principles – CCITT signaling – Digital customer line signaling – Statistical multiplexing – Local area and wide area networks – Large scale and Broadband networks.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thiagarajan Viswanathan	Telecommunication Switching Systems and Networks	Prentice Hall of India Pvt. Ltd	2006
2.	William Stallings	Wireless Communication and Networks	Pearson Education, New Delhi	2004

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	J.E. . Flood	Telecommunications Switching, Traffic and Networks	Pearson Education Ltd	2006
2.	John C Bellamy	Digital Telephony	John Wiley	2000
3.	Behrouz Forouzan	Introduction to Data Communication and Networking	Tata Mc-Graw Hill New York	1996
4.	Tomasi	Introduction to Data Communication and Networking	Pearson Education	2007
5.	R.A.Thomson	Telephone switching Systems	Artech House Publishers	2000

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3. www nptel.ac.in/courses/117104104/
4. www nptel.ac.in/courses/117101050/25
5. www nptel.ac.in/courses/106105080/pdf/M4L1.pdf

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16ECE07 COGNITIVE RADIO NETWORKS **L P T C**
3 0 0 3

COURSE OBJECTIVES

- To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
- To enable the student to understand the essential of Primary Cognitive Radio functions, Behaviors, Components
- To enable the student to understand the location and environment awareness in Cognitive Radios
- To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication
- To expose the student to the evolving next generation wireless networks and their associated challenges

COURSE OUTCOMES

16ECE07.CO1 Explain the principles of the software defined radio
16ECE07.CO2 Describe the architecture of software defined radio
16ECE07.CO3 Explain the design considerations of cognitive radio
16ECE07.CO4 Demonstrate knowledge of spectrum sensing
16ECE07.CO5 Apply cross-layer design for cognitive radio

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE07.CO1	x	x	x	x			x					1	x		
16ECE07.CO2	x	x	1	x			x					x	x		
16ECE07.CO3	x	x	x	x			x					x	x		
16ECE07.CO4	x	x	x	x			x					x	x		
16ECE07.CO5	x	x	1	x			x					x	x		

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO 9

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications

UNIT II SDR ARCHITECTURE

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT III INTRODUCTION TO COGNITIVE RADIOS 9

Marking radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Qusay. H. Mahmoud.	Cognitive Networks: Towards Self Aware Network	John Wiley & Sons Ltd.	2007
2.	Markus Dillinger, KambizMadani, Nancy Alonistioti	Software Defined Radio	John Wiley	2003

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HuseyinArslan	Cognitive Radio, SDR and Adaptive System	Springer	2007
2.	Joseph Mitola	Cognitive Radio Architecture	John Wiley & Sons Ltd	2006
3.	Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu	Cognitive Radio Communication and Networks	Elsevier	2010
4.	J.Mitola	The Software Radio Architecture	IEEE Communications Magazine	1995
5.	J.Mitola	Cognitive Radio: An Integrated Agent Architecture for software defined radio	Royal Inst. Technology	2000

WEB URLs:

1. www.nptel.ac.in/courses/117102062/
2. www.nptel.ac.in/courses/117102062/5
3. www.nptel.ac.in/courses/117107035/1
4. www.nptel.ac.in/courses/117107035/2
5. www.nptel.ac.in/courses/117101002/1

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16ECE08 **RF MEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To acquire basic knowledge about application of MEMS in RF communications.
- To study about MEMS physical modeling and reconfigurable elements.
- To understand MEMS phase shifters
- To learn about Micromachined Transmission line and Antenna
- To study about the MEMS Filters and RF MEMS Filters

COURSE OUTCOMES

16ECE08.CO1 Explain the fabrication process of RF MEMS
16ECE08.CO2 Describe the properties of components used in MEMS
16ECE08.CO3 Summarize characteristics of various types of phase shifters
16ECE08.CO4 Explain the concept of Micro machined transmission line and antenna
16ECE08.CO5 Discuss various types of MEMS Filters

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE08.CO1	x	x	x						x			x		x	
16ECE08.CO2	x	x	x						x			x		x	
16ECE08.CO3	x	x	x	x								x		x	
16ECE08.CO4	x	x	x	x					x					x	
16ECE08.CO5	x	x	x	x								x		x	

UNIT I INTRODUCTION 9

Introduction to RF MEMS: application in wireless communications, space and defense Applications Overview of RF MEMS fabrication, design and testing-Introduction to Micro fabrication Techniques Materials properties-Bulk and surface micromachining-Wet and dry etching- Thin-film depositions (LPCVD, Sputtering, Evaporation). LIGA and Electroplating.

UNIT II MEMS 9

Physical Modeling Physical and practical aspects of RF circuit design: Impedance mismatch effects in RF MEMSRF/Microwave substrate properties: Micro machined – enhanced elements, MEM switches, Resonators. MEMS modeling. Switch parameters Actuation mechanisms - Bistable micro relays and micro actuators.

UNIT III MEMS INDUCTORS CAPACITORS AND PHASE SHIFTERS 9

MEMS Inductor: Effect of inductor layout - Modeling and design issues of planar inductor - MEMS Capacitor: Gap tuning and area tuning capacitors. Types of phase shifters and their limitations - MEMS Phase Shifter: Switched delay line phase shifter - Distributed MEMS phase shifter - Polymer based phase shifters.

UNIT IV MICROMACHINED TRANSMISSION LINES AND ANTENNA 9

Losses in transmission lines - Coplanar lines - Micro machined waveguide components - Micro machined directional coupler. Micro strip antennas - Micromachining techniques to improve antenna performance - Micromachining as a fabrication process for small antennas - Reconfigurable antennas.

UNIT V MEMS FILTERS RF MEMS FILTERS 9

Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMS filters – A Ka-Band millimeter-wave Micromachined tunable filter, A High-Q 8-MHz MEM Resonator filter, RF MEMS Oscillators – fundamentals, A 14-GHz MEM Oscillator, A Ka- Band Micromachined cavity oscillator, A 2.4 GHz MEMS based voltage controlled oscillator..

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	H.J.Delos Santos	RF MEMS circuit Design for Wireless Communications	Artech House.	2002
2.	G.M.Rebeiz	MEMS Theory, Design and Technology	John Wiley	2003

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V.K.Varadanetal	RF MEMS and their Applications	John Wiley	2003
2.	Mohamed Gad-el-Hak	**MEMS:** Introduction and Fundamentals	CRC Press	2005
3.	Mohamed Gad-el-Hak	**MEMS:** Applications	CRC Press	2005
4.	Stephen D.senturia	Microsystem Design	Springer	2000
5.	J.Allen	Micro Electro Mechanical System Design	CRC Press	2005

WEB URLs:

1. www.nptel.ac.in/courses/117105082/
2. www.nptel.ac.in/courses/117105082/4
3. www.nptelvideos.in/2012/12/mems-microsystems.html
4. www.textofvideo.nptel.iitm.ac.in/117105082/lec1.pdf
5. www.uio.no/studier/emner/matnat/ifi/INF5490/v12/.../LN05.pdf

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16ECE09 SOFT COMPUTING TECHNIQUES

L	P	T	C
3	0	0	3

COURSE OBJECTIVES

- To provide adequate knowledge about neural networks
- To teach about the concept of fuzzy involved in various systems
- To provide adequate knowledge about genetic algorithm
- To gain knowledge on Hybrid Computing Techniques
- To provide adequate knowledge to modeling the system

COURSE OUTCOMES

16ECE09.CO1 Describe basics of ANN and its learning algorithms
16ECE09.CO2 Explain the Fuzzy logic concept
16ECE09.CO3 Differentiate the Traditional algorithms and Genetic algorithms
16ECE09.CO4 Develop hybrid Computing Techniques
16ECE09.CO5 Solve the real time problems with MATLAB tool box

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE09.CO1	x	x	x		x				x		x			x	
16ECE09.CO2	x	x	x		x				x		x			x	
16ECE09.CO3	x	x	x	x	x				x		x			x	
16ECE09.CO4	x	x	x	x	x						x	x		x	
16ECE09.CO5	x	x	x		x						x	x		x	

UNIT I NEURAL NETWORKS 9

Fundamentals of Neural Networks – History- Architectures- Learning methods-XOR problem-Delta rule-derivation-Back propagation- applications- parameters in BPN- Associative memory – Hetero associative- BAM-energy function problems-applications of associative memories- ART1- ART2- applications of adaptive networks.

UNIT II BASIC CONCEPTS OF FUZZY LOGIC 9

Introduction to fuzzy logic, Classical sets and Fuzzy sets, Fuzzy relations, Membership function: Features of membership function, Fuzzification, Methods of membership value assignments- Fuzzy rules and reasoning: Fuzzy if-then rules. Fuzzy Inference Systems (FIS): Introduction– Methods of FIS: Mamdani, Sugeno and Tsukamoto. Defuzzification: Lambda-Cuts for fuzzy sets and fuzzy relations, Defuzzification methods.

UNIT III GENETIC ALGORITHMS 9

Fundamentals of Genetic Algorithms-Difference between Traditional Algorithms and Genetic Algorithms – creation of off springs – encoding – fitness function reproduction– Crossover- insertion& deletion- mutation-bitwise operators –applications- Multi-objective Genetic Algorithm (MOGA)- genetic algorithms in search and optimization, GA based clustering Algorithm.

UNIT IV HYBRID SOFT COMPUTING TECHNIQUES 9

Hybrid systems – Neuro Fuzzy Modelling -Applications of Neural Networks- Pattern Recognition and classification – Neuro Genetic hybrids – fuzzy Genetic hybrids- GA based weight determination and applications-fuzzy BPN – simplified fuzzy ARTMAP.
Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

UNIT V PROGRAMMING AND APPLICATIONS 9

Using Neural Network toolbox – Using Fuzzy Logic toolbox- Using Genetic Algorithm & directed search toolbox Application: Printed Character Recognition, Optimization of travelling salesman problem using genetic algorithm approach, Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.N.Sivanandam, S.N.Deepa	Principles of Soft Computing	Wiley	2014
2.	Rajasekaran.S and Vijayalakshmi Pai.G.A	Neural Networks, Fuzzy Logic and Genetic Algorithms	PHI	2011

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	J.S.R.Jang, C.T.Sun, E.Mizutani	Neuro – Fuzzy and Soft Computing	PHI Learning Pvt. Ltd	2012
2.	Timothy J.Ross	Fuzzy Logic with Engineering applications	John Wiley and Sons	2010
3.	Simon Haykin	Neural Networks Comprehensive Foundation	Pearson Education	2005
4.	Samir Roy, Udit Chakraborty	Neuro Fuzzy and Genetic Algorithms	Pearson Education	2013
5.	Davis E.Goldberg	Genetic Algorithms in Search, Optimization, and Machine Learning	Pearson Education	2009

WEB URLs:

1. http://nptel.ac.in/courses/117105084/
2. http://nptel.ac.in/courses/108104049/13
3. http://nptel.ac.in/courses/106106126/15
4. http://nptel.ac.in/courses/108104049/27
5. http://www.nptelvideos.in/2012/12/neural-networks-and-applications.html

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16ECE10 **NANO ELECTRONICS** L P T C 3 0 0 3

- To learn and understand basic concepts of Nano electronics
- To know the techniques of fabrication and measurement
- To know the properties of nano technology
- To gain knowledge about Nanostructure devices
- To gain knowledge of logic devices and application

COURSE OUTCOMES:

16ECE10.CO1 Describe the basics of Nano electronics
16ECE10.CO2 Explain the fabrication of nanostructures and nanodevices
16ECE10.CO3 Outline the properties of Nano electronics
16ECE10.CO4 Discuss the quantum mechanism in Nano Structure Devices
16ECE10.CO5 Design logic devices using Nano Electronics

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE10.CO1	x	x	x	x							x	x	1		
16ECE10.CO2	x	x	x	x	x	x			x					x	
16ECE10.CO3	x	x	x	x		x			x					x	
16ECE10.CO4	x	x	x	1	x	x			x					x	
16ECE10.CO5	x	x	x	x	x				x		x		x		

UNIT I INTRODUCTION TO NANOELECTRONICS 9

Microelectronics towards biomolecule electronics-Particles and waves- Wave-particle duality- Wave mechanics- Schrödinger wave equation- Wave mechanics of particles: – Atoms and atomic orbitals- Materials for nano electronics- Semiconductors- Crystal lattices: Bonding in crystals- Electron energy bands- Semiconductor hetero structures- Lattice-matched and pseudomorphic hetero structures- Inorganic-organic hetero structures- Carbon nanomaterials: nanotubes and fullerenes

UNIT II FABRICATION AND MEASUREMENT TECHNIQUES 9

Growth, fabrication, and measurement techniques for nanostructures- Bulk crystal and hetero structure growth- Nanolithography, etching, and other means for fabrication of nanostructures and nano devices- Techniques for characterization of nanostructures- Spontaneous formation and ordering of nanostructures- Clusters and nanocrystals- Methods of nanotube growth- Chemical and biological methods for nanoscale fabrication- Fabrication of nano-electromechanical systems

UNIT III PROPERTIES OF NANO MATERIALS 9

Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects-Magneto electronics – Magnetism and Magneto transport in Layered Structures-Organic Molecules – Electronic Structures, Properties, and Reactions- Neurons – The Molecular Basis of their Electrical Excitability-Circuit and System Design- Analysis by Diffraction and Fluorescence Methods-Scanning Probe Techniques

UNIT IV NANO STRUCTURE DEVICES 9

Electron transport in semiconductors and nanostructures- Time and length scales of the electrons in solids- Statistics of the electrons in solids and nanostructures- Density of states of electrons in nanostructures- Electron transport in nanostructures-Electrons in traditional low-dimensional structures- Electrons in quantum wells- Electrons in quantum wires- Electrons in quantum dots- Nanostructure devices- Resonant-tunneling diodes- Field-effect transistors- Single-electron-transfer devices- Potential-effect transistors- Light-emitting diodes and lasers- Nano-electromechanical system devices- Quantum-dot cellular automata

UNIT V LOGIC DEVICES AND APPLICATIONS 9

Logic Devices-Silicon MOSFETs-Ferroelectric Field Effect Transistors-Quantum Transport Devices Based on Resonant Tunneling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics- Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing- Molecular Electronics

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio	Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications	Cambridge University Press	2011
2.	SupriyoDatta	Lessons from Nanoelectronics: A New Perspective on Transport	World Scientific	2012

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karl Goser, Peter Glösekötter, Jan Dienstuhl	Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices	Springer	2004
2.	W. R. Fahrner	Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques	SpringerVerlag Berlin Heidelberg	2005
3.	Mark A. Reed, Takhee Lee	Molecular Nanoelectronics	American Scientific Publishers	2003
4.	Jaap Hoekstra	Introduction to Nanoelectronic Single-Electron Circuit Design	Pan Stanford Publishing	2010
5.	W. Ranier	Nano Electronics and Information Technology	John Wiley & Sons	2012

WEB URLs:

1. www.youtube.com/watch?v=tW1-fSRiAdc
2. www.dailymotion.com/video/x3ww9bs
3. www.news-medical.net/life-sciences/Properties-of-Nanoparticles.aspx
4. www.nptel.ac.in/courses/117108047/37
5. www.nptel.ac.in/courses/117108040/downloads/Programmable%20Logic%20Devices%20(PLD).pdf

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16ECE11 WIRELESS COMMUNICATION L T P C
3 0 0 3

COURSE OBJECTIVES

- Basic wireless, cellular concepts.
- Radio wave propagation and Mobile Channel models.
- Various performance analysis of mobile communication system
- Standards 1G, 2G Basic system available.
- Understand the various multiple antenna system

COURSE OUTCOME

16ECE11.CO1 Describe the cellular radio concepts such as frequency reuse and handoff
16ECE11.CO2 Analyze the mobile radio wave propagation models
16ECE11.CO3 Explain the small scale and multipath propagation
16ECE11.CO4 Explain the capacity, diversity and equalization techniques
16ECE11.CO5 Summarize the Wireless Systems and Standards

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE11.CO1	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECE11.CO2	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECE11.CO3	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECE11.CO4	x	x	x	x	x	x	x		x		x	x	x	x	x
16ECE11.CO5	x	x	x	x	x	x	x		x		x	x	x	x	x

UNIT I INTRODUCTION TO WIRELESS COMMUNICATION 9

Evolution of Mobile Radio Communication – Examples of Wireless Communication System – Cellular concept – Frequency Reuse – Channel assignment – Hand off – Interference & System capacity – Trunking and Erlang – capacity calculation – Improving coverage and capacity.

UNIT II MOBILE RADIO WAVE PROPAGATION 9

Radio wave Propagation – Transmit and receive Signal Models – Free Space path loss – Ray Tracing – Empirical Path loss models – Simplified path loss model – Shadow fading – Combine path loss and Shadowing – Outage Probability under path loss & shadowing – Cell coverage area.

UNIT III SMALL SCALE AND MULTIPATH PROPAGATION 9

Small Scale Multipath Propagation – Impulse response model of a Multipath Channel – Small Scale Multipath Measurements – Parameters of Mobile Multipath Channels – Types of fading (fading effects due to Multipath Time Delay Spread & Doppler spread) – Rayleigh and Ricean Distribution.

UNIT IV CAPACITY, DIVERSITY AND EQUALIZATION IN WIRELESS SYSTEM 9

Capacity in AWGN – Capacity of Flat Fading Channels – Channel and System Model – Channel Distribution Information known – CSI at Receiver Diversity Technique – Selection combining – EGC – MRC – Feedback – Time – Frequency – Rake Receiver – Interleaving. Equalization – Linear Equalization – Non linear (DFE & MLSE) – Algorithm of Adaptive Equalization – Zero Frequency algorithm – LMS algorithm – Recursive Least Square algorithm.

UNIT V WIRELESS SYSTEMS AND STANDARDS 9

AMPS & ETACS System overview – Call handling – GSM System – Services and features – Architecture – Radio Subsystem -- GSM Call – Frame Structure – Signal Processing – CDMA Digital Cellular Standard (IS-95) –

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Frequency & Channel Specification – Forward CDMA channel – Reverse CDMA channel. Introduction to OFDM system – Cyclic prefix – Matrix representation case study: IEEE 802.11a wireless LAN.

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rappaport T.S	Wireless Communications: Principles and Practice	Pearson education	2009
2.	William Stallings	Wireless Communication & Networking	Pearson education Asia	2009

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Feher K	Wireless Digital Communications	Prentice Hall	1995
2.	Schiller	Mobile Communication	Pearson Education Asia Ltd	2008
3.	Andrea Goldsmith	Wireless Communications	Cambridge University Press	2005
4.	Lee W.C.Y	Mobile Communications Engineering: Theory & Applications	McGraw Hill	1998
5.	Van Nee, R. and Ramji Prasad	OFDM for wireless multimedia communications	Artech House	2000

WEB URLs:

1. www.nptel.ac.in/courses/117102062/
2. www.youtube.com/watch?v=lBJdZzb2cl0
3. www.youtube.com/watch?v=XQDZn83-V2U
4. www.nptel.ac.in/courses/117102062/28
5. www.nptel.ac.in/courses/117104099/

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16ECE12 **SATELLITE COMMUNICATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Overview of satellite systems in relation to other terrestrial systems.
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.
- Study of DTH and compression standards

COURSE OUTCOMES

16ECE12.CO1 Analyze the satellite orbits
16ECE12.CO2 Analyze the space segment
16ECE12.CO3 Summarize the Satellite Access Techniques
16ECE12.CO4 Analyze the earth segment
16ECE12.CO5 Explain various application Satellites

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE12.CO1	x	x	x	x		x			x		x	x	x	x	x
16ECE12.CO2	x	x	x	x		x			x		x	x	x	x	x
16ECE12.CO3	x	x	x	x		x			x		x	x	x	x	x
16ECE12.CO4	x	x	x	x		x			x		x	x	x	x	x
16ECE12.CO5	x	x	x	x		x			x		x	x	x	x	x

UNIT I **SATELLITE ORBITS** **9**

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping,geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion.

UNIT II **SPACE SEGMENT AND SATELLITE LINK DESIGN** **9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

UNIT III **SATELLITE ACCESS:** **9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Brocast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption

UNIT IV **EARTH SEGMENT** **9**

Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver,Earth Station Tracking System: Satellite acquisition, Automatic tracking, Manual tracking, Program tracking. Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain.

UNIT V **SATELLITE APPLICATIONS** **9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- Worldspace services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing.

TOTAL: 45 Hrs

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dennis Roddy	Satellite Communication	McGraw Hill International	2008
2.	Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson	Satellite Communication Systems Engineering	Prentice.Hall/Pearson	2017

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N.Agarwal	Design of Geosynchronous Space Craft	Prentice Hall	1986
2.	Bruce R. Elbert	The Satellite Communication Applications	Hand Book, Artech House, Bostan ,London	2004
3.	Brian Ackroyd	World Satellite Communication and earth station Design	BSP professional Books	1990
4.	Emanuel Fthenakis	Manual of Satellite Communications	McGraw Hill Book Co..	1984
5.	Robert G. Winch	Telecommunication Trans Mission Systems	McGraw-Hill Book Co..	1983

WEB URLs:

1. www.en.wikipedia.org/wiki/Communications_satellite
2. www.isro.gov.in/applications/satellite-communication
3. www.nasa.gov/directorates/heo/scan/communications/.../txt_satellite_comm.ht.
4. www.radio-electronics.com/.../satellite/communications_satellite/satellite-communication.
5. www.britannica.com/technology/satellite-communication

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16ECE13 TELEVISION AND VIDEO ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the analysis and synthesis of TV Pictures, Composite Video Signal.
- To study and analysis of receiver picture tubes and television Camera Tubes
- To study the principles of Monochrome Television Transmitter and Receiver systems.
- To study the various Color Television systems with a greater emphasis on PAL system.
- To study the advanced topics in Television systems and Video Engineering

COURSE OUTCOME

16ECE13.CO1 Describe the basic concepts of video generation in a television system
16ECE13.CO2 Explain various components of a monochrome TV transmitter and receiver
16ECE13.CO3 Describe different techniques involved in audio and video processing
16ECE13.CO4 Distinguish NTSC, PAL and SECAM colour TV system
16ECE13.CO5 Compare advanced digital TV systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE13.CO1	x	x	x						x			x	x		
16ECE13.CO2	x	x	1						x			x	x		
16ECE13.CO3	x	x	x		x				x			x			
16ECE13.CO4	x	x	x						x			x	x		
16ECE13.CO5	x	x	x		x				x			x	x		

. UNIT I FUNDAMENTALS OF TELEVISION

Geometry form and Aspect Ratio - Image Continuity - Number of scanning lines - Interlaced scanning - Picture resolution - Camera tubes- Image orthicon – vidicon – plumbicon -silicon diode array vidicon -solid state image scanners- monochrome picture tubes- composite video signal-video signal dimension- horizontal sync. Composition-vertical sync. Details – functions of vertical pulse train – scanning sequence details. Picture signal transmission – positive and negative modulation – VSB transmission sound signal transmission – standard channel bandwidth.

UNIT II MONOCHROME TELEVISION TRANSMITTER AND RECEIVER 9

TV transmitter – TV signal propagation – Interference – TV transmission Antennas – Monochrome TV receiver – RF tuner – UHF, VHF tuner- Digital tuning techniques- AFT-IF subsystems - AGC – Noise cancellation- Video and sound inter carrier detection- vision IF subsystem- video amplifiers requirements and configurations - DC re-insertion - Video amplifier circuits- Sync separation – typical sync processing circuits- Deflection current waveform – Deflection Oscillators – Frame deflection circuits – requirements- Line Deflection circuits – EHT generation – Receiver Antennas.

UNIT III BASICS OF COLOUR TELEVISION 9

Compatibility – colour perception- Three colour theory- luminance, hue and saturation-colour television cameras values of luminance and colour difference signals- colour television display tubes- delta – gun-precision – in-line and Trinitron colour picture tubes- purity and convergence- purity and static and dynamic convergence adjustments pincushion correction techniques- automatic degaussing circuit- grey scale tracking – colour signal transmission bandwidth- modulation of colour difference signals – weighting factors- Formation of chrominance signal.

UNIT IV TYPES COLOUR TELEVISION SYSTEMS 9

NTSC colour TV system- NTSC colour receiver- limitations of NTSC system – PAL colour TV system – cancellation of phase errors- PAL –D colour system- PAL coder – Pal-Decolour receiver- chromo signal amplifier-

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separation of U and V signals- colour burst separation – Burst phase Discriminator – ACC amplifier- Reference Oscillator- Ident and colour killer circuits- U and V demodulators- Colour signal matrixing – merits and demerits of the PAL system – SECAM system – merits and demerits of SECAM system.

UNIT V ADVANCED TELEVISION SYSTEMS **9**

Satellite TV technology- Cable TV – VCR- Video Disc recording and playback- Tele Text broadcast receiver – digital television – Transmission and reception- projection Television – Flat panel display TV receiver – Stereo sound in TV – 3D TV – HDTV – Digital equipments for TV studios.

TOTAL: 45 Hrs

TEXT BOOK

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.R.Gulati	Monochrome Television Practice, Principles, Technology and servicing	Third edition, New age International Publishes	2006
2.	R.R.Gulati	Monochrome Television Practice, Principles, Technology and servicing	Second edition, New age International Publishes	2004

REFERENCE

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.R.Gulati	Monochrome and colour television	New age International Publisher	2003
2.	A.M Dhake	Television and Video Engineering	Second edition, TMH	2003
3.	R.P.Bali	Color Television, Theory and Practice	Tata McGraw-Hill	1994
4.	B.Rajagnanapazham	Television and Video Engineering	SCE	2007
5.	R G Gupta	Television engineering and video systems	Tata McGraw-Hill	2006

WEB URLs

1. www.data.kemt.fei.tuke.sk/DigitalnaTelevizia/prednasky/Prezentacie/uocdtv1.html
2. www.youtube.com/watch?v=EAybxdgS2T4
3. www.readorrefer.in/article/PAL-Colour-Television-System_12068/
4. www.freevideolectures.com/Course/2314/Communication-Engineering/17
5. www.eeweb.poly.edu/~yao/EE4414/digitalTV.pdf

16 ECE14 **OPTO ELECTRONIC DEVICES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To know the basics of solid state physics and understand the nature and characteristics of light.
- To understand different methods of luminescence, display devices and laser types and their applications.
- To learn the principle of optical detection mechanism in different detection devices.
- To understand different light modulation techniques and the concepts and applications of optical switching
- To study the integration process and application of opto electronic integrated circuits in transmitters and receivers.

COURSE OUTCOMES

16ECE14.CO1 Review solid state semiconductor physics
16ECE14.CO2 Explain the concepts of lasers
16ECE14.CO3 Classify different optical detection devices
16ECE14.CO4 Distinguish different light modulation techniques
16ECE14.CO5 Summarize applications of opto electronic circuits

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE14.CO1	x	x	x	x	x	x					x	x	x		x
16ECE14.CO2	x	x	x	x	x	x					x	x	x		x
16ECE14.CO3	x	x	x	x	x	x					x	x	x		x
16ECE14.CO4	x	x	x	x	x	x					x	x	x		x
16ECE14.CO5	x	x	x	x	x	x					x	x	x		x

UNIT-I **ELEMENTS OF LIGHT AND SOLID STATE PHYSICS** **9**

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT-II **DISPLAY DEVICES AND LASERS**

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

UNIT-III **OPTICAL DETECTION DEVICES** **9**

Principle and operation of Photo detector, Thermal detector, Photo Devices, Principle and operation of Photo Conductors, Principle and operation of Photo diodes, Detector Performance, details of the basic physics and operation of solar cells.

UNIT-IV **OPTOELECTRONIC MODULATORS AND SWITCHING DEVICES** **9**

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acousto-optic devices, Optical, Switching and Logic Devices, the operation of quantum well electro-absorption modulators and electro-optic modulators

UNIT-V **OPTOELECTRONIC INTEGRATED CIRCUITS** **9**

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices, Designs, demonstrations and projects related to optoelectronic device phenomena.

TOTAL: 45 Hrs

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TEXTBOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jasprit Singh	Opto Electronics – As Introduction to materials and devices	McGraw-Hill International Edition	1998
2.	Bhattacharya	Semiconductor Opto Electronic Devices	Prentice Hall of India Pvt., Ltd., New Delhi	1995

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	J. Wilson and J.Haukes	Opto Electronics – An Introduction	Prentice Hall of India Pvt., Ltd., New Delhi	1995
2.	Xun Li	Optoelectronic Devices: Design, Modeling, and Simulation	Cambridge University Press	2009
3.	Tamir T. Grifel and Henry L. Bertoni	Guided wave opto-electronics: Device characterization, analysis and design	Plenium Press	1995
4.	S.C Gupta	Optoelectronic Devices and systems	Prentice Hall of India Pvt., Ltd., New Delhi	2005
5.	A. K. Ganguly	Optoelectronic Devices and Circuits: Theory and Applications	Alpha Science International Ltd	2007

WEB URLs:

1. www.study.com/academy/.../the-bohr-model-and-atomic-spectra.html
2. www.nptel.ac.in/courses/113104012/Optoelectronic%20Materials%20and%20Devices.pdf
3. www.stanleytools.com/products/hand-tools/.../laser-tape-measure
4. www.textofvideo.nptel.iitm.ac.in/113104012/lec1.pdf
5. www.satishkashyap.com/2013/02/video-lectures-on-optoelectronic.html

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16ECE15 **MOBILE AD-HOC NETWORKS** L T P C
3 0 0 3

COURSE OBJECTIVES

- To gain knowledge in wireless network protocol and standards.
- To study the MAC, Routing protocols for ad hoc networks.
- To gain knowledge about Network Simulator.
- To learn the concept of security mechanism for wireless networks.
- To study about Characteristics of security protocols.

COURSE OUTCOMES

16ECE15.CO1 Summarize applications of opto electronic circuits
16ECE15.CO2 Analyze the medium access control protocols of Ad hoc networks
16ECE15.CO3 Analyze the routing protocols and their performance using network simulator
16ECE15.CO4 Explain the basics of wireless sensor networks
16ECE15.CO5 Analyze the characteristics of different security protocols

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE15.CO1	x	x	x								x	x		x	
16ECE15.CO2	x	x	x								x	x		x	
16ECE15.CO3	x	x	x	x							x	x		x	
16ECE15.CO4	x	x	x	x	x						x	x		x	
16ECE15.CO5	x	x	x	x	x						x	x		x	

UNIT I INTRODUCTION 9

Introduction to Ad-Hoc wireless networks- Packet radio networks-Key definitions of ad-hoc and sensor networks- Advantages of ad-hoc and sensor networks -Unique constraints and challenges and Vulnerabilities-Wireless Communications/Radio Characteristics. Applications of Ad-Hoc/Sensor Network and Future Directions: Driving Applications- Ultra wide band radio communication- Wireless fidelity systems-optical wireless networks - Simulation of Wi-Fi using QUALNET simulator.

UNIT II MEDIA ACCESS CONTROL (MAC) PROTOCOLS 9

Issues in designing MAC protocols-Bandwidth efficiency-Quality of service support-Synchronization hidden node-exposed node problems. Classifications of MAC protocols: Contention based protocols- MACAW-Media access protocol for wireless LAN-media access with reduced handshake- contention based with reservation mechanisms-Distributed priority-scheduling. Mac protocols using directional antenna. Simulation of 802.11using QUALNET

UNIT III ROUTING PROTOCOLS 9

Issues in designing routing protocols-Mobility-bandwidth constraint-Table driven routing protocols :DSDV, ,WRP, CHGSRP, - On demand routing protocol : AODV,DSR, TORA,LAR,ANODR- zone routing protocol-Fish eye state routing protocol-power aware routing protocol. Simulation of routing protocols using QUALNET simulator.

UNIT IV WIRELESS SENSOR NETWORKS 9

Introduction-sensor network architecture-Data dissemination-data gathering-self organizing, MAC Protocols for Sensor Networks - Location discovery- Quality of a Sensor Network - Evolving Standards - Energy efficient issues-Transport layer. Synchronization issues.

UNIT V SECURITY ISSUES IN AD HOC / SENSOR NETWORK 9

Introduction -Need for Security- classification of attack-MAC layer attacks-Network layer attacks-Wired

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Equivalent Privacy(WEP)-Intrusion prevention scheme- Confidentiality : Symmetric Encryption- DES and Triple DES detection systems- Authentication :Digital Signatures, Certificates, User Authentication, Elliptic Curve Cryptosystems. Intrusion detection systems: behavior based detection knowledge based detection-watch dog-path rater. Reputation based system: CORE, CONFIDENT

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Siva Ram Murthy C. and Manoj B S,	Ad Hoc Wireless Networks: Architectures and Protocols	Prentice Hall.	2014.
2.	Toh C K,	Ad Hoc Mobile Wireless Networks: Protocols and Systems	Prentice Hall	2008

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles Perkins, Addision Wesley,	Ad hoc Networking	Pearson	2008
2.	Toh C.K,	Ad Hoc Mobile wireless Networks : protocol and Systems	Prentice Hall PTR,	2008
3.	Feng zhao, Leonidas Guibas	Wireless sensor network,	Morgan Kaufmann publishers,	2015
4.	Kazemsohraby, Daniel minoli and TaiebZnati,	Wireless sensor networks- Technology, Protocols and Applications	Wiley	2007
5.	T.L.Singhal	Wireless Communication	TMH,	2012

WEB URLs

1. www.onlinecourses.nptel.ac.in/noc17_cs07
2. www.nptel.ac.in/courses/106105160/3
3. www.nptel.ac.in/courses/106105080/pdf/M5L7.pdf
4. www.ece.rochester.edu/courses/ECE586/lectures/MANETS_MAC.pdf
5. www.onlinecourses.nptel.ac.in/noc17_cs07/announcements

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16ECE16 INTERNET AND JAVA PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand networking and protocols
- To understand internet routing protocols
- To learn world wide web and its applications
- To learn fundamentals of java programming
- To learn java programming

COURSE OUTCOMES

16ECE16.CO1 Explain the working of internet with TCP/IP protocol and mapping of address.
16ECE16.CO2 Demonstrate the use of various routing protocols.
16ECE16.CO3 Implement the various markup languages.
16ECE16.CO4 Explain the fundamentals of Java programming
16ECE16.CO5 Create Applets, Packages and Database connectivity using Java advanced programs.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE16.CO1	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECE16.CO2	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECE16.CO3	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECE16.CO4	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECE16.CO5	x	x	x	x	x	x		x	x	x	x	x	x	x	x

UNIT I INTERNETWORKING WITH TCP / IP 9

Internetworking concept and Architectural model, Review of network technologies, Internet addressing, Address resolution protocols (ARP / RARP), Routing IP datagrams, Classless and Subnet Address Extensions, Reliable stream transport service (TCP) TCP / IP over ATM networks, Internet applications - E-mail, Telnet, FTP, NFS, Internet traffic management.

UNIT II INTERNET ROUTING 9

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

UNIT III WORLD WIDE WEB 9

Introduction to World Wide Web-Hyper Text Transfer Protocol, Web browsers, Web servers, Internet explorer, Web site and Web page design, Hyper Text Mark-up Language, Dynamic HTML, XHTML, XML,CGI, Java script, Telnet, Dotnet, PHP

UNIT IV AVA FUNDAMENTAL 9

Java Programming Environment, Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes, Packages and Interfaces – Exceptions and Debugging, Muitithreading and RMI.

UNIT V JAVA PROGRAMMING 9

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Networking with Java, Swing: Applets and Applications, Menu's & Tool Bars, Java and XML – Creating packages, Interfaces, JAR files & Annotations, JavaBeans, JDBC, Networking Basics - Java and the Net – InetAddress – TCP/IP Client Sockets – URL –URL Connection.

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas E.Comer,	Internetworking with TCP/IP	Pearson Education	2007
2.	Robert W.Sebesta	Programming the worldwide web	Pearson Education	2007

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cay S.Hortsmann, Gary Cornwell	Core Java 2- Vol I	Pearson Education	2015
2.	W. Richard Stevens	TCP/IP Illustrated, The Protocol	Pearson Education	2012
3.	Behrouz A. Farouzon	TCP/IP Protocol Suite	Tata McGraw Hill	2008
4.	Chris Bates	Web Programming Building Internet Applications	Wiley Publications.	2009
5.	Kogent Solutions Inc	Java Server Programming	Black Book, Dream tech Press	2008

WEB URLs

1. www.nptel.ac.in/courses/106105084/13
2. www.nptel.ac.in/courses/106105084/
3. www.freevideolectures.com › Computer Science › IIT Kharagpur
4. www.nptelvideos.com/video.php?id=725
5. www.nptelvideos.in/2012/11/internet-technologies.html

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16ECE17 ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To teach the architecture of 8 bit RISC processor
- To teach the architecture and programming of 16 bit RISC processor
- To instruct the implementation of DSP in ARM processor
- To discuss on memory management in RISC processor
- To teach the application development with ARM processor

COURSE OUTCOMES

16ECE17.CO1 Explain the internal components of AVR Microcontroller
16ECE17.CO2 Write program for arithmetic and logical operations in ARM processor
16ECE17.CO3 Develop the signal processing applications in ARM processor
16ECE17.CO4 Explain the memory management in RISC processor
16ECE17.CO5 Develop application with advanced processors

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE17.CO1	x	x	x						x			x			
16ECE17.CO2	x	x	1	x					x			x		x	
16ECE17.CO3	x	x	x	x					x			x		x	
16ECE17.CO4	x	x	1		x				x			x		x	
16ECE17.CO5	x	x	x		x				x			x		x	

UNIT I AVR MICROCONTROLLER ARCHITECTURE 9

Architecture – Memory Organization – Addressing Modes – I/O Memory – Buses – Interrupts – DMA-Interface circuits - Daisy Chaining with Priority Group - EEPROM – I/O Ports – SRAM – Timer – UART – Interrupt Structure – Serial Communication with PC – ADC/DAC Interfacing

UNIT II ARM ARCHITECTURE AND PROGRAMMING 9

Arcon RISC Machine – Architectural Inheritance – Core & Architectures – The ARM Programmer's Model – Registers – Pipeline – Interrupts – ARM Organization – ARM Processor Family – Co-processors – Instruction Set – Thumb Instruction Set – Instruction Cycle Timings

UNIT III ARM APPLICATION DEVELOPMENT 9

Introduction to DSP on ARM – FIR Filter – IIR Filter – Discrete Fourier Transform – Exception Handling – Interrupts – Interrupt Handling Schemes – Firmware and Boot loader – Embedded Operating Systems – Fundamental Components – Example: Simple Little Operating System

UNIT IV MEMORY PROTECTION AND MANAGEMENT 9

Introduction of Memory Protection and Management - Protected Regions – Initializing MPU - MIDI Processing Unit, Cache and Write Buffer – MPU to MMU – Virtual Memory – Page Tables – TLB – Domain and Memory Access Permission – Fast Context Switch Extension

UNIT V DESIGN WITH ARM MICROCONTROLLERS 9

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Advanced RISC Machine featuresARM Coretex-M3 Microcontroller - Switching Microcontrollers - Assembler Rules and Directives – Simple ASM/C Programs – Hamming Code – Division – Negation Simple Loops – Look Up Table – Block Copy – Subroutines

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Steve Furber	ARM system on chip architecture'	Addision Wesley	2007
2.	G.M.Rebeiz Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield	ARM System Developer's Guide Designing and Optimizing System Software'	Elsevier	2007

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barnett , L. O' CULL and S. Cox	Embedded C Programming and Atmel AVR	Delmar Cengage Learning	2009
2.	Trevor Martin	The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series	Hitex (UK) Ltd	2005
3.	Dananjay V. Gadre	Programming and Customizing the AVR microcontroller'	McGraw Hill	2001
4.	William Hohl,Christopher hinds	ARM Assebly Language' Fundamentals and Techniques	CRC press	2014
5.	David Seal	ARM Architecture Reference Manual	Addison Wesley	2011

WEB URLs

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2. www.nptel.ac.in/courses/106102114/
3. www.nptel.ac.in/courses/106104024/2
4. www.nptel.ac.in/courses/108102045/5
5. www.textofvideo.nptel.iitm.ac.in/108102045/lec6.pdf

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16ECE18 PATTERN RECOGNITION AND AI TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES

- To provide a strong foundations of fundamental concepts in Artificial Intelligence
- To get familiar with the various applications of these techniques in Intelligent Systems
- To learn the fundamentals of Pattern Recognition techniques.
- To learn the various Statistical Pattern recognition techniques.
- To learn the various Syntactical Pattern recognition techniques.

COURSE OUTCOMES

16ECE18.CO1 Interpret pattern recognition techniques
16ECE18.CO2 Outline the major approaches in statistical and pattern recognition
16ECE18.CO3 Discuss syntactic pattern recognition
16ECE18.CO4 Design of neural pattern recognition system
16ECE18.CO5 Discuss AI concept

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE18.CO1	x	x	x						x			x		x	
16ECE18.CO2	x	x	x	x	x							x		x	
16ECE18.CO3	x	x	1		x				x			x		x	
16ECE18.CO4	x	x	x	x	x							x		x	
16ECE18.CO5	x	x	x	x	x							x		x	

UNIT I PATTERN RECOGNITION OVERVIEW 9

Introduction of Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Introduction to Pattern Recognition System-Training and Learning in PR systems-Pattern recognition Approaches

UNIT II STATISTICAL PATTERN RECOGNITION 9

Introduction to statistical Pattern Recognition—supervised Learning using Parametric and Non Parametric Approaches. Introduction—Discrete and binary Classification problems—Techniques to directly Obtain linear Classifiers -- Formulation of Unsupervised Learning Problems—Clustering for unsupervised learning and classification.

UNIT III SYNTACTIC PATTERN RECOGNITION

Overview of Syntactic Pattern Recognition—Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition—Learning via grammatical inference-Hopcroft–Karp algorithm-String searching algorithm.

UNIT IV NEURAL PATTERN RECOGNITION 9

Introduction to Neural networks- Neuron- ActivationFunction-Feed forward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural Pattern Recognition System.

UNITV INTRODUCTION TO AI 9

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Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system-Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first. Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kevin Knight, Eline Rich B.Nair	Artificial Intelligence	McGraw Hill Education	2012
2.	Robert Schalkoff	Pattern Recognition: statistical structural and neurai approaches	John wiley& sons Inc	2007

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stuart Russel and Peter Norwig	Artificial Intelligence: A Modern Approach	Prentice Hall	2012
2.	Earl Gose, Richard johnsonbaugh, SteveJost	Pattern Recognition and Image Analysis	Prentice Hall of India,.Pvt Ltd	1997
3.	Duda R.O., P.E.Hart& D.G Stork	Pattern Classification	J.WileyInc	2012.
4.	Duda R.O.&P.E.Hart	Pattern Classification and Scene Analysis	J.wileyInc	1973
5.	Bishop C.M	Neural Networks for Pattern Recognition	Oxford University	1995

WEB URLs:

1. www.en.wikipedia.org/wiki/Pattern_recognition
2. www.journals.elsevier.com/pattern-recognition
3. www.coursera.org/courses?query=pattern%20recognition
4. www.quora.com/What-is-pattern-recognition-in-artificial-intelligence
5. www.nptel.ac.in/courses/117105101/

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16ECE19 **BIOMETRICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide students with understanding of biometrics.
- Able to know about more biometric equipment.
- Able to understand automated biometric system.
- To know about the application areas of biometrics.
- Able to know how standards applied to security.

COURSE OUTCOMES

16ECE19.CO1 Explain the fundamentals of Biometric systems
16ECE19.CO2 Explain the various Biometric technologies
16ECE19.CO3 Explain the Biometric system and behavioral biometrics
16ECE19.CO4 Develop a system for Biometric identification
16ECE19.CO5 Use Biometric Standards

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE19.CO1	x	x	x	x		x		x					x		
16ECE19.CO2	x	x	1	x		x		x				x			
16ECE19.CO3	x	x	x	x	x						x	x	x		
16ECE19.CO4	x	x	x	x	x							x			
16ECE19.CO5	x	x	x	1	1			x				x	x		

UNIT I INTRODUCTION 9

Biometric fundamentals – Biometric technologies – Biometrics Vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, EER and ATV rate – Accuracy in Biomedical Systems

UNIT II PHYSIOLOGICAL BIOMETRICS 9

Physiological biometric technologies: components, working principles, competing technologies, strengths and weaknesses Finger-scan – components, working principles, competing technologies, strengths and weaknesses Facial-scan – components, working principles, competing technologies, strengths and weaknesses Iris-scan – components, working principles, competing technologies, strengths and weaknesses Voice-scan – components, working principles, competing technologies, strengths and weaknesses Retina Scan -components, working principles, competing technologies, strengths and weaknesses Retina Vascular Pattern.

UNIT III AUTOMATED BIOMETRIC SYSTEM AND BEHAVIOURAL BIOMETRICS 9

Automated finger print identification systems - Leading technologies: components, feature extraction, working principles, strengths and weaknesses Signature-scan – components, feature extraction, working principles, strengths and weaknesses Keystroke scan – components, feature extraction, working principles, strengths and weaknesses- DNA biometrics.

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UNIT IV BIOMETRIC APPLICATIONS 9

Categorizing biometric applications – application areas: criminal and citizen identification, surveillance, PC/network access, e-commerce and retail/ATM – costs to deploy – other issues in deployment, Signature and Handwriting Technologies.

UNIT V PRIVACY AND STANDARDS IN BIOMETRICS 9

Assessing the Privacy Risks of Biometrics – Designing Privacy-Sympathetic Biometric Systems – Need for standards – Multi biometrics and multi factor biometrics – two factor authentication with passwords – tickets and tokens.

TOTAL: 45 Hrs

TEXT BOOK

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Samir Nanavati, Michael Thieme, Raj Nanavati	Biometrics – Identity Verification in a Networked World	Wiley-dreamtech India Pvt Ltd, New Delhi	2003
2.	John Chirillo and Scott Blaul	Implementing Biometric Security	Wiley Eastern Publication	2005

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paul Reid	Biometrics for Network Security	Pearson Education	2004
2.	John R Vacca	Biometric Technologies and Verification Systems	Elsevier Inc	2007
3.	Anil K Jain, Patrick Flynn, Arun A Ross	Handbook of Biometrics	Springer	2008
4.	John Berger	Biometrics for Network Security	Prentice Hall	2004
5.	Julian Ashbourn	Guide to Biometrics for Large Scale System	Springer	2011

WEB URLs:

1. www.books.google.co.in/books?isbn=9400775229
2. www.dhs.gov/biometrics
3. www.books.google.co.in/books?isbn=0080488390
4. www.books.google.co.in/books?isbn=1856173941
5. www.books.google.co.in/books?isbn=3319290886

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16ECE20 **EMBEDDED SOLUTIONS ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental concepts of embedded systems.
- To learn the architecture of Advanced MSP430 microcontrollers.
- To understand the interfacing and data acquisition using ARM and MSP430.
- To acquire knowledge on the serial and network communication protocols.
- To understand the IoT based embedded system.

COURSE OUTCOMES

16ECE20.CO1 Describe hardware and software architectures of embedded systems
16ECE20.CO2 Explain the architecture of Advanced MSP430 series microcontrollers
16ECE20.CO3 Develop MSP430 based embedded system applications
16ECE20.CO4 Explain the communication protocols used in embedded system
16ECE20.CO5 Develop an embedded system for IoT applications

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECE20.CO1	x	x	x	x					x			x			x
16ECE20.CO2	x	x	x		x				x			x			x
16ECE20.CO3	x	x	x		x			x				x			x
16ECE20.CO4	x	x	x	x					x			x			x
16ECE20.CO5	x	x	x		x			x				x			x

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Embedded system overview, applications, features and architecture considerations - ROM, RAM, timers, data and address bus, I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Low power RISC MSP430 – block diagram, features and architecture, Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller e.g. MSP430, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Sample embedded system on MSP430 microcontroller.

UNIT II MSP430X5X SERIES ARCHITECTURE 9

MSP430x5x series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. I/O ports pull up/down registers concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.

UNIT III EMBEDDED INTERFACING AND APPLICATIONS 9

Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.
Case Study: MSP430 based embedded system application using ADC & PWM demonstrating peripheral intelligence. "Remote Controller of Air Conditioner using MSP430".

UNIT IV EMBEDDED COMMUNICATION PROTOCOLS 9

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Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

Case Study: MSP430 based embedded system application using the interface protocols for communication with external devices: "A Low-Power Battery less Wireless Temperature and Humidity Sensor with Passive Low Frequency RFID"

UNIT V IoT BASED APPLICATIONS 9

IoT overview and architecture, Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications, Building IoT applications using CC3100 user API for connecting sensors.

TOTAL: 45 Hrs

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John H. Davies	MSP430 microcontroller basics	Newnes Publication	2008
2.	Raj Kamal	Embedded Systems	Tata McGraw-Hill Education	2011

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Adrian Fernandez, Dung Dang	Gettingstarted with the MSP430 Launchpad	Newnes Publication	2013
2.	Dung Dang, Daniel J. Pack, Steven F. Barrett	Embedded Systems Design with the Texas Instruments MSP432 32-bit Processor	Morgan & Claypool publishers	2016
3.	Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier	Introduction to Embedded Systems: Using Microcontrollers and the MSP430	Springer Science + Business Media New York	2014
4.	Massimo Conti, Simone Orcioni, Natividad Martínez Madrid, Ralf E.D. Seepold	Solutions on Embedded Systems	Springer Science + Business Media New York	2011
5.	Ivan Cibrario Bertolotti, Gabriele Manduchi	Real-Time Embedded Systems: Open-Source Operating Systems Perspective	CRC Press	2012

WEB URLs:

1. www.nptel.ac.in/courses/108102045/
2. www.nptel.ac.in/courses/108102045/2
3. www.nptelvideos.in/2012/11/embedded-systems.html
4. www.documents.mx/documents/vtulecture1.html
5. www.nptel.ac.in/courses/108102045/10

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16ECF01 **PROJECT WORK PHASE – I** **L T P C**
0 0 6 3

COURSE OBJECTIVES

- To achieve integrated electronic design of a product through parts design, assembly and preparation of printed circuit board drawings

COURSE OUTCOMES

16ECF01.CO1 Discover potential research areas in the field of ECE
16ECF01.CO2 Summarize a survey of several available literatures in the preferred field of study
16ECF01.CO3 Compare the several existing solutions for research challenge
16ECF01.CO4 Demonstrate an ability to work in teams and manage the conduct of the research study
16ECF01.CO5 Formulate and propose a plan for creating a solution for the research plan identified

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECF01.CO1	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF01.CO2	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF01.CO3	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF01.CO4	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF01.CO5	x	x	x	x	x	x		x	x	x	x	x	x	x	x

Students are asked to form a team which consists of 4 members, maximum. Each team has to work under a project supervisor. Based on the current industrial scenario, any relevant problem should be selected for the project with the consultation of the supervisor. Literature review should be done related to the problem considered. The working methodology of the project work for the phase II should be decided. These activities should be registered in a report and submitted by the student which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

TOTAL: 90 Hrs

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16ECF02 **PROJECT WORK PHASE -II**

L T P C
0 0 30 15

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES

16ECF02.CO1 Demonstrate a sound technical knowledge of their selected project topic
16ECF02.CO2 Formulate a solution for the problem identified
16ECF02.CO3 Design engineering solutions to complex problems with a systematic approach
16ECF02.CO4 Develop an engineering product
16ECF02.CO5 Demonstrate the knowledge, skills and attitudes of a professional engineer

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECF02.CO1	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF02.CO2	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF02.CO3	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF02.CO4	x	x	x	x	x	x		x	x	x	x	x	x	x	x
16ECF02.CO5	x	x	x	x	x	x		x	x	x	x	x	x	x	x

Based on the work methodology decided in the Phase I, the project is further developed. Necessary modeling and analysis is done using required software. The project is fabricated. The analytical results and the experimental results are validated. Three reviews will be conducted periodically by a committee constituted by the Head of the Department. A project report to be prepared by the students along with which the project has to be submitted for the final viva voce examination

TOTAL: 450 Hrs

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16MEF03 COMPREHENSION

L T P C
0 0 2 2

COURSE OBJECTIVES

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E. Degree course through periodic exercise
- To gain ability to understand and comprehend any given problem related to mechanical engineering field.

COURSE OUTCOMES

16MEF03.CO1 Recall the basic principles of previous semester courses.
16MEF03.CO2 Comprehend and analyze problems associated with mechanical engineering

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16MEF03.CO1	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-
16MEF03.CO2	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-

The students have to recall the principles and fundamental of the courses studied in their previous semesters. Weekly examination will be conducted and evaluated. The question papers will contain objective and descriptive questions which will be asked from the previous semester Courses. The average of the marks obtained in the tests will be considered for the end semester evaluation.

TOTAL: 30 Hrs

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16ECF04 **DESIGN PROJECT** **L T P C**
0 0 4 2

COURSE OBJECTIVES

- To give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

COURSE OUTCOMES

16ECF04.CO1 Use of design principles and develop conceptual and engineering design of any components.
16ECF04.CO2 Ability to fabricate any components using different modern tools.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECF04.CO1	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-
16ECF04.CO2	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-

The students may be grouped into 2to4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 Hrs

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16ECF05 **TECHNICAL SEMINAR** **L T P C**
0 0 4 2

COURSE OBJECTIVES

- To give an opportunity to the student to get speaking skills in explaining a complete working model, which is designed by them

COURSE OUTCOMES

16ECF05.CO1 Use of design principles and develop conceptual and engineering design of any components.
16ECF05.CO2 Ability to explain the concept of working model using modern tools.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16ECF05.CO1	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-
16ECF05.CO2	x	x	x	-	-	-	-	-	-	-	-	-	x	-	-

The students may be grouped into 2 to4 and work under a supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. Students will present a power point presentation about their models. It will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the technical seminar is evaluated based on oral presentation of each student by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 Hrs

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