PAAVAI ENGINEERING COLLEGE, NAMAKKAL - 637 018

(AUTONOMOUS)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS 2015

CURRICULUM

SEMESTER VII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	EC15701	Wireless Networks	3	0	0	3
2	PC	EC15702	Microwave Engineering	3	0	0	3
3	PC	EC15703	Optical Communication	3	0	0	3
4	PC	EC15704	Television Signal Processing and Display Systems	3	0	0	3
5	PE	EC15***	Elective IV	3	0	0	3
6	PE	EC15***	Elective V	3	0	0	3
Practical							
6	PC	EC15705	Electronic System Design Laboratory	0	0	4	2
7	PC	EC15706	Optical And Microwave Laboratory	0	0	4	2
8	EE	EC15707	Project Work Phase I	0	0	4	2
			Total	18	0	12	**24**

SEMESTER VIII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	EC15801	Mobile Communication	3	0	0	3
2	PE	EC15***	Elective VI	3	0	0	3
3	PE	EC15***	Elective VII	3	0	0	3
4	EE	EC15802	Project Work Phase II	0	0	12	6
			Total	9	0	12	**15**

LIST OF ELECTIVES

PROGRAMME ELECTIVE IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	EC15451	Mobile Adhoc networks	3	0	0	3
2	PE	EC15452	Mobile Application Development	3	0	0	3
3	PE	EC15453	Information Theory	3	0	0	3
4	PE	EC15454	Space Time Communication	3	0	0	3

PROGRAMME ELECTIVE V

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	EC15551	Internet and JAVA	3	0	0	3
2	PE	EC15552	Cryptography and Network Security	3	0	0	3
3	PE	EC15553	Biosignal Processing	3	0	0	3
4	PE	EC15554	Electromagnetic Interference and Compatibility	3	0	0	3

PROGRAMME ELECTIVE VI

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	EC15651	Wireless Sensor Networks	3	0	0	3
2	PE	EC15652	Satellite Communication	3	0	0	3
3	PE	EC15653	Nano - Electronics	3	0	0	3
4	PE	EC15654	RF Microelectronics	3	0	0	3

PROGRAMME ELECTIVE VII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PE	EC15751	Optoelectronic Devices	3	0	0	3
2	PE	EC15752	Micro-Electro-Mechanical Systems	3	0	0	3
3	PE	EC15753	Optical Networks	3	0	0	3
4	PE	EC15754	Virtual Instrumentation	3	0	0	3

EC15701 WIRELESS NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know the challenges in Wireless Networks.
- study the WLANs standards
- acquire the generations of WWANs
- learn the necessity of Adhoc and sensor networks.
- gain the knowledge of advancements in wireless networks.

UNIT I CHALLENGES IN WIRELESS NETWORKS 09

Medium Access Alternatives, Fixed Assignment for Voice Oriented Networks, Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.

UNIT II WIRELESS LANs 09

Wireless LANs, IEEE 802.11b WLAN, Architecture and Services, Installation of WLAN, Other IEEE 802.11 standards and a,g,n, HIPERLAN, Wi–Fi and Wi-Max standards.

UNIT III WIRELESS WANs 09

First Generation Analog, Second Generation TDMA, GSM, GPRS, Second Generation CDMA, IS-95, Third Generation Systems WCDMA, CDMA 2000.

UNIT IV ADHOC AND SENSOR NETWORKS 09

Characteristics of MANETs, Table–driven and Source initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks, Classification, Routing protocols, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery and quality of a Sensor Network.

UNIT V ADVANCES IN WIRELESS NETWORKS 09

Introduction of 4G vision, 4G features and challenges, Applications of 4G, Bluetooth, ZigBee, Ultra wide Band Radio communication, Optical wireless Networks, Software Defined Radio, Cognitive Radio.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the challenges in Wireless Networks.
- analyze the different concept of WLAN standards.
- design the generations of WWANs
- evaluate the necessity of Adhoc and sensor networks.
- apply the concept of advancements in wireless networks.

TEXT BOOKS

1. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks: A unified approach", Prentice Hall, 2002.
2. Dharma Prakash Qing–AnZeng & Agrawal, “Introduction to Wireless and Mobile Systems”, 4thEdition,Thomson India Edition, 2015.

REFERENCES

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, 2007.
2. Clint Smith, P.E. & Daniel Collins, “3G Wireless Networks”, 3rd Edition, Tata McGraw Hill, 2014.
3. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, Prentice Hall, 2003.

WEB LINKS

1. http://williamstallings.com/Wireless/Wireless2e.html
2. http://www.isi.edu/nsnam/ns/tutorial/

Mapping of Course Objectives with Programme Outcomes:

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO2	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO3	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO4	2	2	2	2	2	2	-	-	1	-	-	2	2	2
CO5	2	2	2	2	2	2	-	-	1	-	-	2	2	2

EC15702 MICROWAVE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basics required for circuit representation of RF networks
- know the issues in the design of microwave amplifier.
- impart knowledge on the properties of various microwave components
- study the various methods of microwave generation.
- describe the microwave generation and microwave measurement techniques

UNIT I TWO PORT NETWORK THEORY 09

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, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT II MICROWAVE AMPLIFIER AND PARAMETRIC AMPLIFIER 09

Microwave amplifier – characteristics, Amplifier power relations, Stability considerations, Gain Considerations, Parametric amplifier - Manley-Rowe relations, Linearized equations for parametric amplifiers, Parametric up-converter.

UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES 09

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Circulator, Isolator, Transferred Electron Devices - Gunn diodes, IMPATT diode, TRAPATT diode.

UNIT IV MICROWAVE GENERATION 09

Review of conventional Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, and Magnetron Oscillator.

UNIT V MICROWAVE MEASUREMENTS AND APPLICATIONS OF MICROWAVES 09

Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Attenuation, S-parameters, Microwave radar systems, Microwave communication systems, Industrial applications of microwaves.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare the different active, passive microwave devices and components used in Microwave communication systems
- elaborate the usage of multi- port RF networks and RF transistor amplifiers
- apply the concepts of microwave amplifiers in circuit design
- examine the generation of microwave signals
- analyze the microwave signal parameters.

TEXT BOOKS

1. Samuel Y.Liao, “Microwave Devices and Circuits”, Pearson Education Inc.2011
2. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2005.

REFERENCES

1. Reinhold Ludwig and Gene Bogdanov, “RF Circuit Design: Theory and Applications”, Pearson Education Inc.2011
2. Robert E Colin, “Foundations for Microwave Engineering”, John Wiley & Sons Inc, 2005
3. Thomas H Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
4. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India, 2006.

WEB LINKS

1. http://nptel.ac.in/courses/117105130/
2. http://nptel.ac.in/courses/117105130/5
3. http://nptel.ac.in/courses/117105130/13

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
Programme Outcomes														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	1	-	-	2	-	-	2	1	1
CO2	3	2	1	1	2	-	-	-	2	-	-	2	1	1
CO3	3	-	-	1	2	1	-	-	-	-	-	2	1	1
CO4	3	-	-	1	2	-	-	-	-	-	-	2	1	1
CO5	3	2	1	1	2	1	-	-	2	-	-	2	1	1

EC15703 **OPTICAL COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- gain the knowledge about optical fiber sources and transmission techniques
- learn the principle of light propagation through optical fibers
- understand signal distortion mechanisms in the fiber
- study optical transmitters and receivers for fiber /free space links
- acquire optical network concepts and components involved.

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Evolution of fiber optic system - Element of an Optical Fiber Transmission link - Total internal reflection - Acceptance angle - Numerical aperture - Skew rays Ray Optics - Optical Fiber Modes and Configurations - Mode theory of Circular Wave guides - Overview of Modes - Key Modal concepts - Linearly Polarized Modes Single Mode Fibers - Graded Index Fiber structure.

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS 9

Attenuation - Absorption losses - Scattering losses - Bending Losses - Core and Cladding losses - Signal Distortion in Optical Wave guides - Information Capacity determination - Group Delay -Material Dispersion - Wave guide Dispersion - Signal distortion in SM Fibers - Polarization Mode dispersion - Intermodal dispersion - Pulse Broadening in GI Fibers - Mode Coupling - Design Optimization of SM Fibers - RI profile and cut -off wavelength.

UNIT III FIBER OPTICAL SOURCES AND COUPLING 9

Direct and indirect Band gap materials - LED structures - Light source materials - Quantum efficiency and LED power - Modulation of a LED - lasers Diodes -Modes and Threshold condition - Rate equations - External Quantum efficiency - Resonant frequencies - Laser Diodes - Temperature effects - Introduction to Quantum laser - Fiber amplifiers - Power Launching and coupling - Lencing schemes - Fiber -to- Fiber joints - Fiber splicing - Signal to Noise ratio - Detector response time.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS 9

Fundamental receiver operation - Pre amplifiers - Error sources - Receiver Configuration - Probability of Error - Quantum limit. Fiber Attenuation measurements - Dispersion measurements - Fiber Refractive index profile measurements - Fiber cut - off Wave length Measurements - Fiber Numerical Aperture Measurements - Fiber diameter measurements.

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9

Basic Networks: SONET / SDH - Broadcast and select WDM Networks - Wavelength Routed Networks - Non linear effects on Network performance - Link Power budget - Rise time budget - Noise Effects on System Performance -Operational Principles of WDM Performance of WDM + EDFA system - Solutions - Optical CDMA -Ultra High Capacity Networks**.**

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various optical fiber modes - configurations.
- evaluate the various signal degradation factors associated with Optical fiber.
- apply the various optical sources and optical detectors and their use in the optical communication system.
- compare the fiber optic receiver and measurements.
- analyze the digital transmission and its associated parameters on system performance.

TEXT BOOKS

1. Gerd Keiser - "Optical Fiber Communication" McGraw -Hill International - 4th Edition - 2010.
2. John M.Senior - "Optical Fiber Communication" - Second Edition - Pearson Education - 2007.

REFERENCES

1. Ramaswami - Sivarajan and Sasaki "Optical Networks" - Morgan Kaufmann - 20 9.
2. J.Senior - "Optical Communication - Principles and Practice" - Prentice Hall of India - 3rd Edition - 2008.
3. J.Gower - "Optical Communication System" - Prentice Hall of India - 2001.

WEB LINKS

1. http://www.sosmath.com/matrix/matrix.html

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	-	-	3	3	3

EC15704 TELEVISION SIGNAL PROCESSING AND DISPLAY SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- gain the knowledge about the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes.
- familiarize principles and operation of Studio Equipment.
- learn the principles of Transmission and Propagation Systems.
- understand the various Digital Television Standard.
- acquire the concept of Modern Technology of Television.

UNIT I FUNDAMENTALS OF TELEVISION 09

Television System and Scanning Principles: Sound and Picture Transmission, Video Signals, Characteristics of Human Eye, Aspect Ratio and Rectangular Scanning, Persistence of Vision and Flicker, Vertical Resolution, Kell factor, Horizontal Resolution and Video Bandwidth, Interlaced Scanning. Camera Tubes: Vidicon, Plumbicon, Silicon Diode Array Vidicon, CCD-Solid State Image Scanners.

UNIT-II TELEVISION STANDARDS AND STUDIO EQUIPMENTS 09

Composite Video Signal- Horizontal and Vertical Synchronous, Blanking Standards, Reception of VSB Signals, TV Broadcast Channels, CCIR-B Standards. Various TV Broadcast Systems: NTSC, PAL and SECAM System.

UNIT-III TELEVISION TRANSMISSION SYSTEM, PROPAGATION AND ANTENNA 09

Requirements of TV Broadcast Transmission, Block diagram of TV Transmitters, Transmitting Antennas, Propagation Phenomena, Space Wave Propagation, Line of Sight Range, Shadow Zones, Co-Channel Interference, Ghost Images Interference Problems, Parasitic Elements, Receiving Antennas.

UNIT-IV DIGITAL TELEVISION 09

Digital TV: Introduction, Digital System Hardware ,Signal Quantization and Encoding, Digital Satellite Television, Direct to Home Satellite Television ,Digital TV Receivers, Merits of Digital TV Receivers,Geo Stationary Satellite, Satellite Communication Systems,Colour picture Tube- PIL-Delta Gun –Trinitron – Operation.

UNIT-V MODERN TV TECHNOLOGIES 09

Stereo Sound Systems, Projection Television, Flat panel Display TV receivers,3-D Television Picture,EDTV,HDTV, CATV, Cable signal Processing, Cable signal Distribution , Displays devices -LCD-LED -OLED –Operation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes
- analyze principles and operation of Studio Equipment.

- evaluate the principles of transmission and propagation systems.
- compare Various Digital Television Standards.
- synthesize the modern technologies of Television.

TEXT BOOKS

1. R-R-Gulati-"Modern Television Practice -Technology and Servicing – Third Edition – New age International publishes -2012.
2. R-R-Gulati-"Monochrime and Colour Television – Second Edition – New age International publishes - 2009.

REFERENCES

1. A-M-Dhake-" Television and video Engineering" Second Edition TMH 2003..
2. R.G.Gupta, "Television Engineering and Video systems," First Edition, TMH India 2007. 3. S-P-Bali-" Colour Television -Theory and practice "- TMH 1994
3. Bernard Grob," Basic Television Principles and Servicing"- Second Edition, New age International Publisher 2004.

WEB LINKS

1. http://nptel.iitm.ac.in/
2. https://electronics.howstuffworks.com/home-audio-video-channel.htm
1. http://nifrasmail.weebly.com/uploads/2/1/6/7/2167487/analog_telev

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	-	-	3	3	3

EC15705 ELECTRONIC SYSTEM DESIGN LAB 0 0 4 2

COURSE OBJECTIVES

To enable students to

- know the design of AC/DC voltage regulator using SCR
- study the Microprocessor/Micro Controller based system design
- understand the design of Data acquisition and storage of signals through Serial / Parallel port to PC
- implement the Simulation Experiments

List of Experiments:

1. Design of AC/DC voltage regulator using SCR
2. Design of Process Control Timer
3. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using LVDT.
4. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Strain gauge and Pressure Transducer.
5. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Photocell / LDR.
6. Microprocessor/Micro Controller based system design along with suitable signal conditioners for the measurement using Temperature measurement using RTD-Thermo couples.
7. DC motor speed control using digital logic circuits/Microprocessor/PC
8. Simulation Experiments (using MATLAB)
   a. DTMF generation & detection
   b. Multirate Processing
9. Simulation Experiments (using MATLAB)
   a. Echo Cancellation
   b. Error Detection coding
10. PCB Layout design using CAD

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design and test the SCR applications
- synthesize the working and applications of process control timer
- design of Data acquisition and storage of signals through Serial / Parallel port to PC
- implement the Simulation Experiments

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	2	-	3	-	-	-	-	2	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	3	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	2	3	3	3

EC15706 OPTICAL AND MICROWAVE LAB 0 0 4 2

COURSE OBJECTIVES

To enable students to

- understand the working principle of optical sources, detector, fibers and microwave components
- gain knowledge about simple optical communication link.
- learn about the characteristics and measurements in optical fiber
- know about the behavior of microwave components.

OPTICAL EXPERIMENTS

1. DC Characteristics of LED and PIN Photo diode
2. Mode Characteristics of Fibers
3. Measurement of connector and bending losses
4. Fiber optic Analog and Digital Link- frequency response(analog) and eye diagram (digital)
5. Numerical Aperture determination for Fibers
6. Attenuation Measurement in Fibers

MICROWAVE EXPERIMENTS

1. Reflex klystron or Gunn diode characteristics and basic microwave parameter measurement such as VSWR, frequency, wavelength.
2. Directional Coupler Characteristics.
3. Radiation Pattern of Horn Antenna.
2. S-parameter Measurement of the following microwave components (Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee)
3. Attenuation and Power Measurement

TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze the performance of simple optical link.
- examine the microwave and optical components.
- synthesize the mode characteristics of fiber
- compare the radiation of pattern of antenna.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	3	-	-	-	-	2	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	3	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	2	3	3	3

EC15707 **PROJECT WORK PHASE I** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to

- gain knowledge on literature review
- categorize the requirements for the project
- develop hardware solutions for simple applications.
- learn to work in a team.

Every student will be required to undertake a suitable project work in the Department during VII semester, in consultation with the Head of the Department and the guide. Every student will have to prepare and submit the literature review and simulated output of their project at the end of the semester within the stipulated time as announced by the Institute/Department

COURSE OUTCOMES

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

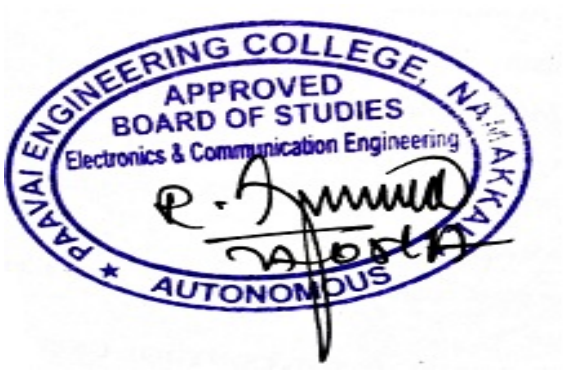
- apply knowledge of basic science and engineering to Electronics and Communication engineering problems.
- analyze the requirements for the project.
- identify, formulate simple problem statements and find solutions.
- implement the hardware and test.

TOTAL PERIODS 60

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO2	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO3	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO4	3	2	3	2	3	2	1	1	2	2	3	1	3	2



ELECTIVE IV

EC15451 MOBILE ADHOC NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn the different types of MAC protocols.
- know about different types of adhoc routing protocols.
- study about the TCP issues in adhoc networks.
- gain the knowledge of architecture and protocols of wireless sensor networks.
- acquire knowledge advanced networks

UNIT I ADHOC NETWORKS 09

Introduction to adhoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models.

UNIT II MEDIUM ACCESS PROTOCOLS 09

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas.IEEEstandards:802.11a, 802.11b, 802.11g, and 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS 09

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

UNIT IV END-END DELIVERY AND SECURITY 09

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G 09

Cross layer Design: Need for cross layer design, cross layer optimization, Parameter optimization techniques, Cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the concepts, network architectures and applications of ad hoc and wireless sensor networks.
- analyze the protocol design issues of ad hoc and sensor networks.
- design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issue.
- evaluate the QoS related performance measurements of ad hoc networks
- examine cross layer design of adhoc network

TEXT BOOKS

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

2. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks: A unified approach", Prentice Hall, 2002.

REFERENCES

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Charles E. Perkins, Adhoc Networking, Addison –Wesley,2000
3. Azzedine Boukerche, “Algorithms and protocols for wireless and Mobile Adhoc networks”, Wiley-IEEE press, Nov 2008.

WEB LINKS

1. http://nptel.ac.in/courses/106105160/3
2. http://nptel.ac.in/courses/106105160/4
3. https://www.youtube.com/watch?v=LXSkpB35cjw

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
Programme Outcomes														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	1	2	3	3	1	3	-	-	1	-	3	3	2	2
CO2	1	2	3	3	1	3	-	-	1	-	3	3	2	2
CO3	1	-	-	3	1	3	-	-	1	-	3	3	2	2
CO4	1	-	-	3	1	3	-	-	1	-	3	3	2	2
CO5	1	2	3	3	1	3	-	-	1	-	3	3	2	2

EC15452 MOBILE APPLICATION DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand system requirements for mobile applications
- know the suitable design using specific mobile development frameworks
- study the mobile application design
- learn the design using specific mobile development frameworks
- acquire the principles of mobile applications in marketplace for distribution

UNIT I MOBILE APPLICATIONS 09

Introduction to mobile operating systems , Embedded systems, Market and Business drivers for mobile applications, Publishing and delivery of mobile applications, Requirements gathering and validation for mobile applications

UNIT II EMBEDDED DESIGN 09

Introduction to basics of embedded systems design, Embedded Operating Systems , Design constraints for mobile applications both hardware and software related, Architecting mobile applications, user interfaces for mobile applications , Touch events and gestures, Achieving quality constraints , performance, usability, security, availability and modifiability

UNIT III ADVANCED DESIGN 09

Designing applications with multimedia and web access capabilities, Integration with GPS and social media networking applications, Accessing applications hosted in a cloud computing environment, Design patterns for Mobile applications.

UNIT IV ANDROID TECHNOLOGY 09

Establishing the development environment, Android architecture, Activities and views, Interacting with UI, Persisting data using SQLite, Packaging and deployment, Interaction with server side applications, Using Google Maps, GPS and Wifi, Integration with social media applications.

UNIT V iOS TECHNOLOGY 09

Introduction to Objective C, iOS features, UI implementation , Touch frameworks , Data persistence using Core Data and SQLite, Location aware applications using Core Location and Map Kit, Integrating calendar and address book with social media application, Using Wifi, iPhone marketplace

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the requirements for mobile applications
- evaluate the challenges in mobile application design and development
- develop design for mobile applications for specific requirements
- apply the design using Android SDK

- analyze the design using Objective C and iOS

TEXT BOOKS

1. Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3rd Edition
2. Zigurd Mednieks, Laird Dornin.G, Blake Meike and Masumi Nakamura, - Programming Android, O"Reily, 2011.

REFERENCES

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Dream Tech, 2012
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.

WEB LINKS

1. http://developer.android.com/develop/index.html
2. https://www.letsnurture.com/services/mobile.html
3. https://onlinecourses.nptel.ac.in/noc18_cs05

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2	1	1	-	-	-	-	3	1	2
CO2	3	2	2	2	2	1	1	-	2	-	-	-	3	3
CO3	3	3	2	1	2	1	1	-	-	-	-	-	3	3
CO4	3	3	3	2	2	1	1	-	-	-	-	3	3	3
CO5	3	2	3	2	2	1	1	-	2	-	-	3	3	3

EC15453 INFORMATION THEORY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the concepts of error–control coding.
- Know the encoding and decoding of digital data streams
- learn the methods for the generation of codes and decoding techniques.
- acquire the knowledge of compression and decompression techniques.
- gain the knowledge of concepts in multimedia communication.

UNIT I INFORMATION THEORY 09

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II DATA AND VOICE CODING 09

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates –Vocoders- Linear Predictive Coders.

UNIT III ERROR CONTROL CODING 09

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial– Parity checks polynomial – Encoder for cyclic codes – calculation of syndrome– Convolutional codes.

UNIT IV COMPRESSION TECHNIQUES 09

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V AUDIO AND VIDEO CODING 09

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders– Video compression Principles – H.261, H.263, MPEG 1, 2, 4 Video standards.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine an application with error–control.
- apply the audio and video compression techniques
- analyze text and image compression techniques
- compare compression and decompression techniques.
- synthesize the concepts of multimedia communication

TEXT BOOKS

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5.

REFERENCES

1. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
2. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.
3. K Sayood, “Introduction to Data Compression” 3/e, Elsevier 2006

WEB LINKS

1. http://nptel.ac.in/courses/117105083/
2. www.cs.uml.edu/~glchen/cs414-564/handouts/chapter7.pdf
3. https://www.voip-info.org/wiki/view/What+is+VOIP

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	3	1	-	-	3	-	1	1	2	2
CO2	3	2	1	1	3	-	-	-	3	-	1	1	2	2
CO3	3	-	-	1	3	1	-	-	3	-	1	1	2	2
CO4	3	-	-	1	3	-	-	-	3	-	1	1	2	2
CO5	3	2	1	1	3	1	-	-	3	-	1	1	2	2

EC15454 SPACE-TIME COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

To enable students to

- acquire the knowledge on coding schemes for space-time Wireless Communications.
- understand transmission and decoding techniques of Wireless Communications.
- learn the Diversity performance in extended channels
- gain knowledge in coding of multiple antenna and receivers
- study the Spread Spectrum and MIMO Multiuser Detection

UNIT I MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION 09

Wireless channel, Scattering model in macro cells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST Multiuser and ST interference channels, ST channel estimation..

UNIT II CAPACITY OF MULTIPLE ANTENNA CHANNELS 09

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of Rician fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

UNIT III SPATIAL DIVERSITY 09

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space – time -frequency selective fading channel..

UNIT IV MULTIPLE ANTENNA CODING AND RECEIVERS 09

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers(SISO,SIMO,MIMO), Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre - filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

UNIT V ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION 09

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO-OFDM,SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO-SS. MIMO-MAC, MIMO-BC, Outage performance for MIMO-MU, MIMO- MU with OFDM, CDMA and multiple antennas.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the coding schemes for space-time Wireless Communications..

- evaluate the transmission and decoding techniques of Wireless Communications.
- synthesize the Diversity performance in extended channels
- compare the coding of multiple antenna and receivers
- analyze the concepts of Spread Spectrum and MIMO Multiuser Detection

TEXT BOOKS

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005

2. Paulraj, RohitNabar, Dhananjay Gore., "Introduction to Space Time Wireless Communication Systems", Cambridge University Press, 2003

REFERENCES

1. Andre Viterbi " Principles of Spread Spectrum Techniques" Addison Wesley 1995
2. Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University press, 2005.
3. Sergio Verdu " Multi User Detection" Cambridge University Press, 1998

WEB LINKS

1. http://nptel.ac.in/courses/117105132/5
2. https://dokumente.unibw.de/pub/bscw.cgi/d1223037/paper_ssd05.pdf
3. https://arxiv.org/ftp/arxiv/papers/0909/0909.3342.pdf

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	3	1	-	-	3	-	1	1	2	2
CO2	3	2	1	1	3	-	-	-	3	-	1	1	2	2
CO3	3	-	-	1	3	1	-	-	3	-	1	1	2	2
CO4	3	-	-	1	3	-	-	-	3	-	1	1	2	2
CO5	3	2	1	1	3	1	-	-	3	-	1	1	2	2

ELECTIVE V

EC15551 INTERNET AND JAVA 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the concepts and architecture of the World Wide Web
- practice markup languages
- study the web design
- acquire basic concepts of Java programming
- impart knowledge on web services

UNIT I INTRODUCTION TO WWW 09

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.

UNIT II HTML BASICS 09

Markup Language (HTML5):Basics of Html - Syntax and tags of Html -Introduction to HTML5 - Semantic/Structural Elements - HTML5 style Guide and Coding Convention – Html API‟s -Audio & Video - Drag/Drop - Local Storage - Web socket API – Debugging and validating Html

UNIT III CASCADING STYLE SHEET 09

Cascading Style Sheet (CSS3): The need for CSS – Basic syntax and structure Inline Styles – Embedding Style Sheets - Linking External Style Sheets - Introduction to CSS3 – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS -Responsive Web Design.

UNIT IV JAVA BASICS 09

Introduction to Java – Test - driving a java application - Input / Output and operators -Classes, Objects, Methods and strings - control statements - Methods: A deeper look - Arrays and Array Lists - classed and objects: A deeper look - Inheritance - polymorphism and Interfaces - Exception handling

UNIT V XML AND WEB SERVICES 09

Xml – Introduction-Form Navigation-XML Documents – DTD - Namespace - XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the technologies used in Web Programming.
- create a basic website using HTML
- design and implement simple web page using Cascading Style Sheets
- analyze the salient features of Java over C++ and write programs using fundamental concepts
- build web based application and to present data in XML format

TEXT BOOKS

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World wide web - How to Program", Fifth Edition, Pearson Education, 2011
2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.

REFERENCES

1. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013
2. Michael Morrison XML Unleashed Tech media SAMS.
3. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
4. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010

WEB LINKS

1. http://nptel.ac.in/courses/106105031/
2. http://nptel.ac.in/courses/106105031/4
3. http://nptel.ac.in/courses/106105031/7

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
	Programme Outcomes													
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO10	PO1 1	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO5	3	3	3	3	3	3	-	-	3	3	-	3	3	3

EC15552 CRYPTOGRAPHY AND NETWORK SECURITY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about OSI security architecture and classical encryption techniques
- acquire fundamental knowledge on the concepts of finite fields and number theory
- understand various block cipher and stream cipher models
- study the principles of public key cryptosystems, hash functions and digital signature
- know about web security

UNIT I NUMBER THEORY 09

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques -Symmetric cipher model, substitution techniques, transposition techniques, steganography. Finite Fields And Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem-Discrete logarithms

UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 09

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard - Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 09

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT IV SECURITY PRACTICES AND SYSTEM SECURITY 09

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT V WEB SECURITY 09

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload Internet Key Exchange - Phases of IKE, ISAKMP/IKE Encoding. Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- compare various Cryptographic Techniques
- analyze the design of secure applications

- evaluate Inject secure coding in the developed applications
- apply the E-mail Security.
- examine the Web Security

TEXT BOOKS

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013

2. Behrouz A. Foruzan, Data communications and Networking, The McGraw-Hill Companies, Inc. 5th edition. (2013)

REFERENCES

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Charles P Fleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
3. Andrew S.Tannenbaum, Computer Networks, PHI, (2010).

WEB LINKS

1. http://nptel.ac.in/courses/106105031/
2. http://nptel.ac.in/courses/106105031/4
3. http://nptel.ac.in/courses/106105031/7

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	1	2	1	3	-	3	2	3	-	-	-	3	1	2
CO2	-	2	2	3	-	3	-	2	-	-	-	2	1	1
CO3	-	2	1	3	-	3	-	2	-	-	-	1	1	1
CO4	-	1	2	2	-	2	1	2	-	-	-	1	1	1
CO5	-	1	2	2	-	1	1	2	-	-	-	1	1	1

EC15553 BIO SIGNAL PROCESSING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- study the characteristics of biomedical signals
- acquire the principles of noise filtering and Interference cancellation
- learn the event detection and extraction techniques
- know the modeling of biomedical systems
- understand the pattern classification and diagnostic decision

UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS 09

Introduction to Biomedical Signals - ECG, EEG, EMG, ENG etc. Event related potentials- Biomedical Signal Analysis - Computer Aided Diagnosis. Concurrent, coupled and correlated processes - illustration with Case studies

UNIT II NOISE FILTERING 09

Random noise structured noise and physiological interference- noise and artifacts in ECG. Time domain filters- Frequency domain filters- Principles of adaptive filters- Winer Filtering- Steepest Descent algorithms- Widrow Hopf, Least mean square adaptive algorithms- Adaptive noise canceller- Interference cancellation in Electrocardiography- noise cancellation in electro surgery

UNIT III EVENT DETECTION AND EXTRACTION 09

Detection of P, QRS and T waves in ECG- EEG rhythms- Detection of EEG spike and wave complexes- density- Homomorphic filtering. Analysis of event related potential – Morphological analysis of ECG waves- Envelope extraction and analysis- Analysis of activity: zero crossing rates. Fourier Spectrum, Estimation of power spectral moments and spectral power ratio.

UNIT IV MODELING OF BIOMEDICAL SYSTEMS 09

Point processes- Parametric system modeling- All-pole, pole zero modeling, electromechanical models of signal generation. Analysis of non-stationary signals: Characterization- Fixed segmentation- Short Time Fourier Transform- Adaptive segmentation- Adaptive filters for segmentation- RLS and Lattice Filter.

UNIT V PATTERN CLASSIFICATION AND DIAGNOSTIC DECISION 09

Supervised and unsupervised pattern classification- Probabilistic models and statistical decisions- Logistic of regression analysis- training and test steps neural networks- Measures of diagnostic accuracy and cost- Reliability classifiers and decisions. Application: Normal versus Ectopic ECG beats- Detection of Knee Joint cartilage Pathology.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the basics of biomedical signals
- compare the noise filtering techniques

- analyze event detection and extraction of bio signals
- apply the different models of biomedical systems.
- evaluate the pattern classification and decision making techniques.

TEXT BOOKS

1. Rangaraj M. Rangayyan, „Biomedical Signal Analysis-A case study approach, Wiley- Interscience/IEEE Press, 2002
2. D.C.Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005.

REFERENCES

1. Metin Akay, "Biomedical Signal Processing", Academic press, Inc
2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001
3. Khandpur R.S, "Hand Book of Biomedical Instrumentation", Tata McGraw Hill publication , New Delhi 2nd edition 2003.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc18_ec02/preview
2. https://www.sciencedirect.com/journal/biomedical-signal-processing-and-control
3. https://www.journals.elsevier.com/biomedical-signal-processing-and-control

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	-	-	-	-	2	-	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	2	-	-	3	3	3

EC15554 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know about the basics of EMI and EMC Environment
- study about EMI and EMC Coupling Principles
- acquire about EMI used in instrumentation system
- understand the control techniques involved in Electromagnetic Interference
- learn the EMI Specification Standards and Limit

UNIT I EMI ENVIRONMENT 09

Concepts of EMI and EMC and definitions - Sources of EMI – Celestial Electromagnetic noise- Lightning discharge- Switches Electrostatic Discharge- Electromagnetic Pulse - Electromagnetic emissions - Noise from relays and- Nonlinearities in Circuits

UNIT II EMI COUPLING PRINCIPLES 09

Capacitive coupling - Inductive coupling- Common impedance ground coupling- Ground loop coupling-Transients in power supply lines- Radiation coupling, Conduction coupling-Common – mode and Differential mode.

UNIT III EMI MEASUREMENTS 09

Open area test site measurements-Measurement precautions – Open area test site- Anechoic Chamber-TEM Reverberating TEM-GTEM cell – Comparisons

UNIT IV EMI CONTROL TECHNIQUES 09

EMC Technology- Grounding-Shielding-Electrical Bonding-Power line filter-CM filter – DM filter- EMI suppression Cables- EMC Connectors -Isolation transformer.

UNIT V EMI AND EMC STANDARDS 09

Introduction- Standards for EMI/EMC- MIL-STD-461/462-IEEE/ANSI standard-CISPR/IEC standard- FCC regulations-British standards-VDE standards-Euro norms-Performance standards-some comparisons

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concepts of EMI and EMC
- synthesize solutions to EMI Sources
- evaluate the measurements in EMI
- examine, test and implement EMI system
- compare the different EMI and EMC standards

TEXT BOOKS

1. Prasad Kodali – “Engineering Electromagnetic Compatibility – Principles, Measurements, and

Technologies", IEEE press.

2. Clayton R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley Publications, 2008.

REFERENCES

1. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1987
3. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006.

WEB LINKS

1. https://www.nasa.gov/.../639521main_EMI-EMC_User_Test_Planning_.
2. www.irpel.org/pdf.../electromagnetic-interference-and-compatibility.pdf
3. www.rfwireless-world.com/Terminology/EMI-vs-EMC.html

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes (Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	-	-	-	-	2	-	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	2	-	-	3	3	3

EC15801 **MOBILE COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the fundamental cellular concepts.
- learn the different ways of radio propagation models.
- study various modulation and equalization techniques.
- gain the knowledge about multiple access and speech coding techniques.
- know the generation of wireless networks and wireless standards.

UNIT I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9

Introduction to wireless communication systems: Evolution of mobile radio communications - mobile radio systems - Examples. Cellular Concept: Frequency reuse - channel assignment and hand off strategies - Interference and system capacity - trunking and grade of service - Improving Coverage and capacity in Cellular systems

UNIT II MOBILE RADIO PROPAGATION 9

Free space propagation model - reflection - diffraction - scattering - link budget design - Outdoor Propagation models - Indoor propagation models - Small scale Multipath propagation - Small scale Multipath measurements - parameters of Mobile multipath channels - types of small scale fading.

UNIT III MODULATION TECHNIQUES AND EQUALIZATION 9

Modulation Techniques: Minimum Shift Keying - Gaussian MSK - M-ary QAM - M-ary FSK - Orthogonal Frequency Division Multiplexing - Spread spectrum modulation techniques Equalization: Survey of Equalization Techniques - Linear Equalization - Non -linear Equalization. Diversity Techniques - RAKE receiver.

UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES 9

Coding: Vocoders - Linear Predictive Coders - Selection of Speech Coders for Mobile Communication - GSM Codec - USDC Codec. Multiple Access Techniques: FDMA - TDMA - CDMA - SDMA - Capacity of Cellular CDMA and SDMA.

UNIT V WIRELESS SYSTEMS AND STANDARDS 9

AMPS and ETACS -Global system for mobile -CDMA digital cellular standard (IS-95) -Digital European cordless telephone.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various standards used in Wireless communication.
- evaluate the different radio propagation models.

- compare different equalization and diversity techniques.
- synthesize different multiple access techniques.
- analyze different wireless standards and generations.

TEXT BOOKS

1. T.S.Rappaport - “Wireless Communications: Principles and Practice - Second Edition – Pearson B Education/ Prentice Hall of India - Third Indian Reprint 2003.
2. W.C.Y.Lee - "Mobile Communications Engineering: Theory and applications - Second Edition - McGraw -Hill International - 1998.

REFERENCES

1. R. Blake - “Wireless Communication Technology” - Thomson Delmar - 2003.
2. Kaveh Pahlavan - Prashant Krishnamurthy - "Principles of Wireless Networks: A unified approach" - Prentice Hall - 2002.
3. Stephen G. Wilson - “Digital Modulation and Coding” - Pearson Education - 2003.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 6**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15802 **PROJECT WORK PHASE II** **0 0 12 6**

COURSE OBJECTIVES

To enable the students to

- learn to work as a member of a project team.
- understand project management tasks.
- simulate software solution for a real-time, industry relevant problem
- develop a hardware for a real-time, industry relevant problem

Every student will be required to undertake a suitable project work in the Department during VIII semester, in consultation with the Head of the Department and the guide. Every student will have to submit their project report at the end of the Semester within the stipulated time as announced by the Institute/Department.

COURSE OUTCOMES

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

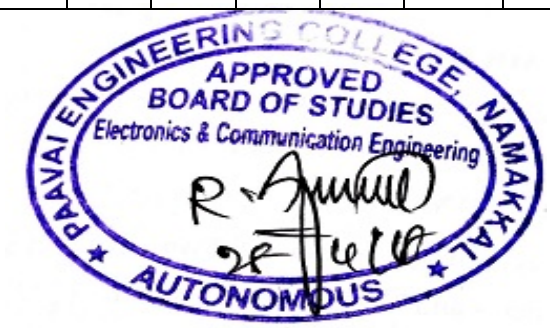
- apply knowledge of basic science and engineering to Electronics and Communication Engineering problems
- recognize the real world applications and to solve with core engineering knowledge.
- analyze and work on multidisciplinary tasks
- choose latest tools, software and equipment to solve real world problems identify, formulate, and model engineering equipment

TOTAL PERIODS 180

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO2	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO3	3	2	3	2	3	2	1	1	2	2	3	1	3	2
CO4	3	2	3	2	3	2	1	1	2	2	3	1	3	2



EC15651 **WIRELESS SENSOR NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the state of the art in wireless sensor network - architectures and applications
- study the functions of different wireless architectures
- learn the various aspects of MAC protocols
- know the concept of infrastructure establishment
- gain knowledge about various tools and platform in the networks

UNIT I INTRODUCTION OF WIRELESS SENSOR NETWORKS 9

Introduction - Background of WSN Technology - Sensor Network Standards - RF Technologies for WSN - Difference between mobile adhoc and sensor networks - Applications of sensor networks - Challenges for Wireless Sensor Networks.

UNIT II 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 - Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations - MAC Protocols for Wireless Sensor Networks - Low Duty Cycle Protocols and Wakeup Concepts - SMAC - Address & Name Management – Assignment of MAC Addresses - Routing Protocols - Energy Efficient Routing - Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT AND POWER CONTROL 9

Topology Control - Clustering - Time Synchronization - Localization and Positioning - Sensor Tasking and Control - Power Consumption in Sensor Nodes – Power Control at different protocol Layers - Physical Layer Power Conservation Mechanisms – Higher Layer Power Conservation Mechanisms.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Operating Systems for Wireless Sensor Networks - Sensor Node Hardware – Hardware Platforms for WSNs:Mica2 -MicaZ -Btnode - and Sun SPOT – WSN Simulation Platform - Node Level Simulators : NS2 - TOSSIM - Middleware Architecture for WSN –Open Issues in software Technologies

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the various wireless sensor networking strategies.
- evaluate the different types of architecture used in sensor networks.

- analyze the technical issues related to networking of sensors
- synthesize knowledge to control the sensor network.
- design and build a wireless sensor network using simulators

TEXT BOOKS

1. Holger Karl & Andreas Willig - "Protocols And Architectures for Wireless Sensor Networks" - John Wiley - 2005.
2. Kaveh Pahlavan - Prashant Krishnamurthy - "Principles of Wireless Networks: A unified approach" - Prentice Hall - 2002.

REFERENCES

1. Kazem Sohraby - Daniel Minoli - &Taieb Znati - "Wireless Sensor Networks -Technology - Protocols - And Applications" - John Wiley - 2007
2. Anna Hac - "Wireless Sensor Network Designs" - John Wiley - 2003.
3. Feng Zhao & Leonidas J. Guibas - "Wireless Sensor Networks - An Information Processing Approach" Elsevier - 2007.

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

Cos	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO2	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO3	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO4	3	3	-	-	3	-	3	-	-	-	-	3	3	3
CO5	3	3	-	-	3	-	3	-	-	-	-	3	3	3

EC15652 **SATELITE COMMUNICATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- study the overview of satellite systems in relation to other terrestrial systems
- gain knowledge about the earth segment and space segment components
- learn the satellite access by various users
- gain the concept of earth segment
- Know the DTH and compression standards

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 Broadcast - 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 - 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 - Direct to home Broadcast - Digital audio broadcast - World space services - Business TV - GRAMSAT - Specialized services – E–mail - Video conferencing - Internet.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to analyze

- evaluate the earth segment and space segment
- analyze the design of various satellite applications. .
- apply the various multiple access techniques

- analyze the design of various satellite applications.

TEXT BOOKS

1. Dennis Roddy - "Satellite Communication" - McGraw Hill International - 4th Edition - 2006
2. Gerard Maral and Michel Bousquet - "Satellite Communication Systems – Techniques and Technologies" – Wiley - 5th Edition.

REFERENCES

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 - 1997.
3. M.Richharia - "Satellite Communication System Design Principles" - Macmillan 2003.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

	Programme Outcomes(POs)													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												3	3
CO2		3	3										3	3
CO3				3	3	3		3					3	3
CO4				3	3		3		3			3	3	3
CO5		3	3	3	3				3	3	3	3	3	3

EC15653 NANO-ELECTRONICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the overview of Nano electronics and Nano computer architecture
- study the concepts Fabrication and Measurement Techniques
- know about the properties of Nano electronics
- acquire knowledge about Nano electronic architectures.
- learn about Logic Devices and Applications

UNIT I NANO ELECTRONICS FOUNDATIONS 9

Overview of basic Nano Electronics - Recent past - the present and its challenges - Future of Nano Electronics - Nano computer architectures: Introduction to Nano computers– Nano computer Architecture - Quantum DOT Cellular Automata - QCA circuits - single electron circuits - molecular circuits.

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 Nano structures - Spontaneous formation and ordering of Nanostructures - Clusters and Nano crystals - Methods of Nano tube growth - Chemical and biological methods for Nano scale fabrication

UNIT III PROPERTIES OF NANO ELECTRONICS 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 ELECTRONIC ARCHITECTURES 9

Nanofabrication - Nano patterning of Metallic/Semiconducting Nanostructures - e-beam/X -ray - Optical Lithography - STM/AFM -SEM and Soft -lithography-Nano phase materials – Self assembled Inorganic/Organic layers.

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 PERIODS 45

COURSE OUTCOMES

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

- examine the concepts of Nano electronics and Nano computer architectures.
- evaluate the techniques for characterization of Nano structures
- compare and utilize various properties of Nano materials

- analyze the architecture of Nano electronics.
- apply the concepts of Logic Devices and its applications.

TEXT BOOKS

1. Karl Goser - JanDienstuhl - "Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices" -
2. K.Goser - P.Glosekotter and J.Diestuhi - " Nanoelectronics and Nano systems" - Springer - 2004

REFERENCES

1. Vladimir V. Mitin - Viatcheslav A. Kochelap - Michael A. Stroscio - "Introduction to Nanoelectronics: Science - Nanotechnology - Engineering - and Applications" - Cambridge University Press 2011.
2. Supriyo Datta - "Lessons from Nanoelectronics: A New Perspective on Transport" - World Scientific 2012.
3. Dr. H.C. Marcel Van de Voorde - "Nanoelectronics: Materials - Devices - Applications" - Wiley 2017.

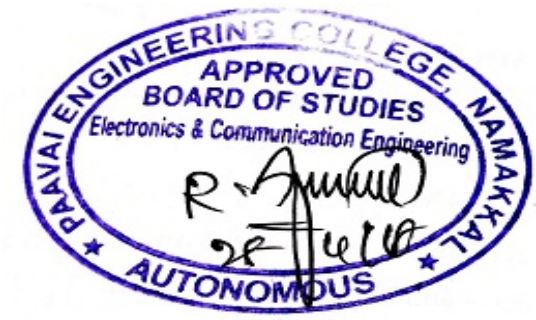
WEB LINKS

1. https://www.youtube.com/watch?v=0_FjPqBqPec
2. https://www.youtube.com/watch?v=tW1 -fSRiAdc
3. www.nptel.ac.in/syllabus/117108047/

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3



EC15654 **RF MICROELECTRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know the concepts in RF design.
- understand the communication concepts in microelectronics
- learn about transceiver architecture
- gain knowledge on the concepts and types of PLL
- study the power amplifiers concepts in microelectronics.

UNIT I CONCEPTS IN RF DESIGN **9**

Introduction to RF - Design challenges of RF - General consideration - Effects of Nonlinearity - Noise - Sensitivity and dynamic range - Passive impedance Transformation - Scattering parameters - Analysis of Nonlinear dynamic systems - Volterra series.

UNIT II COMMUNICATION CONCEPTS **9**

General consideration - Analog and Digital modulation - Spectral regrowth - Mobile RF communications - Multiple access techniques - Wireless standards.

UNIT III TRANSCEIVER ARCHITECTURE **9**

Receiver architecture: - Basic heterodyne receivers - Modern heterodyne receivers - Direct conversion receivers - Image reject receivers - Low IF Receivers. Transmitter architectures: Direct conversion transmitters - Modern direct conversion transmitters - Heterodyne Transmitters - Other TX architectures - OOK transceivers.

UNIT IV PHASE -LOCKED LOOPS **9**

Basic concepts - Type I PLLs - Type II PLLs - PFD/CP Non idealities - Phase noise in PLLs - Loop Bandwidth - Design procedure.

UNIT V POWER AMPLIFIERS **9**

General considerations - Classification of power amplifiers - High efficiency power amplifiers - Cascode output Stages – Large signal impedance matching - Basic Linearization Techniques - Polar modulation - Out phasing - Doherty power amplifier - Design Examples

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the concepts in RF design.

- analyze the communication concepts in microelectronics.
- compare various transceiver architecture.
- examine power amplifiers concepts in RF microelectronics.
- evaluate the concepts and types of PLL in microelectronics.

TEXT BOOKS

1. B.Razavi - "RF Microelectronics" - Prentice Hall PTR - 1998.
2. Behzad Razavi - "Design of Analog CMOS Integrated Circuits" - McGraw Hill - Second Edition - 2008

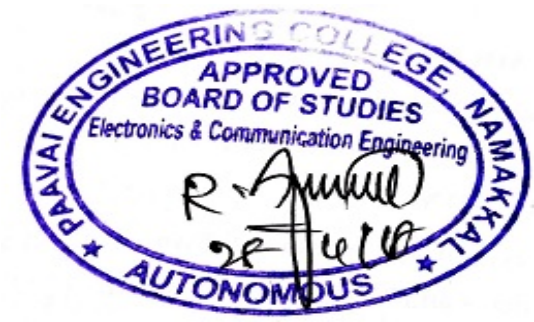
REFERENCES

1. R. Jacob Baker - H.W.Li and D.E. Boyce - "CMOS Circuit Design - Layout and Simulation" - Prentice - Hall of India -1998.
2. Y.P.Tsividis - "Mixed Analog and Digital VLSI Devices and Technology" - McGraw Hill - 1996.
3. Robert E Colin - "Foundations for Microwave Engineering" - John Wiley & Sons Inc - 2005

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 6**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3



EC15751 **OPTOELECTRONIC DEVICES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basics of solid state physics
- acquire the knowledge of display devices.
- learn the concepts of optical detection devices.
- gain knowledge about optoelectronic integrated circuits.
- know the design of optoelectronic integrated circuits.

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 Semiconductor Physics and Semiconductor Junction theory.

UNIT II DISPLAY DEVICES AND LASERS **9**

Introduction - Photo Luminescence - Cathode Luminescence - Electro Luminescence - Injection Luminescence - Light Emitting Diodes - 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 DETECTION DEVICES **9**

Photo detection Principle - Photoconductors - Noise in photoconductors -Photodiodes - PIN Photodiode - APD Detector performance parameters - Detectors for long wavelength operation - wavelength - selective detection - Charge Coupled Device.

UNIT IV OPTOELECTRONIC MODULATOR **9**

Introduction - Analog and Digital Modulation - Electro -optic modulators - Magneto -optic Devices - Acousto -optic devices.

UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS **9**

Introduction - hybrid and Monolithic Integration - Application of Opto Electronic Integrated Circuits - Integrated transmitters and Receivers - Guided wave devices

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to analyze

- examine the basics of solid state physics.
- analyze the design of optoelectronic detection devices and modulators. .
- evaluate the concepts of optical detection devices.
- synthesize the design of optoelectronic integrated circuits.

- apply the concepts of Opto electronic and integrated circuits

TEXT BOOKS

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices” - Prentice Hall of India Pvt. - Ltd. - NewDelhi
2. .Jasprit Singh - “Opto Electronics – As Introduction to Materials and Devices” - McGraw -Hill International Edition - 1998

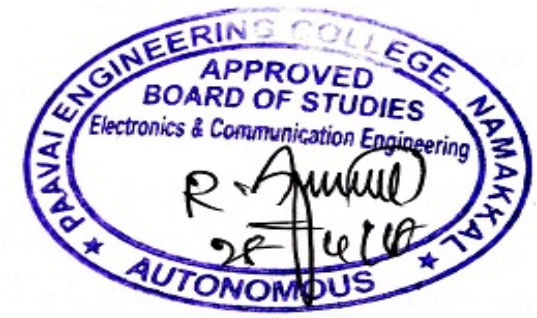
REFERENCES

1. . S.O.Kasap - “Opto Electronics and Photonics – Principles and Practices” - Pearson - Second Edition
2. S C Gupta - Opto Electronic Devices and Systems - Prentice Hal of India - 2005.
3. J. Wilson and J.Haukes - “Opto Electronics – An Introduction” - Prentice Hall - 1995

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 6**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3



EC15752 MICROELECTROMECHANICAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn MEMS and its fabrication methods
- understand the principle of mechanical sensing.
- study the micro opto - electro principles.
- acquire the principle of magnetic sensing.
- gain knowledge about the significance of radio frequency MEMS and its applications.

UNIT I MEMS AND ITS FABRICATION METHODS 9

Definition of MEMS - MEMS history and development - micro machining - lithography principles and methods - structural and sacrificial materials - thin film deposition - impurity doping - etching - surface micro machining - wafer bonding.

UNIT II MECHANICAL SENSORS AND ACTUATORS 9

Principles of sensing and actuation: beam and cantilever - capacitive - piezo electric - strain - pressure - flow pressure measurement by micro phone - MEMS gyroscopes - shear mode piezo actuator - gripping piezo actuator - Inchworm technology.

UNIT III MICRO - OPTO - ELECTRO MECHANICAL SYSTEMS 9

Principle of MEMS technology - properties of light - light modulators - beam splitter - micro lens - micro mirrors - digital micro mirror device - light detectors - grating light valve - optical switch - wave guide and tuning - shear stress measurement

UNIT IV MAGNETIC SENSORS AND ACTUATORS 9

Magnetic materials for MEMS and properties - magnetic sensing and detection - magneto resistive sensor - more on hall effect - magneto diodes - magneto transistor - MEMS magnetic sensor - MEMS actuators by directional micro actuator - feedback circuit integrated magnetic actuator - magnetic probe based storage device.

UNIT V RADIO FREQUENCY MEMS 9

RF based communication systems - RF MEMS - MEMS inductors - varactors - tuner/filter - resonator - clarification of tuner - filter - resonator - MEMS switches - phase shifter.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine the basics of MEMS.
- analyze the principle of mechanical sensing.
- apply the micro -opto -electro principles.
- synthesize the principle of magnetic sensing.
- compare the radio frequency MEMS and its applications.

TEXT BOOKS

1. Nitaigour Premchand Mahalik - "MEMS" - TMH Publishing co.
2. Tai -Ran Hsu - "MEMS and Micro Systems: Design and Manufacture" - TMH Publishers.

REFERENCES

1. Chang Liu - "Foundation of MEMS" - Prentice Hall Ltd.
2. Sergey Edwrd Lyshevski - "MEMS and NEMS" - CRC Press - Indian Edition.
3. Mohamed Gad -el -Hak - "MEMS – Introduction and fundamentals" - Taylor and Francis - Second Edition - 2013

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3

EC15753 **OPTICAL NETWORKS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire basic concepts in optical system components.
- know the concepts in optical network architectures.
- learn about wavelength routing networks.
- gain knowledge on the concepts of packet switching and access networks.
- study the network design and management.

UNIT I OPTICAL SYSTEM COMPONENTS **9**

Light propagation in optical fibers - Loss and bandwidth - System limitations - Non -linear effects; Optical network components - Couplers - Isolators and Circulators - Multiplexers and Filters - Optical Amplifiers - Switches - Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES **9**

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

UNIT III WAVELENGTH ROUTING NETWORKS **9**

The optical layer - Node Designs - Optical layer cost tradeoff - Routing and wavelength assignment - Virtual topology design - Wavelength Routing Test beds - Architectural variations.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS **9**

Photonic Packet Switching - OTDM - Multiplexing and Demultiplexing - Synchronization - Broadcast OTDM networks - Switch -based networks; Access networks - Network architecture overview - Future Access Networks - Optical Access Network Architectures; OTDM networks.

UNIT V NETWORK DESIGN AND MANAGEMENT **9**

Transmission System Engineering - System model - Power penalty - transmitter - receiver - Optical amplifiers - crosstalk - dispersion; Wavelength stabilization; Overall design considerations; Control and Management - Network management functions - Configuration management - Performance management - Fault management - Optical safety Service interface

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the basic concepts in optical system components.
- examine the concepts in optical network architectures

- elucidate about wavelength routing networks.
- evaluate the concepts of packet switching and access networks
- apply about network design and management

TEXT BOOKS

1. Rajiv Ramaswami and Kumar N. Sivarajan - “Optical Networks: A Practical Perspective” - Harcourt Asia Pte Ltd. - Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy - “WDM Optical Networks: Concept - Design and Algorithms” - Prentice Hall of India - Ist Edition - 2002.

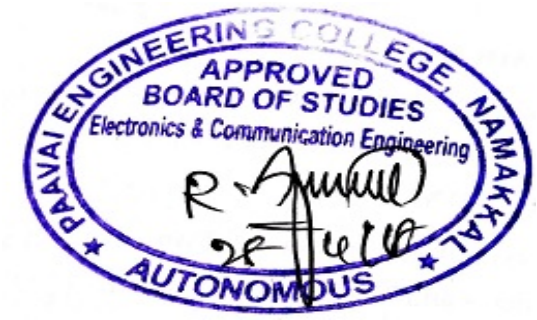
REFERENCES

1. P.E. Green - Jr. - “Fiber Optic Networks” - Prentice Hall - NJ - 1993
2. John M.Senior - "Optical Fiber Communication” - Second Edition - Pearson Education - 2007.
3. Gerd Keiser - "Optical Fiber Communication" McGraw -Hill International - 4th Edition - 2010.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	**Programme Outcomes(POs)**															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 6**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3



EC15754 **VIRTUAL INSTRUMENTATION** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- know about virtual versus traditional instruments and programming techniques
- learn about A/D and D/A converter and data acquisition.
- study PC buses - Instrumentation buses and network protocols
- design using VI software
- understand PC operating system and instrumentation

UNIT I VIRTUAL INSTRUMENTATION 9

Virtual Instrumentation - Definition and Flexibility - Block diagram and Architecture for Virtual Instruments versus Traditional Instruments - Review of software in Virtual Instrumentation - VI Programming techniques - VI - sub VI - Loop and Charts - Arrays - Clusters and Graphs - Case and Sequence Structures - Formula nodes - String and File Input / Output.

UNIT II DATA ACQUISITION IN VIRTUAL INSTRUMENTATION 9

A/D and D/A converters - Plug -in Analog Input / Output cards – Digital Input and Output Cards - Organization of the DAQ VI system – Opto isolation – Performing analog input and analog output – Scanning multiple analog channels – Issues involved in selection of Data acquisition cards – Data acquisition modules with serial communication – Design of digital voltmeter with transducer input – Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES 9

Introduction to PC Buses – Local busses: - ISA - PCI - RS232 - RS422 and RS485 – Interface Buses: USB - PCMCIA - VXI - SCXI and PXI – Instrumentation Buses : Modbus and GPIB – Networked busses – ISO/OSI Reference model - Ethernet and TCP/ IP Protocols

UNIT IV REAL TIME CONTROL IN VIRTUAL INSTRUMENTATION 9

Designs using VI Software - ON/OFF controller – Proportional controller – Modeling and basic control of level and reactor processes – Case studies on development of HMI - SCADA in VI

UNIT V OPERATING SYSTEM AND HARDWARE OVERVIEW 9

PC architecture - current trends - operating system requirements - PC based instrumentation - analog and digital interfaces - PXI and SCXI main frame - modular instruments – Transducers – power - speed and timing considerations.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- examine virtual instrumentation concepts.
- analyze the various acquisition methodologies.
- evaluate traditional and virtual instrumentation.
- discuss operating systems required for virtual instrumentation.
- synthesize the implementation methods for instrumentation.

TEXT BOOKS

1. .Barry Paton - "Sensor - transducers and LabVIEW" - Prentice Hall of India 2000.
2. Sanjay Gupta and Joseph John - " Virtual Instrumentation using LabVIEW" Second Edition

REFERENCES

1. Lisa K Wells and Jeffery Travis "LabVIEW for Everyone" - Prentice Hall of India.1996.
2. Buchanan - W. "Computer buses" - CRC Press 209
3. .Jeffery Travis "Internet applications in LabVIEW" - Prentice Hall of India.1996

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	2	-	3	3	3	3
CO3	3	3	2	2	-	3	-	-	-	-	2	-	3	3	3	3
CO4	3	3	3	1	-	-	-	-	-	-	2	-	3	3	3	3
CO5	3	3	3	1	-	3	-	-	-	-	2	-	3	3	3	3