E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

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NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Third Year – Eighth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1901MGX07	Universal Human Values and Ethics	3	0	0	3	40	60	100	HSSC
	Professional Elective – IV	3	0	0	3	40	60	100	PEC
	Professional Elective – V	3	0	0	3	40	60	100	PEC
Laboratory Course									
1904EC851	Project Work	0	0	14	7	50	50	100	
Total		**9**	**0**	**14**	**16**	**170**	**230**	**400**	

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
PROFESSIONALELECTIVES – IV								
1903EC016	Machine Learning and Pattern recognition	3	0	0	3	40	60	100
1903EC017	Embedded System	3	0	0	3	40	60	100
1903EC018	Multimedia Communication	3	0	0	3	40	60	100
1903EC019	Wireless Communication	3	0	0	3	40	60	100
1903EC020	High Speed Switching Networks	3	0	0	3	40	60	100
PROFESSIONALELECTIVES – V								
1903EC021	Nano Electronics	3	0	0	3	40	60	100

1903EC022	Opto Electronic Devices	3	0	0	3	40	60	100
1903EC023	Speech Processing	3	0	0	3	40	60	100
1903EC024	Microwave Integrated Circuits	3	0	0	3	40	60	100
1903EC025	Satellite Communication	3	0	0	3	40	60	100

1901MGX07	Universal Human Values and Ethics	L	T	P	C
		3	0	0	3
	(Common to B.E / B.Tech – CSE, IT & ECE)				
Course Objectives:					
	1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.				
	2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession				
	3. To help students understand the meaning of happiness and prosperity for a human being.				
	4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.				
	5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life				
Module I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**9 Hours**			
1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels					
Module II	**Understanding Harmony in the Human Being - Harmony in Myself**	**9 Hours**			
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensureSanyam and Swasthya					
Module III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**9 Hours**			
13. Understanding harmony in the Family- the basic unit of human interaction 14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship 15. Understanding the meaning of *Vishwas*; Difference between intention and competence 16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship 17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals 18. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!					
Module IV	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**	**9 Hours**			

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence

Module V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**9 Hours**

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in Professional Ethics:

a) Ability to utilize the professional competence for augmenting universal human order,

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models

27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations

	Total:	**45 Hours**

Further Reading:

Professional Ethics & Business Ethics

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

References:

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Reference Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

LABORATORY COURSE

1904EC851	PROJECT WORK	L	T	P	C
		0	**0**	**14**	**7**

Course Objectives: The students should be made to:

1. To develop self-learning skills of utilizing various technical resources to design a product.
2. To test technical presentation and communication skills.

The students (with team size no more than 4 students in a team) are expected to make a project on topics (Preferably in recent trends) related to Electronics and Communication Engineering. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as power point presentation and demonstrative models which should be presented to panel which consist no less than five faculties (excluding course co coordinator). The average of the mark given by all panel members is taken into consideration. A project report is required at the end of the semester. 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.

Evaluation Scheme: Continuous Assessment (100)

Distribution of marks for Continuous Assessment:

ZEROTH REVIEW :	10 marks
FIRST REVIEW:	20 marks
SECOND REVIEW:	20 marks
FINAL REVIEW/DEMO:	30 marks
REPORT:	20 marks
Total Marks:	**100**

Total: 210 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Inspect technology for designed product in Electronics and communication engineering field.
2. Improve the technical presentation and communication skills.
3. Connect different domains to make intelligent system.
4. Maximize their technical knowledge with discussing others.
5. Develop solution for mathematical models with respect to Electronics and Communication engineering field.

PROFESSIONAL ELECTIVES – IV

			L	T	P	C
1903EC016		**MACHINE LEARNING AND PATTERN RECOGNITION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		(Common to B.E / B.Tech – CSE, IT & ECE)				

Course Objectives:

1. Provide knowledge of models, methods and tools used to solve regression, classification, feature selection and density estimation problems
2. Provide knowledge of learning and adaptation in supervised modes of learning
3. Provide knowledge of recognition, decision making and statistical learning problems.
4. Provide knowledge of current research topics and issues in Pattern Recognition and Machine Learning
5. Provide knowledge about linear functions

Unit I	**BASICS OF PROBABILITY, RANDOM PROCESSES AND LINEAR ALGEBRA**	**9 Hours**

Probability: independence of events- conditional and joint probability-Bayes theorem Random Processes: Stationary and non-stationary processes- Expectation- Autocorrelation, Cross-Correlation-spectra.

Unit II	**BAYES DECISION THEORY**	**9 Hours**

Minimum-error-rate classification. Classifiers-Discriminant functions-Decision surfaces. Normal density and discriminant functions-Discrete features.

Unit III	**PARAMETER ESTIMATION METHODS**	**9 Hours**

Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering- Algorithms for clustering: K-Means-Hierarchical and other methods-Cluster validation- Gaussian mixture models- Expectation-Maximization method for parameter estimation- Maximum entropy estimation-Sequential Pattern Recognition-Hidden Markov Models (HMMs)-Discrete HMM- Continuous HMMs-Nonparametric techniques for density estimation- Parzen-window method- K-Nearest Neighbour method.

Unit IV	**DIMENSIONALITY REDUCTION**	**9 Hours**

Principal component analysis - it relationship to eigen analysis- Fisher discriminant analysis - Generalised eigen analysis- Eigen vectors/Singular vectors as dictionaries. Factor Analysis- Total variability space - a dictionary learning methods-Non negative matrix factorisation - a dictionary learning method.

Unit V	**LINEAR ALGEBRA AND LINEAR DISCRIMINANT FUNCTIONS**	**12 Hours**

Inner product-outer product, inverses- eigen values-eigen vectors-singular values-singular vectors-Gradient descent procedures-Perceptron-Support vector machines - a brief introduction.

	Total:	**45 + 15 Hours**

Further Reading:	
	attern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop
	he Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition…
Course Outcomes:	
	After completion of the course, Student will be able to
	1:Identify areas where Pattern Recognition and Machine Learning can offer a solution
	2: Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
	3: Describe genetic algorithms, validation methods and sampling techniques
	4 :l Describe some discriminative, generative and kernel based techniques
	5 :Describe and model sequential data
References:	

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

1903EC017		EMBEDDED SYSTEM	L	T	P	C
			3	0	0	3

Course Objectives:

1. Discuss the concepts of basic embedded systems.
2. Describe about the ARM architecture.
3. To introduce various technologies and protocols involved in Embedded communication protocols.
4. To study about the different I/O device interfacing modules.
5. To use the embedded controllers in real time applications.

Unit I	**Introduction**	**9 Hours**
Introduction to Embedded System, Embedded System Architecture, Embedded hardware, Embedded software, Classifications of Embedded Systems and Characteristics, Challenges and Design issues in Embedded systems, Embedded System on-chip. .		
Unit II	**ARM Processor**	**9 Hours**
ARM processor naming, Types. CISC vs. RISC, Von-Neumann vs. Harvard architecture, ARM M3 features, Architecture, pipeline, Mode of operation, Instruction set, Exception handling		
Unit III	**Embedded Communication Protocols**	**9 Hours**
Communication protocols – USART, I2C, CAN, SPI. Wireless communication protocols: Bluetooth, ZigBee, Z wave.		
Unit IV	**I/O Device Interfacing**	**9 Hours**
C Programming, Interfacing Simple I/O Devices Like LED, Seven Segment, LCD, Switches, Motor (DC, Stepper, Servo), Relays and Sensors. Introduction to IOT		
Unit V	**Embedded controllers Application**	**9 Hours**
Home automation, Wireless sensor monitoring, Environmental monitoring, Gas leakage detection, Elevator design, Alarm clock using timers, Washing machine, Auto focusing Digital camera and Wearable devices		
	Total:	**45Hours**

Further Reading:

1. Arduino Machine learning using raspberry pi

Course Outcomes:

After completion of the course, Student will be able to

1. Outline the properties of embedded system.
2. Point out the functionality of ARM processor.
3. Make use of the communication protocols in application specific purposes.
4. Interface I/O device peripherals with microcontroller.
5. Solve the real life problems using embedded systems.

References:

1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Second Edition, Tata McGraw-Hill Publications, 2008.
2. Julio Sanchez Maria P.Canton, "Microcontroller Programming: The microchip PIC", CRC Press, Taylor & Francis Group, 2007.
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C Second Edition Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay.
4. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006.

1903EC018		MULTIMEDIA COMMUNICATIONS	L	T	P	C
			3	0	0	3

Course Objectives:

1.To have a detailed knowledge of compression and decompression techniques
2.To introduce the concepts of multimedia communication
3. To introduce standards of MPEG

Unit I	IntroductiontoMultimedia Communications	5 Hours

Componentsofmultimediasystem,Desirable features,Applicationsofmultimediasystems, Introductiontodifferent types,Multimedia storage device.

Unit II	Digital audio representation	9 Hours

Digital audio representationandprocessing-timedomainand transformdomain representations.Codingstandards, transmissionandprocessingofdigitalaudio.Musical instrument synthesizers.

Unit III	Imagecodingalgorithms	12 Hours

Stillimagecoding-JPEG.DiscretecosineTransform.SequentialandProgressiveDCT based encodingalgorithms,lossless coding,hierarchicalcoding.Basicconceptsofdiscrete wavelettransformcodingandembeddedimagecodingalgorithms. Introductionto JPEG2000.

Unit IV	MPEG	9 Hours

Feature ofMPEG1,structureofencodinganddecodingprocess,MPEG2enhancements, and differentblocksofMPEGvideo encoder.

Unit V	Videocoding	10 Hours

Contentbasedvideocoding-overview ofMPEG4video,motionestimationand compensation. Different codingtechniquesandverificationmodels. Block diagramofMPEG4videoencoderanddecoder.AnoverviewofH261 andH263video coding techniques

Total: 45

Further Reading:

1. Advanced compression techniques
2. Coding Techniques

Course Outcomes:

After completion of the course, Student will be able to

1. Describe various multimedia components
2. Describe compression and decompression techniques
3. Apply the compression concepts in multimedia communication
4. Describe the video encoding
5. To know the digital audio representation

References:

1. Fred Halsall, "**Multimedia Communications**", Pearson education, 2001
2. J.S. Chitode, **"Information coding techniques"**, Technical publications, 1st edition 2007.
3. Raifsteinmetz, Klara Nahrstedt, "**Multimedia: Computing, Communications and Applications**", Pearson education, 2002
4. John Billamil, Louis Molina, "**Multimedia : An Introduction**", PHI, 2002

1903EC019		WIRELESS COMMUNICATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. To impart the fundamentals concepts of wireless communication systems.
2. To introduce various technologies and protocols involved in wireless cellular communication.
3. To understand the concepts of signalling schemes for fading channels and analyze its channel capacity.

Unit	Title	Hours
Unit I	**PROPAGATION AND MULTIPLE ACCESS TECHNIQUES**	**9 Hours**
Fading - Multipath propagation mechanisms - Propagation Models: Free space model, Two ray ground reflection model, Macro cell and Micro cell propagation models. Multiple Access Techniques: FDMA, CDMA, TDMA, SDMA.		
Unit II	**CELLULAR MOBILE WIRELESS SYSTEMS**	**9 Hours**
Cellular Systems: Structure - Cell Cluster - Frequency reuse - Channel Interference - Cell splitting andsectoring - Channel Assignment schemes: Fixed, Dynamic and Hybrid - Network Architecture - Mobility Management - Location Management - Resource Management: Microcell Concept.		
Unit III	**WIDEBAND SYSTEMS**	**9 Hours**
GSM Network Architecture - GPRS: Network Architecture, Signaling, Mobility management, LocationManagement, Roaming. CDMA: IS95 systems, Forward link, Reverse Link, PN sequence related toCDMA - UMTS: Network Architecture and Interface.		
Unit IV	**EQUALIZATION AND DIVERSITY TECHNIQUES**	**9 Hours**
Fundamentals of equalization - Equalizers in communication receivers: Linear equalization, Non-linearequalization: DFE, MLSE Equalizer, Adaptive Equalizer. Diversity Techniques: Time diversity, Antennadiversity, Frequency diversity: Single carrier with ISI, DSSS, OFDM.		
Unit V	**MOBILE TECHNOLOGY**	**9 Hours**
GSM.3G, 4G (LTE), NFC systems, WLAN technology. WLL. Hyper LAN. Ad hoc networks. Bluetooth.		
	Total:	**45 Hours**

Further Reading:

3. 5G Communication
4. FSOC

Course Outcomes:

After completion of the course, Student will be able to

1. Describe the cellular concept and analyze capacity improvement Techniques.
2. Design Base Station (BS) parameters and analyze the antenna configurations.
3. Explain the various concept of Wideband systems.
4. Summarize diversity reception techniques
5. Assess the latest wireless technologies.

References:

1. Cory Beard and William Stallings, "Wireless Communication Networks and Systems" Pearson, 2015.
2. A.F.Molisch, Wireless Communications, Wiley, 2005.
3. T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
4. ITI SahaMisra, "Wireless Communication and Networks : 3G and beyond", McGraw Hil Education Pvt Ltd., Second edition, 2013.
5. K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley, 2012.
6. P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

1903EC020		**HIGH SPEED SWITCHINGNETWORKS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

1. Totellimportant conceptsofmultimedianetworking.
2. To studythetypes of VPNandtunnelingprotocolsfor security.
3. Tolearnabout networksecurityinmanylayersandnetwork management.

Unit I	**INTRODUCTION**	**9 Hours**
Review of OSI,TCP/IP; Multiplexing, Modes of Communication, Switching, Routing .SONET– DWDM– DSL–ISDN–BISDN,ATM.		
Unit II	**MULTIMEDIANETWORKING APPLICATIONS**	**9 Hours**
Streaming stored Audio and Video–Best effort service–protocols for real time interactive applications–Beyond best effort–scheduling and policing mechanism –integrated services– RSVP-differentiated services.		
Unit III	**ADVANCED NETWORKS CONCEPTS**	**9 Hours**
VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.		
Unit IV	**TRAFFIC MODELLING**	**9 Hours**
Little'stheorem, Need for modeling, Poisson modeling and its failure, Non-poissonmodels, Network performance evaluation.		
Unit V	**NETWORK SECURITYAND MANAGEMENT**	**9 Hours**
Principles of cryptography –Authentication–integrity–key distribution and certification–Access control and: firewalls–attacks and counter measures–security in many layers. Infrastructure for network management – Theinternet standard management framework – SMI, MIB, SNMP, Security and administration–ASN.1		
	Total:	**45 Hours**

Further Reading:

IP Switching ,Ipv6,Ipv6 over ATM

Course Outcomes:

After completion of the course, Student will be able to

1. know basics of Networks
2. Understand applications of multimedia networking
3. Examine advanced networking techniques
4. illustrate Traffic modelling concepts
5. know security basics and its management

References:

1. J.F. Kuros$_n$e$_d$&K.W. Ross,"ComputerNetworking- A topdownapproachfeaturing theinternet", Pearson 2 edition, 2003.
2. Walrand.J. Varatya,High performance communicationnetwork, MorganKauffman– Harcourt AsiaPvt.Ltd.2ndEdition,2000.3.
3. LEOM-GarCIA,WIDJAJA,"Communicationnetworks", TMH seventh reprint2002.
4. Aunuragkumar,D.MAnjunath, Joykuri, "CommunicationNetworking", MorganKaufmann Publishers,1ed2004.5.
5. HersentGurle& petit, "IP Telephony,packetPoredMultimediacommunicationSystems", Pearsoneducation2003.6.
6. FredHalsall andLinganaGoudaKulkarni,"Computer NetworkingandtheInternet"fifthedition,Pearsoneducation7
7. Nader F.Mir,ComputerandCommunicationNetworks, firstedition.8.
8. Larryl.Peterson&BruceS.David,"ComputerNetworks: A System Approach"-1996

PROFESSIONAL ELECTIVES – V

1903EC021		NANOELECTRONICS	L	T	P	C
			3	0	0	3

Course Objectives:

1. To be exposed of basic electronics and quantum electronics.
2. To be familiar with basic Nanoelectronics devices and Plasmonics.
3. To learn about optoelectronics and Spintronics.
4. To know various architecture methodologies

Unit I	**INTRODUCTION TO ELECTRONICS AND QUANTUM DEVICES:**	**9 Hours**
Classification Of Solids-Energy Level-Intrinsic and Extrinsic Semiconductor-Conduction In Metal And Semiconductor-Semiconductor Diodes-Basic Principle Of Led-Charge And Spin In Single Quantum Dots-Coulomb Blockade-Electrons In Mesoscopic Structures-Single Electron Transfer Devices (Sets)-Electron Spin Transistor –resonant tunnel diodes ,tunnel FETs-quantum interference transistors devices(QUITs)-quantum dot cellular automata(QCAs)-quantum bits(qubits).		
Unit II	**NANOELECTRONICS DEVICES AND PLASMONICS:**	**9 Hours**
Electronic transport in 1,2 and 3 dimensions-quantum confinement –energy sub bands –effective mass-diode conduction-mean free path in 3D-ballistic conduction –phase coherence length –quantized conductance-buttiker-landauer formula-electron transport in pn junctions-short channel nano transistor -single photon transistor using surface plasmon-nanowire surface plasmons-interaction with matter-channel plasmon-polarising guiding by sub wavelength metal groves-surface plasmon polarizations and localized surface plasmon.		
Unit III	**OPTOELECTRONIC CRYSTAL ANS ITS FABRICATION:**	**9 Hours**
Linear optonic crystal –maxwells equations bloch's theorem transmission spectra –non linear optics in linear optonic crystals slab –nonlinear optonic crystal and its application-fabrication of optonic crystals structures(1D,2D&3D)-applications;1D crystals -coupler waveguide-high-Q cavities –optonic crystal fiber-4 tunable optonic crystal filters.		
Unit IV	**SPINTRONICS:**	**9 Hours**
Spin tunnelling devices-magnetic tunnel junction –tunnelling spin polarization –giant tunnelling using MgO tunnel barriers-tunnel-based spin injectors-spin injections and spin transport in hybrid nanostructures –spin filters -spin diodes –magnetic tunnel transistor-spin relaxation and spin dephasing-memory devices and sensors-ferroelectric random access memory-MRAMS-field sensors –multferro electric sensors-spintronic biosensors		
Unit V	**NANOELETRONIC ARCHITECTURES AND COMPUTATIONS**	**9 Hours**
Architecture principles-mono and multi processor systems-parallel data processing –power dissipation and parallelism –classic systolic arrays –molecular devices-properties –self-organization –size dependent limitations,computation:montecarlo simulations –computational methods and simulations from ab initio multiscale modelling –modelling of nanodevices		
	Total:	**45 Hours**

Further Reading:

1. Quantum Dots for fiber optic communication
2. Quantum cellular automata

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the theory, principle of basic electronics and quantum electronics.
2. Explain the characteristics of Nanoelectronics and Plasmonic devices.
3. Summarize the various type's Optoelectronic crystals and its working principle.
4. Explain the characteristics, theory and construction of Spintronics devices.
5. Design an architecture Nanoelectronics system design

References:

1. W.Rainer, Nano electronics and information technology, Wiley,.
2. K.E.Drexlex, Nanosystems,Wiley,(2014).revised edition
3. M.C.Gupta, J.Balloto the Handbook of photonics.
4. Nanotechnology for microelectronics and optoelectronics, J.M.Martinez-Durat, Raul J.Martin-palma.
5. V.Kochelp,M.stroscio,''Introduction to nanoelectronics, Cambridge university press (2013).

6. Rainer Waser, “Nano electronics and information technology; advanced electronic material and novel devices”, Wiley-VCH(2010).

1903EC022		OPTOELECTRONICS DEVICES	L	T	P	C
			3	0	0	3

Course Objectives:

1. To understand the elements of solid state physics
2. To study lighting emitting and detecting devices
3. To provide basic knowledge about optical modulators and various applications of optoelectronics

UNIT I	Elements of solid state physics	9 Hours

Wave nature of light- Polarization interference- Diffraction- Light Source- Review of quantum mechanical concept - III-V and II-VI Semiconductor.- Electronic and optical properties of III-V and II-VI semiconductors (Energy bandgap and wavelength)

UNIT II	Principles of Light emitting devices	9 Hours

Photo luminescence- Cathode luminescence- Electro luminescence- Injection luminescence- LEDS plasma display- Liquid crystal displays- Numeric displays laser emission- Absorption- Radiation- laser and its different classes – applications of laser in various fields.

UNIT III	Photodetectors	9 Hours

Photodetectors -performance criteria of a photodectetor- expressions for quantum efficiency -responsivity, photoconductors and photodiodes-PIN diodes - heterojunction diodes and APDs - characteristics and device performance - high speed measurement photoresistors - CCDs, photomultiplier tube- noises in photodetectors, SNR - noise equivalent power.

UNIT IV	Optical Modulators	9 Hours

Birefringence, uniaxial and biaxial crystals, index ellipsoid, electro-optic effect, electro optic retardation. Phase and amplitude modulators, transverse electro optic modulators and design considerations- high frequency modulation considerations, transit time limitations in lumped modulators, travelling wave modulators. Acousto-optic effect, Raman-Nath and Bragg regime, acousto-optic modulators, magneto optic effects, spatial light modulators.

UNIT V	Applications of optoelectronics	9 Hours

Optical communication sources – Quantum dot laser - Quantum well laser – application of lighting devices in mechatronics and biomedical fields – laser in welding technology- case study: eye operation by laser methodologies.

Total: 45 Hours

Further Reading: Integrated optics circuits

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the various elements of light emitting devices
2. Discuss different light emitting devices
3. Explain the working principle of photodetectors
4. Reveal the operation of optical modulators
5. Discuss the various application of optoelectronics.

References:

1. Wilson J and Hawkes J, ―Opto-electronics: An Introduction‖, 3rd Edition, PHI Learning, 2007
2. Pallab Bhattacharya, ―Semiconductor Opto-electronic Devices‖, 3rd Edition, PHI Learning, New Delhi, 2010
3. http://nptel.ac.in/courses/115102026/

1903EC023	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

1. To make the students to understand the digital Speech fundamentals.
2. To study the digital models and processing of speech signal
3. To acquire the basic knowledge in filters, voice enhancement, voice restoration and compression techniques.

Unit	Title	Hours
Unit I	**DIGITAL MODELS FOR SPEECH SIGNAL**	**9 Hours**
Process and of speech production –Acoustic theory of speech production –Digital models		
Unit II	**TIME DOMAIN METHODS FOR SPEECH PROCESSING**	**9 Hours**
Time domain parameters of Speech –Methods for extracting the parameters–Zero crossings –Auto correlation –Pitch estimation		
Unit III	**FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**	**9 Hours**
Short Time Fourier analysis –Filter bank analysis –Spectrographic analysis –Formant extraction –pitch extraction –Analysis & synthesis systems		
Unit IV	**LINEAR PREDICTIVE CODING OF SPEECH**	**9 Hours**
Formulation of LPC in time domain –Solution of LPC equations –Interpretation of LP in auto correlation and spectral domains.		
Unit V	**SPEECH ANALYSIS AND SYNTHESIS**	**9 Hours**
Cepstral analysis of speech –Pitch estimation –Speech recognition, Synthesis & Speaker verification		
	Total:	**45 Hours**

Further Reading:

Course Outcomes:

After completion of the course, Student will be able to

1. Identify nature of speech generation and modeling of speech production
2. Discuss digital models and processing of speech signal
3. Classify different methods for speech processing .
4. Apply mathematical tools to module speech
5. Outline various speech parameters with appropriate techniques

References:

1. L.R. Rabiner and R.E Schafer, - Digital processing of speech signals, Dorling Kindersley (India) Pvt. Ltd , 2011
2. L.R. Rabiner and Biling Hwang Juang,- Fundamentals of Speech recognition, Pearson Education,2003
3. J.L Flanagan, - Speech Analysis Synthesis and Perception - 2nd Edition , Springer Berlin Heidelberg, 2012
4. I.H. Witten, - Principles of Computer Speech,Academic press, 2010.
5. Thomas F. Quateri, -Discrete - Time Speech Processing – Principles and Practice, Pearson Education, 2004

1903EC024	MICROWAVE INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives:

1.To gain knowledge in the area of planar microwave engineering and to makethem understand the intricacies in the design of microwave circuits.
2.To learn about the state of art in MIC technology.

Unit I	**INTRODUCTION TO MICROWAVE CIRCUITS**	**9 Hours**
Definitions – Frequency Bands – Lumped versus Distributed Circuits - Behavior of finite length transmission lines – General Characteristics of PC Boards – Transmission Lines on PC Boards – Passives made from Transmission Lines – Resonators - Combiners, Splitters and Couplers		
Unit II	**MATCHING NETWORKS AND FILTER DESIGN**	**9 Hours**
Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements, Filter design.		
Unit III	**AMPLIFIERS AND OSCILLATORS**	**9 Hours**
Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design, Oscillators: Oscillator versus Amplifier Design – Oscillation conditions – Design and stability considerations of Microwave Transistor Oscillators		
Unit IV	**MIXERS AND CONTROL CIRCUITS**	**9 Hours**
Mixer Types – Conversion Loss – SSB and DSB Mixers – Design of Mixers: Single Ended Mixers – Single Balanced Mixers - Sub Harmonic Diode Mixers ,Microwave Diodes , Phase Shifters – PIN Diode Attenuators		
Unit V	**MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES**	**12 Hours**
Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology - Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, Experimental field probing techniques.		
	Total:	**45 + 15 Hours**

Further Reading:

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss about lumped elements, distributed elements and transmission line parameters in Electronic circuits.
2. Illustrate the concept of Matching networks and filter design in Microwave Engineering.
3. Describe about Oscillator and amplifier in Microwave integrated circuits.
4. Interpret the concept of Mixer circuits in Microwave engineering.
5. Identify the fabrication techniques of MMIC and HMIC in Microwave engineering.

References:

Thomas H.Lee, “Planar Microwave Engineering”, Cambridge University Press, 2004,

Matthew M. Radmanesh, “Radio Frequency and Microwave Electronics”, Pearson Education, II Edition, 2002.

“Microwave Transistor Amplifiers – Analysis and Design”, II Edition, Prentice Hall, New Jersy

Ravender Goyal, “Monolithic MIC; Technology & Design”, Artech House, 1989.

Gupta K.C. and Amarjit Singh, “ Microwave Integrated Circuits”, John Wiley, New York, 1975.

Ulrich L. Rohde and David P.N., “ RF / Microwave Circuit Design for Wireless Applications”, John Wiley, 2000.

1903EC025		SATELLITE COMMUNICATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. To impart knowledge about the Satellite communication.
2. To enhance the students' knowledge in astronomy and space

Unit I	SATELLITE ORBITS	9 Hours

Introduction - Spectrum allocations for satellite systems -Kepler's Laws - orbital parameters - orbital perturbations - station keeping – Type of orbits - 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 AND EARTH SEGMENT	9 Hours

Spacecraft technology- structure- power supply- attitude and orbit control - thermal control and propulsion - communication subsystems - telemetry, tracking and command - TranspondersAntenna subsystem, Equipment reliability. Earth station technology -Receive only home TV systems - MATV – CATV – Transmit Receive Earth Stations.

Unit III	SATELLITE ACCESS	9 Hours

Modulation and Multiplexing-Voice, Data, Video, Analog – digital transmission system-Digital video broadcast - multiple access: FDMA, TDMA, CDMA- assignment methods -spread spectrum communication

Unit IV	SATELLITE LINK DESIGN	9 Hours

Introduction- Equivalent isotropic radiated power -Transmission Losses – Link power budget equation - System Noise, Carrier to Noise ratio – uplink – downlink – effects of rain – combined uplink and downlink C/N ratio – inter modulation noise - Interference between satellites.

Unit V	SATELLITE APPLICATIONS	9 Hours

Satellite mobile services – VSAT- Radarsat- GSM, GPS, Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH) -Digital audio broadcast (DAB) – World space services, Business TV (BTV) – GRAMSAT - Specialized services: E mail, Video conferencing, Internet- INTELSAT Series- INSAT – INMARSAT.

	Total:	45 Hours

Further Reading:

Latest trend in satellite communication, Recent launching satellites and its application, Communication between satellites, Comparison of satellite

Course Outcomes:

After completion of the course, Student will be able to

1. Describe the basics of orbit and launching methods in satellite communication
2. Summarize the elements in space segment and link budget calculations
3. Explain earth station technology and test equipments
4. Interpret the accessing technique used in satellite communication
5. Differentiate various broadcast services and DTH compression standards. utilizing satellite communication

References:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.