PUNE VIDYARTHI GRIHA'S

COLLEGE OF ENGINEERING AND TECHNOLOGY, PUNE-9

(AFFILIATED TO SAVITRIBAI PHULE PUNE UNIVERSIT, PUNE)

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

(Accredited By National Board of Accreditation (NBA), New Delhi)

CURRICULUM BOOK

ACADEMIC YEAR: 2015-16

FOR THE PROGRAMME

B. E. (ELECTRONICS & TELECOMMUNICATION ENGINEERING)

PUNE VIDYARTHI GRIHA'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

VISION

TO ACHIEVE EXCELLENCE IN ENGINEERING EDUCATION

MISSION

- **To satisfy all stakeholders**
- **To develop ethical, highly motivated engineering professionals with good human values, requisite skills and competencies**
- **To adopt innovative teaching mechanisms**
- **To promote research culture**
- **To contribute to country's economic development**
- **To be responsive to changes in technology, socio-economic and environmental conditions**

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

VISION

To achieve academic excellence in the arena of Electronics Communication Technology and Embedded Systems.

MISSION

1. To provide students with practical knowledge of theoretical concepts through a series of lectures by industry experts.
2. To impart soft-skill techniques through a series of lectures by industry experts.
3. To provide students a platform to design and develop laboratory experiments.
4. To disseminate the knowledge acquired by faculty through different Faculty Development Workshops to improve teaching-learning process.
5. To motivate students to actively participate in interdisciplinary projects and participate in national and international level competition.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Applying Electronics Engineering knowledge based on a solid foundation in Telecommunication Engineering areas for the needs of the stakeholders.

PEO2: Upholding the importance of professionalism and ethics in Electronics Engineering profession to form a cultured and more developed society.

PEO3: Possessing communication and interpersonal skills, to meet the nations and stakeholders' aspiration.

PEO4: Developing skills in research in Electronics Engineering particularly in the areas of Telecommunication Engineering to generate new knowledge to satisfy the needs of the stakeholders.

PROGRAMME OUTCOMES

The Programme Outcomes of the Department of Electronics and Telecommunication are:

PO1. Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Ability to conduct experiments, analyze and interpret data.

PO3. Ability to gather broad education necessary to recognize the impact of engineering solutions in global and societal context.

PO4. Ability to exercise professional and ethical responsibility in multicultural environment.

PO5. Ability to communicate effectively with engineers and community at large.

PO6. Ability to identify, formulate and solve Electronic Engineering problems.

PO7. Ability to recognize the need and engage life-long learning.

PO8. Ability to comprehend management and entrepreneurship skills.

PO9. Ability to design process, components and system to meet specified needs in Electronic Engineering.

PO10. Understanding the principle of sustainable development for Electronic Engineering Design.

PO11. Ability to use the techniques, skills and modern engineering tools necessary for Electronics Engineering practice.

PO12. Ability to work in multi-disciplinary teams within Electronic Engineering discipline.

PROGRAMME SPECIFIC OUTCOMES

PSO1. Demonstrate reasonable amount of proficiency in the areas of digital communication, embedded systems and project development.

PSO2. Utilize modern tools to analyze the performance of communication systems.

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Final year

Curriculum Book

Syllabus Structure of Savitribai Phule Pune University, Pune
Course Structure for B. E. (Electronics & Telecommunication Engineering)
2012 Course

Course Code	Course	Teaching Scheme Hrs/Week			Examination Scheme					Marks Total
		L	T	P	Theory		TW	P	O	
					On-Line	Theory				
Legends:										
L: Lectures T: Tutorial P: Practical TW: Term Work O: Oral										
Semester-VII										
404181	VLSI Design & Technology	3	-	-	30	70	-	-	-	100
404182	Computer Networks	3	-	-	30	70	-	-	-	100
404183	Microwave Engineering	4	-	-	30	70	-	-	-	100
404184	Elective-I	3	-	-	30	70	-	-	-	100
404185	Elective-II	3	-	-	30	70	-	-	-	100
404186	Lab Practice-I (CN & MWE)		-	4			50	-	50	100
404187	Lab Practice-II (VLSI & Elective-I)			4			50	50	-	100
404188	Project Phase-I		2				-	-	50	50
	Total of Semester-VII	**16**	**2**	**8**	**150**	**350**	**100**	**50**	**100**	**750**
Semester-VIII										
404189	Mobile Communication	3	1	-	30	70	-	-	-	100
404190	Broadband Communication Systems	3	-	-	30	70	-	-	-	100
404191	Elective-III	3	-	-	30	70	-	-	-	100
404192	Elective-IV	3	-	-	30	70	-	-	-	100
404193	Lab Practice-III (MC & BCS)	-	-	4	-	-	50	-	50	100
404194	Lab Practice-IV (Elective-III)	-	-	4	-	-	50	50	-	100
404195	Project Work	-	6	-	-	-	100	50	-	150
	Total of Semester-VIII	**12**	**6**	**8**	**120**	**280**	**200**	**100**	**50**	**750**

Instructions:

1	All Theory papers are three hours duration
2	Practical/Oral shall be based on term-work
3	Term-work of Project Part I consist of project report based on project
4	** * Exam at the end of II term

Electives

Sr. No.	Elective-I	Elective-II	Elective-III	Elective-IV
1	Digital Image Processing	Multi-rate & Adaptive Signal Processing	Speech & Audio Signal Processing	Biomedical Signal Processing
2	Embedded Systems and RTOS	Electronic Product Design	RF Circuit Design	Nano Electronics & MEMS
3	Software Defined Radio	Next Generation Networks	Audio Video Engineering	Detection & Estimation Theory
4	Industrial Drives Control	PLCs & Automation	Soft Computing	Artificial Intelligence
5				Open Elective (Note on repetition)

BE (E&TC)

Semester I

VLSI Design and Technology

Course Title: VLSI Design and Technology		**Course Number:** 404181	**Course Name** :C401
Year: BE		**Semester: I**	
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work	Practical
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Combinational and Sequential Digital circuits, MOSFET		
Course Objectives			
1	To understand the concepts of modeling a digital system from abstract level to concrete level using Hardware Description Language		
2	To get insight into architecture of different programmable logic devices like CPLD and FPGAs.		
3	To learn the design aspects of System on Chip(SoC) and optimization methods for design and development of the same		
4	Understand basics of MOS Circuit Design and modeling with basics of MOS process Technology and design concepts for digital CMOS logic.		
5	Overview of the principles, operation, modelling and application of the analog building block like MOSFET for performing various functions like CMOS amplifiers.		
6	To realize importance of testability in logic circuit design		
7	Acquaint the students with emerging trends in VLSI design and technology and motivate them to pursue higher education in the field of VLSI.		
Course Outcomes			
CO1	Modelling, simulation and synthesis of digital VLSI systems from register-transfer or higher level descriptions in hardware description languages and its practical implementation on an FPGA or CPLD.		
CO2	Design analog & digital CMOS circuits for specified applications using layout design tools.		
CO3	Understand chip level issues and need of testability.		
Course Contents			
Unit-I	**VHDL Modeling**		
	Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, VHDL Test bench, Test benches using text files. VHDL modeling of Combinational, Sequential logics & FSM, Meta-stability.		
	Practical		
	To write a VHDL code and simulate for 4 bit ALU for add, subtract, AND, NAND, XOR, XNOR, OR, & ALU pass		
	Universal shift register with mode selection input for SISO, SIPO, PISO, &		

	PIPO modes.
Unit-II	**PLD Architectures**
	PROM, PLA, PAL: Architectures and applications. Software Design Flow. CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications, Applications.
	Practical
	To write VHDL code, simulate with test bench, synthesis, implement on PLD FIFO Memory LCD Interface Keypad interface
Unit-III	**SoC & Interconnect**
	Clock skew, Clock distribution techniques, clock jitter. Supply and ground bounce, power distribution techniques. Power optimization. Interconnect routing techniques; wire parasitic, Signal integrity issues. I/O architecture, pad design. Architectures for low power.
Unit-IV	**Digital CMOS Circuits**
	MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology Scaling. CMOS inverter, DC transfer characteristics, Power components, Power delay product. Transmission gate. CMOS combo logic design. Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.
	Practical
	To prepare CMOS layout in selected technology, simulate with and without capacitive load, comment on rise, and fall times. 1. Inverter, NAND, NOR gates, Half Adder 2. 2:1 Multiplexer using logic gates and transmission gates. 3. Single bit SRAM cell. 4. D flip-flop.
Unit- V	**Analog CMOS Design**
	Current sink and source, Current mirror. Active load, Current source and Push-pull inverters. Common source, Common drain, Common gate amplifiers. Cascode amplifier, Differential amplifier, Operational amplifier
Unit-VI	**Testability**
	Types of fault, Need of Design for Testability (DFT), Testability, Fault models, Path sensitizing, Sequential circuit test, BIST, Test pattern generation, JTAG & Boundary scan, TAP Controller

Text Books	**Author**	**Title of Book**	**Publication**
T1	Charles H. Roth	Digital systems design using VHDL	PWS
T2	Wyane Wolf	Modern VLSI Design (System on Chip)	PHI
Reference Books			
R1	Allen Holberg	Analog CMOS Design	Oxford University Press
R2	Neil H. E. Weste,	CMOS VLSI Design: A	Pearson Publication

	David Money Harris	Circuit & System Perspective	
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series for Unit IV		
	www.xilinx.com for Unit II		
Contents beyond Syllabus	Nil		
Additional Experiments	**To prepare CMOS layout in selected technology for MOSFET as a diode**		
	To conduct PLD based experiment in Virtual Lab		
Bridging Courses	Nil		
Assignments			
1	Example VHDL code for digital circuits		
2	Comparison of different PLD architectures		
Tutorials	Combinational logic design using CMOS.		
Presentations	Unit I		
	Unit II		
	For Students: Unit VI		

Computer Networks

Course Title:Computer Networks		**Course Number:404182**	**Course Name:C402**
Year: BE		**Semester: I**	
Designation of Course: Professional Core			
Teaching Scheme: 3Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem. Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work: Lab Practice-I (CN & MWE) 50 Marks	Oral: Lab Practice-I (CN & MWE) 50 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session,Group Discussion
Prerequisites	Analog Communication, Digital Communication		

Course Objectives	
1	Understand state-of-the-art in network protocols, architectures, and applications
2	To provide students with a theoretical and practical base in computer networks issues
3	Define the basic terminology of computer networks
4	Recognize the individual components of the big picture of computer networks
5	Outline the basic network configurations
6	List the layers of the TCP/IP and OSI model and describe the duties of each layer
7	Understand the transmission methods underlying LAN and WAN technologies

Course Outcomes	
CO1	Understand fundamental underlying principles of computer networking
CO2	Describe and analyze the hardware, software, components of a network and the interrelations
CO3	Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and technologies;
CO4	Have a basic knowledge of the use of cryptography and network security
CO5	Have a basic knowledge of installing and configuring networking applications
CO6	Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols

Course Contents	
Unit-I	**Physical Layer**
	Data Communications, Networks, Network types, Protocol layering, OSI model, Layers in OSI model, TCP / IP protocol suite, and Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.
	Practical
	Implementation of LAN using suitable multiuser Windows operating System and demonstrating client-server and peer to peer mode of configuration
	Simulating LAN or WAN using suitable network simulator
Unit-II	**Data Link Layer**
	Introduction to Data link Layer, DLC Services, DLL protocols, HDLC, PPP, and

	Media Access Control: Random Access, Controlled Access, and Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet.
	Practical
	Study of different network components (Switch)
Unit-III	**Wireless LANS & Virtual Circuit Networks**
	Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.
	Practical
	Study of wireless LANs (Demonstrating Data communication with Wi-Fi, Bluetooth networking etc.)
Unit-IV	**Network Layer**
	Network Layer Services, Packet Switching, Network layer performance, IPv4, addresses, Forwarding of IP packets, Network layer protocols: IP, ICMPv4, Mobile IP, Unicast Routing: Introduction, Routing Algorithms, Unicast Routing protocols, Multicast Routing Introduction, Next Generation IP:IPv6 Addressing, The IPv6 protocol, ICMPv6, Transition from IPv4 to IPv6.
	Practical
	Study of Network Protocol Analyzer tool/software
	Study of network monitoring tool/software
	Configuration of router & study of routing between LAN's
	Write a program for implementation of Shortest Path algorithm
	Study of IP Address subnetting and CIDR
	Installation and configuration of Proxy server
Unit- V	**Transport Layer**
	Introduction, Transport layer protocols and services, Port numbers User Datagram Protocol (UDP), Transmission Control protocol (TCP), SCTP, Quality of services: Dataflow characteristics, Flow Control.
	Practical
	Socket Programming for client/Server application using Linux OS
Unit-VI	**Application Layer**
	Introduction, World Wide Web and HTTP, FTP, Electronic mail, Telnet, Name System (DNS), Cryptography and Network Security: Introduction, Symmetric key ciphers and Asymmetric key Ciphers**,** Introduction to network security.
	Practical
	Installation and configuration of Web server
	Installation and configuration of FTP Server
	Study of DNS, SMTP & POP3 Determine the local host address, Ping to a host using its NetBIOS name Add IP addresses/host name mappings to the local host file Configure DNS service on Windows 2000 server Use Domain Name Service to resolve hostnames into IP addresses. Interact with an Email server using SMTP and POP3 protocols commands
	Installation and configuration of Telnet server for Telnet communication
	Installation and configuration of DHCP server

	Write a program for Encryption and Decryption		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Behrouz A. Foruzan	Data communication and Networking	Tata McGraw-Hill,5th Edition
T2	James F. Kurouse& W. Rouse	Computer Networking: A Top down Approach	6th Edition, Pearson Education
Reference Books			
R1	Andrew S. Tannenbaum	Computer Networks	Pearson Education, Fourth Edition,2003
R2	Wayne Tomasi	Introduction to Data Communication and Networking	1/e, Pearson Education
R3	Greg Tomsho, Ed Tittel, David Johnson	Guide to Networking Essentials	fifth edition, Thomson India Learning, 2007
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series on Computer Networksby Prof. Sujoy Ghosh and Prof A. Pal, Department of Computer Science & Engineering, IIT Kharagpur.		
	www.Youtube.com (Lectures series by CCNA)		
Contents beyond Syllabus	Practical: Study of different network components		
	Practical: Preparation of LAN cable		
	Practical: Remote desktop access and sharing of printer		
Additional Experiments	Simulation of VLAN using Cisco Packet Tracer		
Bridging Courses	Nil		
Assignments			
1	Simulation of LAN using Cisco Packet Tracer		
2	Simulation of WAN using Cisco Packet Tracer		
3	Simulation of VLAN using Cisco Packet Tracer		
Tutorials	Nil		
Presentations	Error detection technique		
	Stop and Wait, and sliding window protocol for flow control		
	Forward error correction using hamming code		
	Backward Error Detection		
	Multiple access scheme		

Microwave Engineering

Course Title: Microwave Engineering		**Course Number:404183**	**Course Name**:**C403**
Year: BE		**Semester: I**	
Designation of Course: Professional Core			
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-Semester Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work 50 Mark	Oral 50 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Fundamentals in analogue and digital communication, electromagnetic, antenna and wave propagation		
Course Objectives			
1	To lay the foundation for microwave engineering		
2	To understand the applications of microwave engineering		
3	To perform the microwave network analysis.		
Course Outcomes			
CO1	Formulate the wave equation in wave guide for analysis.		
CO2	Identify the use of microwave components and devices in microwave applications.		
CO3	Understand the working principles of all the microwave tubes.		
CO4	Understand the working principles of all the solid state devices.		
CO5	Choose a suitable microwave tube and solid state device for a particular application.		
CO6	Carry out the microwave network analysis.		
CO7	Choose a suitable microwave measurement instruments and carry out the required measurements.		
Course Contents			
Unit-I	**Transmission Lines and Waveguides**		
	Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave. General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide. Wave guide parameters. Introduction to coaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators.		
	Practical		
	Study of various transmission lines and waveguides		
Unit-II	**Microwave Components**		
	Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. **Ferrites components**: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator. **Striplines**: Structural details and applications of Striplines, Microstrip line, Parallel Strip line, Coplanar Strip line, Shielded		

	Strip Line.
	Practical
	Study of microwave components and equipments.
	Verification of Port Characteristics of Directional Coupler. Calculation of coupling factor, insertion loss and directivity.
	Verification of Port Characteristics of Isolator and Circulator. Also calculation of insertion loss and isolation in dB.
	To test and verify Microwave Integrated Circuits using Microstrip trainer kit and finds parameters, and plot the frequency response.
Unit-III	**Microwave Network Analysis**
	Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix **Scattering Matrix**:-Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. Related problems.
	Practical
	Study the Network Analyzer, Carry out the measurements of s-parameter measurement for the various micro-strip components
	Explain in detail the concept of RF power measurement. Carry out the RF power measurement using microwave bench.
Unit-IV	**Microwave Tubes**
	Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation. **O type tubes Two cavities Klystron**: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. **Reflex Klystron**: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. **M-type tubes Magnetron**: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. **Slow wave devices** Advantages of slow wave devices, **Helix TWT**: Construction and principle of operation, Applications.
	Practical
	Reflex Klystron as a Microwave source in laboratory and plot its mode characteristics.
Unit- V	**Microwave Solid State Devices**
	Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Structural details, Principle of operation, various modes, specifications, and applications of all these devices.
	Practical
	Study of Gunn Diode and PIN Modulator as a Microwave source. Plot the V-I characteristics.
Unit-VI	**Microwave Measurements**
	Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power

	measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement		
	Practical		
	Study of slotted section with probe carriage. Measure the VSWR for various values of terminating impedances (open / short / matched termination).		
	Measurement of the free space wavelength of the microwave (for TE 10 mode) with the help of the X-band microwave test bench and verify with its theoretical calculation.		
	Measurement of VSWR using VSWR meter and theoretical formulas and power and attenuation measurement using power meter in various experiments.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Samuel Y. Liao	Microwave Devices and Circuits, 3rd edition, Pearson	Pearson
T2	David M. Pozar	Microwave Engineering, 4th Edition	Wiley.
Reference Books	**Author**	**Title of Book**	**Publication**
R1	M. Kulkarni	Microwave and Radar engineering, 3rd edition	Umesh Publications
R2	ML Sisodia & GS Raghuvamshi	Microwave Circuits and Passive Devices	Wiley
R3	M L Sisodia & G S Raghuvanshi	Basic Microwave Techniques and Laboratory Manual	New Age International (P) Limited, Publishers.
Self-Learning Facilities, Web Resources, Research papers for reference	Preparation of presentations on recent advances in Microwave Technology and its applications. Facilities available are IEEExplore with subscription of IEEE journal Microwave Theory and Applications, various books available in library		
	NPTEL Lecture Series		
	IEEE xplorer with journal microwave theory and applications		
	Author	**Title of Paper**	**Journal/Transaction**
	T. S. Sarkar, R. J. Mailloux, A. A. Oliner, M. Salazar-Palma, and D. Sengupta	History of Wireless.	John Wiley & Sons, Hoboken, N.J., 2006.
	A. A. Oliner	Historical Perspectives on Microwave Field Theory	IEEE Transactions on Microwave Theory and Techniques, vol. MTT-32, pp. 1022–1045, September 1984
	K. S. Packard	The Origin of Waveguides: A Case of Multiple Rediscovery	IEEE Transactions on Microwave Theory and Techniques, vol. MTT-32, pp. 961–969, September 1984.
	D. D. Grieg and H. F. Englemann	Microstrip—A New Transmission Technique	Proceedings of the IRE, vol. 40, pp. 1644–1650,

		for the Kilomegacycle Range	December 1952.
	I. J. Bahl and R. Garg	A Designer's Guide to Stripline Circuits	Microwaves, January 1978, pp. 90–96.
Contents beyond Syllabus	Assignments to collect literature on recent advances in microwave theory and their applications		
Additional Experiments	Syllabus suggest any 08 experiments, but we will conduct more than 10 experiments		
Bridging Courses	No bridging course is required since all the prerequisite courses have been learnt by the students at SE and TE classes.		
Assignments			
1	Prepare a write up on study of fundamentals of transmission lines and various types of transmission lines and their characteristics features and advantages and disadvantages.		
2	Collect recent advances in microwave technologies and their application using IEEE xplore facility available in library.		
3	If necessary additional assignment will be given for improving the understanding and self learning abilities of the student.		
Tutorials			
1	Determine impedance of unknown load using 50Ω coaxial slotted line practically and using Smith chart. Reference: David M. Pozar, "Example 2.4: impedance measurement with a slotted line, Chapter 2-Transmission line theory", Microwave Engineering, 4th edition, 2012, page 70-71.		
2	Self learning tutorial on micro strip based feed technique simulation will be given.		
Presentations			
	One lecture will be given for presenting the recent literature collected by the student on advances in microwaves and their applications. A selected no. of students will be given a chance. All the students will compulsorily prepare the presentations but will be selected for oral presentation on random basis.		

Digital Image Processing

Course Title: Digital Image Processing		**Course Number:**404184	**Course Name:C404 a**
Year: BE		**Semester: I**	
Designation of Course		Professional Core	
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-semester Examination: 50/30 Marks	Theory/End Semester Examination: 50/70 Marks
		Term-work	Practical/Oral
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Digital Signal Processing , Information theory and Compression techniques		

Course Objectives	
1	To learn the fundamental concepts of Digital Image Processing
2	To study basic image processing operations.
3	To understand image analysis algorithms.
4	To expose students to current applications in the field of digital image processing

Course Outcomes	
CO1	Develop and implement algorithms for digital image processing.
CO2	Apply image processing algorithms for practical object recognition applications
CO3	Understand and Apply different image compression techniques.

Course Contents	
Unit-I	**Fundamentals of Image Processing**
	.Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Colour fundamentals & models – RGB, HSI YIQ.
	Practical
	To perform basic operations on images
	To perform conversion between colour spaces.
Unit-II	**Image Enhancement and Restoration**
	Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

	Practical		
	To perform histogram equalization.		
	To perform image filtering in spatial domain.		
	To perform image filtering in frequency domain.		
	To perform image restoration		
Unit-III	**Image Compression**		
	Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transforms. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.		
	Practical		
	To perform image compression using DCT / Wavelet transform.		
Unit-IV	**Image Segmentation and Morphological Operations**		
	Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.		
	Practical		
	To perform edge detection using various masks.		
	To perform global and adaptive thresholding.		
	To apply morphological operators on an image.		
Unit- V	**Representation and Description**		
	Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture. Principal Components for Description.		
	Practical		
	To obtain boundary / regional descriptors of an image.		
Unit-VI	**Object Recognition and Applications**		
	Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing		
	Practical		
	To perform image classification / recognition.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Rafael C. Gonzalez and Richard E. Woods	Digital Image Processing	Third Edition, - Pearson Education
T2	S Sridhar	Digital Image Processing	Oxford University Press
Reference Books			

R1	Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins	Digital Image Processing Using MATLAB	Second Edition, - Tata McGraw Hill Publication
R2	S Jayaraman, S Esakkirajan, T Veerakumar	Digital Image Processing	Tata McGraw Hill Publication
Self-Learning Facilities, Web Resources, Research papers for reference	Lecture Series on Digital Image Processing by Prof. P.K. Biswas , Department of Electronics & Electrical Communication Engineering, I.I.T, Kharagpur . For more details on NPTEL visit http://nptel.iitm.ac.in.		
Contents beyond Syllabus	Nil		
Additional Experiments	Nil		
Bridging Courses	Nil		
Assignments			
1	Study different Image file formats.		
2	Study different colour spaces		
3	Study of different compression techniques(JPEG)		
Tutorials	N/A		
Presentations	Nil		

Electronic Product Design

Course Title: Electronic Product Design		**Course Number: 404185**	**Course Name:C405 b**
Year: BE		**Semester: I**	
Designation of Course		Professional Core	
Teaching Scheme: 3 Hrs/Week		**Laboratories:**	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work	Practical/Oral
	Indirect Methods	Assignments, Quizzes	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Analog, Digital Electronics, Microprocessors and Microcontrollers, Design related lab work.		
Course Objectives (University Defined)			
1	To understand the stages of product design (hardware/ software) and development.		
2	To learn different considerations of analog, digital and mixed signal design		
3	To be acquainted with methods of PCB design and different tools for PCB design		
4	To understand the importance of testing in product design cycle.		
5	To understand the processes and importance of documentation.		
Course Outcomes (University defined)			
CO1	Understand various stages of hardware, software and PCB Design		
CO2	Importance of product test & test specifications		
CO3	Special design considerations and importance of documentation		
Course Outcomes (Teacher defined)			
CO1	List various ergonomic considerations observable in any laboratory equipment		
CO2	Draft specifications of any indentified electronic product		
CO3	Compare different software development techniques		
CO4	Identify applicable EMI Tests for a given product based on its intended environment		
Course Contents			
Unit-I	**Introduction to Electronic Product Design**		
	Man machine dialog and industrial design, user-centric design, five elements of successful design, cognition, ergonomics, Packaging and factors, design for manufacture, assembly disassembly. Wiring, temperature, vibration and shock. Safety, noise, energy coupling, grounding, filtering, shielding.		
Unit-II	**Hardware Design and Testing Methods**		
	Design process. Identifying the requirements, formulating specifications, design specifications. Specifications versus requirements, System partitioning. Functional Design. Functional model versus architectural model. Prototyping, performance and efficiency measures. Formulating a test plan. Writing specifications. Test procedures and test cases. Egoless design, design reviews.		

	Module debug and test: black box test, white box test, gray box test.		
Unit-III	**Software Design and Testing Method**		
	Types of software, waterfall model of software development. Models, metrics and software limitations. Risk abatement and failure preventions. Software bugs and testing. Good programming practices. User interface. Embedded, real-time software.		
Unit-IV	**PCB Design**		
	Fundamental definitions, Standards. Routing Topology Configurations, Layer stack-up assignment, Grounding Methodologies, Aspect ratio, Image planes, Functional partitioning, Critical frequencies, Bypassing and decoupling. Design techniques for ESD protection, Guard band implementation.		
Unit- V	**Product Debugging and Testing**		
	Steps for debugging, Techniques for troubleshooting, characterization, Electromechanical components, passive components, active components, active devices, operational amplifiers, Analog-Digital conversion. Digital Components, Inspection and testing of components. Simulation, Prototyping and testing, Integration, validation and verification. EMI/EMC issues.		
Unit-VI	**Documentation**		
	Definition, need, and types of documentation. Records, Accountability, and Liability. Audience. Preparation, Presentation, and Preservation of documents. Methods of documentation, Visual techniques, Layout of documentation. Bill of material.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Kim Fowler	Electronic Instrument Design	Oxford University Press
T2	Robert J Herrick	Printed Circuit Board Design Techniques for EMC Compliance	IEEE Press
Reference Books			
R1	James K Peckol	Embedded Systems, A Contemporary Design Tool	Wiley
R2	J C Whitakar	The Electronic Handbook	CRC Press
Self-Learning Facilities (OCW, Handouts, Web Recourses, Research papers	NPTEL Lecture Series		
	Application Notes		
	Application Notes by Analog Devices, Altera Corporation, Maxim, TI etc.		

etc.)	
Contents beyond Syllabus	Environmental Testing Methods, Reliability theory
Additional Experiments	Nil
Bridging Courses	Nil
Assignments	**For students**
1	List advantages and disadvantages of different filtering techniques used to achieve EMC
2	Sketch front panel of an Analog Real time oscilloscope
3	Prepare a write-up on Spiral Model of software development
4	A write-up on Mixed signal design practices
5	Prepare detailed Bill of material for Mini project
Tutorials	Nil
Presentations	Technical specifications of a professionally designed product
	Black box, white box and gray box testing
	ESD and protection techniques

PLC & Automation

Course Title: PLC& Automation		**Course Number:**404185	**Course Name:C405 c**
Year: BE		**Semester: II**	
Designation of Course		Professional Core	
Teaching Scheme: 3 Hrs/Week		**Laboratories:** Nil	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
	Indirect Methods	Assignments, Presentations	Q&A session
Prerequisites	Control Systems		
Course Objectives			
1	Ability to recognize industrial control problems suitable for PLC control		
2	An overview of technology of advanced topics such as SCADA, DCS Systems, Digital Controller, CNC Machines.		
3	The ability to select the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.		
Course Outcomes			
CO1	Understand PLC architecture, PLC addressing concepts.		
CO2	Develop PLC ladder programs for simple industrial applications		
CO3	Design Automation systems for industrial applications		
Course Contents			
Unit-I	**Process Control & Automation**		
	Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation; Architecture of Industrial Automation systems, Advantages and limitations of Automation, Effects of modern developments in automation on global competitiveness.		
Unit-II	**Transmitters and Signal Conditioning**		
	Need of transmitters, Standardization of signals, Current, Voltage and pneumatic signal standards,2-Wire&3-Wiretransmitters, Analog and Digital signal conditioning for RTD, Thermocouple, DPT etc, Smart and Intelligent transmitters		
Unit-III	**Controllers and Actuators**		
	PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable automation controller) Mechanical switches, Solid state switches Electrical actuators: Solenoids, Relays and Contactors, AC Motor, VFD, energy conservation schemes through VFD, DC Motor, BLDC Motor, Stepper Motor, Servo Motor, Pneumatic and hydraulic actuators		
Unit-IV	**PLC and Human Machine Interface(HMI)**		

	Functions of PLC, Advantages, Architecture, working of PLC Selection of PLC, Networking of PLCs, Ladder Programming Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLCprogrammingstandardIEC61131, Soft PLC techniques. **IT Interfaces required:** for ERP, MIS, and MES. **Supporting Applications interfaces**: RFID, Barcode, and Vision Systems**.** **HMI:** Block Diagram, Types, Advantages, Applications.
Unit- V	**SCADA & Distributed control system**
	Elements of SCADA ,Features of SCADA, MTU-functions of MTU,RTU-Functions of RTU, Applications of SCADA Communications in SCADA-types & methods used, Mediums used for communication Introduction to DCS, Architecture of DCS, Input and output modules, communication module, Specifications of DCS
Unit-VI	**Automation and CNC(Computer Numeric Control) Machines**
	Introduction of CNC Machines: Basics and need of CNC machines, NC, CNC and DNC (Direct NC) systems, Structure of NC systems, Applications of CNC machines in manufacturing, Advantages of CNC machines. Industrial Communication: Device net, Inter **Electronic Product Design** bus, Device network: Foundation Field bus -H1, HART, CAN, PROFIBUS-PA, Control network: Control Net, FF-HSE, PROFIBUS-DP, Ethernet, and TCP/IP. Panel Engineering for Automation

Text Books	**Author**	**Title of Book**	**Publication**
T1	Curtis Johnson,	Process Control Instrumentation Technology	8th Edition,PearsonEducation
T2	Madhuchhanda Mitra, Samarjit Sen Gupta,	Programmable Logic controllers and Industrial Automation	Penram International Publishing India Pvt.Ltd
T3	Stuart A. Boyer	SCADA supervisory & Data acquisition	ISA publication
Reference Books			
R1	John W.Webb, RonoldAReis	Programmable Logic Controllers, Principles and Applications	5thEdition,Prentice Hallof IndiaPvt.Ltd
R2	Kilian	Modern control technology: components &systems	Delmar 2nd edition
R3	Bela GLiptak, ,	Process software and digital networks	3rdedition, 2002.
R4	Pollack. Herman, W&Robinson., T.	Computer Numerical Control	PrenticeHall. NJ.
R5	Pabla, B.S.	CNC Machines	NewAgePublishers,

	&Adithan, M.		New Delhi
Self-Learning Facilities (OCW, Handouts, Web Recourses, Research papers etc.)	NPTELLecture Series Industrial Automation		
	NPTEL notes on Industrial Automation, TI presentations on transmitters		
	Mehul S. Prajapati, Prof. Ashish G. Patel ,"PLC & SCADA Based Automation of Industrial Reverse Osmosis Desalination Plants ",IJERT,ISSN: 2278-0181		
Contents beyond Syllabus	Arranged expert session to give in depth idea of ladder diagram programming on specific applications		
Additional Experiments	Nil		
Bridging Courses	Nil		
Assignments			
1	Ladder Diagram for Bottle filling plant.		
2	Ladder Diagram for Elevator system.		
Tutorials	Nil		
Presentations	Guest session on Overview of ladder diagram programming		
	Power point presentations		

BE (E&TC)

Semester II

Mobile Communication

Course Title: Mobile Communication		**Course Number:** 404189	**Course Name:C409**
Year: BE		**Semester: II**	
Designation of Course		Professional Core	
Teaching Scheme: 4Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem. Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work	Oral
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Analog Communication, Digital Communication, Telecommunication Switching Systems, Computer Network		
Course Objectives			
1	To learn and understand the basic principles of Telecommunication switching, traffic and networks.		
2	To learn and understand basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network.		
3	To learn and understand architecture of GSM and CDMA system.		
4	To understand mobile management, voice signal processing and coding in GSM and CDMA system.		
Course Outcomes			
CO1	Explain and apply the concepts telecommunication switching, traffic and networks.		
CO2	Analyze the telecommunication traffic.		
CO3	Analyze radio channel and cellular capacity.		
CO4	Explain and apply concepts of GSM and CDMA system.		
Course Contents			
Unit-I	**Telecommunication Switching & Traffic**		
	Telecommunication switching: Message switching, Circuit switching, Manual System, Electronic Switching. Digital switching: Switching functions, Telecommunication Traffic: Unit of Traffic, Traffic measurement, A mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem, traffic tables. Queuing systems: Erlang Distribution, probability of delay, Finite queue capacity, Systems with a single server, Queues in tandem, delay tables and application of Delay formulae.		
	Practical		
	Set up and carry out experiment on analysis of telecommunication traffic.		
Unit-II	**Switching Networks and Signalling**		
	Single Stage Networks, Grading, Link Systems, and Grade of service of link systems. Time Division Switching: Space and time switching, Time division switching networks, Synchronization, Call processing Functions, Common		

	Control, Reliability, Availability and Security. Signalling: Customer line signalling. FDM carrier systems, PCM signalling, Inter-register signalling, Common channel signalling principles, CCITT signalling No. 6, CCITT signalling No.7, Digital customer line signalling.		
	Practical		
	Set up and carry out experiment on PSTN TST switch.		
Unit-III	**Cellular Concepts**		
	Evolution of Wireless systems, Introduction to cellular telephone system, Frequency reuse, Channel Assignment, Handoff strategies, Cell Splitting, Propagation Mechanism: Free space loss, Reflection, Diffraction, Scattering. Fading and Multipath: Small scale multipath propagation, Impulse response model of multipath channel. Multiple Access Techniques-TDMA,FDMA, CDMA		
	Practical		
	Simulation of a wireless channel model.		
Unit-IV	**First and Second Generation Mobile Systems**		
	First Generation Cellular Systems, AMPS, GSM Cellular Telephony: Introduction, Basic GSM Architecture, Basic radio transmission parameters in GSM system, Logical Channels, GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover, Modifications and derivatives of GSM.		
	Practical		
	Set up and carry out experiment on Mobile phone.		
	Set up and carry out experiment on GSM.		
	Set up and carry out experiment on AT commands.		
Unit- V	**GSM Services**		
	GSM Physical layer: Speech Coding and decoding, GMSK modulation, Data transmission in GSM: Data Services, SMS, HSCSD, GPRS, And EDGE.		
	Practical		
	Simulation of Speech coding and decoding.		
Unit-VI	**CDMA Based Mobile Systems**		
	Motivation for CDMA use, Spreading Sequences, Basic Transmitter and Receiver schemes, Rake Receiver, IS-95 system: Frequency Range, Downlink transmission, Uplink transmission, Power control, Introduction to 3G mobile systems: W-CDMA and cdma-2000.		
	Practical		
	Set up and carry out experiment on GMSK modulation.		
	Set up and carry out experiment on spreading Sequences.		
	Set up and carry out experiment on CDMA.		
	Set up and carry out experiment on3G Mobile.		
	Set up and carry out experiment on VOIP implementation		
Text Books	**Author**	**Title of Book**	**Publication**
T1	J. E. Flood	Telecommunications Switching, Traffic and	Pearson Education

		Networks	
T2	Krzysztof Wesolowski	Mobile Communication Systems	Wiley Student Edition
Reference Books			
R1	Theodore S Rappaport	Wireless Communications Principles and Practice	Second Edition, Pearson Education
R2	John C. Bellamy	Digital Telephony	Third Edition; Wiley Publications
R3	ThiagarajanVishwanathan	Telecommunication Switching Systems and Networks	PHI Publications
R4	Wayne Tomasi	Electronic Communications Systems	5th Edition; Pearson Education
R5	Vijay K Garg, Joseph E Wilkes	Principles and Applications of GSM	Pearson Education
R6	Vijay K Garg, Joseph E Wilkes	IS-95CDMA and CDMA 2000 Cellular/PCS Systems Implementation	Pearson Education
R7	Mischa Schwartz	Mobile Wireless Communications	Cambridge University Press

Self-Learning Facilities (OCW, Handouts, Web Recourses, Research papers etc.)	NPTEL Lecture Series on Mobile Communication by Prof. Sujoy Ghosh and Prof A. Pal, Department of Computer Science & Engineering, IIT Kharagpur.
	www.Youtube.com (Lectures series by Experts)
Contents beyond Syllabus	Concept of Telegraphy
	Three stage network
	Grade of service of link system(Three stage network)
Additional Experiments	Simulation to set up and carry out experiment on CDMA
Bridging Courses	
Assignments	Simulation of a wireless channel model.
	Set up and carry out experiment on analysis of telecommunication traffic.
	Numerical on Traffic calculation
	Traffic Measurement
	Numerical on first erlang distribution
	Numerical on channel capacity
Tutorials	Nil
Presentations	Traffic performance
	Cellular concepts, Switching systems

Broadband Communication Systems

Course Title: Broadband Communication Systems		**Course Number: 404190**	**Course Name:C410**
Year: BE		**Semester: II**	
Designation of Course: Professional Core			
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work:50*	Oral:50**Lab Practise III: BCS & MC
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Physics, Electromagnetic Fields and Communication theory		
Course Objectives			
1	To understand the three primary components of a fiber-optic communication system.		
2	To understand the system design issues and the role of WDM components in advanced light wave systems.		
3	To understand the basics of orbital mechanics and the look angles from ground stations to the satellite.		
4	To apply their subject understanding in Link Design.		
Course Outcomes:			
After successfully completing the course students will be able to:			
CO1	Carry out Link power budget and Rise Time Budget by proper selection of components and check its viability.		
CO2	Carry out Satellite Link design for Up Link and Down Link.		
Course Contents			
Unit-I	Light wave System Components 6L		
	Key Elements of Optical Fiber Systems, Optical Fibers as a Communication Channel: Optical Fiber Modes and Configurations , Mode Theory for Circular Waveguides , Single-mode Fibers, Graded-index Fiber Structure, Signal Degradation in Optical Fibers.Optical Sources: Basic Concepts and characteristics of LEDs and LASERs. Photodetectors: Basic Concepts, Common Photodetectors.		
	Practical		
	1.Estimation of Numerical aperture of fiber		
	2. Plot the characteristics of various sources and detectors		
	3. Measure attenuation of MMSI and SMSI fiber and comment on the result based on attenuation due to increase in length as well as loss due to bend		
Unit-II	Light-wave Systems 6L		

	System Architectures, Point-to-Point Links: System Considerations, Design Guidelines: Optical Power Budget, Rise Time Budget, Long-Haul Systems.
	Practical
	4. Set up a digital link and analyze.
	5. Tutorial on Power budget and time budget analysis of optical fiber
Unit-III	Multichannel Systems 6L
	Overview of WDM, WDM Components: 2 x 2 Fiber Coupler, Optical Isolators and Circulators, Multiplexers and De-multiplexers, Fiber Bragg Grating, FBG applications for multiplexing and De-multiplexing function, Diffraction Gratings, Overview of Optical Amplifiers: SOA, EDFA and RFA in brief.
Unit-IV	Orbital Mechanics and Launchers 6L
	History of Satellite Communication, Orbital Mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and Launch Vehicles, Orbital effects in communication system performance.
Unit- V	Satellites 6L
	Satellite Subsystems, Attitude and control systems (AOCS), Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment Reliability and space qualification.
Unit-VI	Satellite Communication Link Design 6L
	Introduction, Basic transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design of Specified C/N : Combining C/N and C/I values in Satellite Links, System Design Examples.
	Practical
	6. Establishing a direct communication link between Uplink Transmitter and Downlink Receiver using tone signal.
	7. To communicate VOICE signal through satellite link.
	8. To establish an AUDIO-VIDEO satellite link between Transmitter and Receiver
	9. To transmit and receive PC data through satellite link
	10. Tutorial on satellite link design

Text Books	**Author**	**Title of Book**	**Publication**
T1	Gerd Keiser	Optical fiber Communications	Tata McGraw Hill, 4th edition
T2	Timothy Pratt, Charles Bostian, Jeremy Allnutt	Satellite Communications	John Wiley & Sons.
Reference Books			
R1	Govind P. Agrawal	Fiber-Optic Communication Systems	Wiley, 3rd edition.
R2	Dennis Roody	Satellite Communications	McGraw Hill

Self-Learning Facilities (OCW, Handouts, Web Recourses, Research papers etc.)	NPTEL Lecture Series on Optical Fiber Communication by Prof Shevgaonkar, IITB.
Contents beyond Syllabus	State of art – Optical Link Components, Google Fiber Standards
Additional Experiments	1. Characterizing optical fiber link using OTDR.
	2. Simulation based.
Bridging Courses	Nil
Assignments	
1	Light wave Components
2	Optical Power Budget
3	Optical Rise Time Budget
4	Orbital Mechanics & Launchers
5	Satellite Link Design
Tutorials	Tutorial on Power budget and time budget analysis of optical fiber
	Tutorial on satellite link design
Presentations	Dense Wavelength Division Multiplexing Scheme
	Satellite Systems
Videos	Fiber Fabrication & Installation Satellite Communication

Audio Video Engineering

Course Title: Audio Video Engineering (Elective-III)		**Course Number:404191**	**Course Name: C411 c**
Year: BE		**Semester: II**	
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work 50 Marks	Practical/Oral50 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Basics of analog communication and transmission Techniques Knowledge about the antennas In depth understanding of cathode ray tube		
Course Objectives			
1	After learning AVE course, students will understand the working of real life video system and the different elements of video system plus the encoding/decoding techniques.		
2	The learners will be groomed up to understand different channel allocations, difference between various systems present in this world, their transmission and reception techniques		
3	Students will get insight on functioning of individual blocks, different standards of compression and they will be acquainted with different types of analog, digital TV and HDTV systems.		
4	The students will get overview of fundamentals of audio systems and basics of Acoustics		
Course Outcomes			
CO1	The learners will be able to understand the transmission of video signals.		
CO2	The learners will also understand the importance of television standards to effectively work with broadcasting applications.		
CO3	They will gain knowledge in advanced digital video transmission standards.		
CO4	They will be conversant with the studio acoustics and related parameters like reverberation		
Course Contents			
Unit-I	**Fundamentals of Colour Television**		
	Color TV systems, fundamentals, mixing of colors, colour perception, chromaticity diagram. NTSC, PAL, SECAM systems, colour TV transmitter, (high level, low level), colour TV receivers, remote control. Fault finding and servicing equipments like Wobbuloscope, TV Pattern Generator, and Field Strength meter.		
	Practical		
	-Voltage and Waveform analysis for color TV receiver		

Unit-II	**Digital TV and Display Devices**		
	Introduction to Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, advanced MAC signal transmission, Digital TV receivers, Basic principles of Digital Video compression techniques, MPEG Standards. Digital TV recording techniques, Display devices: LED, LCD, TFT, Plasma.		
	Practical		
	Study of Direct to home TV and set top box		
	Study of Digital TV Pattern Generator		
	Study of Digital TV		
Unit-III	**HDTV**		
	HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite Systems, video on demand, CCTV, CATV, direct to home TV, set top box with recording facility, conditional access system (CAS), 3D TV systems, Digital broadcasting, case study (Cricket match, Marathon, Football match).		
	Practical		
	Study of HDTV		
Unit-IV	**Advanced TV Systems**		
	IP Audio and Video, IPTV systems, Mobile TV, Video transmission in 3G mobile System, IPod(MPEG4 Video player), Digital Video Recorders, Personal Video Recorders, Wi-Fi Audio / Video Transmitter and Receivers. Video Projectors, HD Video projectors, Video Intercom systems/ Video door phones.		
	Practical		
	Study of Wi-Fi TV /IPTV system		
Unit- V	**Fundamentals of Audio-Video Recording**		
	Methods of sound recording & reproduction, optical recording, CD recording, , audio standards. Digital Sound Recording, CD/ DVD player, MP3 player, Blue Ray DVD Players, MPEG, MP3 Player.		
	Practical		
	Simulation of Video, Audio & Image Processing Techniques(Software Assignment)		
	Study of Audio system: CD Players and MP3 Players		
Unit-VI	**Fundamentals of Acoustics**		
	Studio acoustics & reverberation, P.A. system for auditorium, , acoustic chambers ,Cordless microphone system, special types of speakers & microphones, Digital Radio Receiver Satellite radio reception.		
	Practical		
	Study of PA system with cordless microphone		
	Directivity Pattern of microphones/ Loudspeakers		
Text Books	**Author**	**Title of Book**	**Publication**
T1	A. M. Dhake	Television and Video Engineering	TMH Publication.

T2	Keith jack	Video Demisified	Penram International Publication.
	R.G. Gupta,	Audio Video System	TMH Publication
Reference Books			
R1	S. P. Bali	"Color TV Theory and Practice"	
R2	Bernard Grobb, Charles E	"Basic TV and Video Sytems	
R3	Gulathi	"Monochrome & Color TV	
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series www.dvdforum.com www.trai.gov.in		
Contents beyond Syllabus	Introduction to Advanced compression techniques like MPEG-4 and JPEG-2000. Latest technology like 3D along with the latest 3D camera devices and viewing technology. Introduction to the latest broadcasting and reception technologies as the World is moving towards Digitization.		
Additional Experiments	Troubleshooting of Colour TV receiver from Expert		
Bridging Courses	Expert lectures by Communication Faculties		
Assignments			
1	Color TV receiver and PAL decoder		
2	Comparison between NTSC, PAL and SECAM		
3	Comparison of CD,DVD and Blu-ray DVDs.		
Tutorials	Calculations of channel frequencies on VHF and UHF bands		
	All parameters of display technologies like CRT, LCDs, TFTs, Plasmas, LEDs. Their comparison and voltages required		
	Calculations of satellite TV channels and LNBC frequencies		
Presentations	Presentation on Display Device Technologies Introduction to New Broadcasting Antennas Discussion of latest Video Compression Techniques		

Soft Computing

Course Title: Soft Computing (Elective-III)		**Course number: 4 04191**	**Course Name:C411 d**
Year: BE		**Semester: II**	
Designation of Course		Professional Core	
Teaching Scheme:3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work: 50 Marks	Practical/Oral 50 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Basics of Linear Algebra (vector analysis),chain rule Probability Theory		
Course Objectives			
1.	Introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.		
2.	Insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems techniques		
3.	To create awareness of the application areas of soft computing technique		
4.	Provide alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system		
Course Outcomes			
CO1	Use a new tool /tools to solve a wide variety of real world problems		
CO2	Find an alternate solution , which may offer more adaptability, resilience and optimization		
CO3	Identify the suitable antenna for a given communication system		
CO4	Gain knowledge of soft computing domain which opens up a whole new career option		
CO5	Tackle real world research problems		
Course Contents			
Unit-I	**Artificial Neural Network -I**		
	Biological neuron, Artificial neuron model, concept of bias and threshold , McCulloch-Pits Neuron Model , implementation of logical AND, OR, XOR functions Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model : concept of error energy , gradient descent algorithm and application of linear neuron for linear regression, Activation functions : binary , bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule, Perceptron and its limitations		
	Practical		

	Implement simple logic network using MP neuron model		
	Implement a simple linear regressor with a single neuron model		
	Implement single layer perceptron		
Unit-II	**Artificial Neural Network-II**		
	Multilayer perceptron (MLP) and back propagation algorithm o Application of MLP for classification and regression o Self-organizing Feature Maps, k-means clustering,Learning vector quantization Radial Basis Function networks: Cover's theorem, mapping functions (Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression ,Hopfield network, associative memories.		
	Practical		
	1. Implement and test MLP trained with back-propagation algorithm		
	2. Implement and test RBF network		
	3. Implement SOFM for character recognition		
Unit-III	**Fuzzy Logic -I**		
	Concept of Fuzzy number, fuzzy set theory(continuous, discrete),Operations on fuzzy sets, Fuzzy membership functions (core ,boundary ,support) , primary and composite linguistic terms , Concept of fuzzy relation, composition operation (T-norm,T-conorm),Fuzzy if-then rules.		
Unit-IV	**Fuzzy Logic -II**		
	Fuzzification , Membership Value Assignment techniques, De-fuzzification (Max membership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules- Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems -Mamdani fuzzy model , Sugeno fuzzy model , Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing		
	Practical		
	4. Implement Fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)		
	5. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method)		
	6. Implement FIS with Mamdani inferencing mechanism		
Unit- V	**Fuzzy Control Systems**		
	Control system design problem, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design V, Fuzzy Logic Controllers Soft o Comparison with traditional PID control, advantages of FLC, Architecture of a FLC: Mamdani Type , Example Aircraft landing control problem.		
Unit-VI	**Adaptive Neuro-Fuzzy Inference Systems (ANFIS)**		
	ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression		
	Practical		
	7. A small project: may include classification or regression problem, using any soft computing technique studied earlier		
Text Books	**Author**	**Title of Book**	**Publication**

T1	LaureneFausett,	Fundamentals of Neural Networks: Architectures, Algorithms And Applications	Pearson Education, Inc, 2008
T2	Third Edition Thomas ,Timothy Ross	Fuzzy Logic With Engineering Applications	John Wiley & Sons,2010
	J.S. Jang, C.T. Sun, E. Mizutani	Neuro- Fuzzy and Soft Computing	PHI Learning Private Limited
	S. N. Sivanandam, S. N. Deepa,	Principles of Soft Computing	John Wiley & Sons, 2007
Reference Books			
R1	John Hertz, Anders Krogh, Richard Palmer, Addison	Introduction to the theory of neural computation	Wesley Publishing Company, 1991
R2	Simon Haykin	Neural Networks:A comprehensive foundation	Prentice Hall International Inc-1999
R3	José C. Principe Neil R. Euliano , W. Curt Lefebvre,	Neural and Adaptive Systems: Fundamentals through Simulations	John-Wiley & Sons, 2000
R4	Peter E. Hart, David G.	Pattern Classification	Stork Richard .Duda,Second Edition,2000
R5	SergiosTheodoridis , KonstantinosKoutroumbas,	Pattern Recognition,	Fourth Edition, Academic Press, 2008
	Hung T. Nguyen, Elbert A. Walker	A First Course in Fuzzy Logic, Third Edition	Taylor & Francis Group, LLC, 2008
	S. N. Sivanandam , S.Sumathi, S. N. Deepa,	Introduction to Fuzzy Logic using MATLAB	Springer Verlag, 2007

Self-Learning Facilities, Web Resources, Research papers for reference

NPTEL Lecture Series

www.neuralnetworksanddeeplearning.com

Author	Title of Paper	Journal/Transaction
Vikas Chandrakant Raykar	Classification and Regression using Linear Networks, Multilayer Perceptrons and Radial Basis Functions	ENEE 739Q SPRING 2002 COURSE ASSIGNMENT 2 REPORT 1
Lofti Zadeh	Fuzzy Logic, Neural Networks and Soft Computing	Fuzzy Systems, AI

	Anil K Jain and Jianchang Mao	Artificial Neural Networks: A tutorial	Theme Feature, march 1996
Contents beyond Syllabus	Discussion on ADALINE and MADALINE networks (Supervised Learning Networks)		
Additional Experiments	Prerequisite experiment on vector and matrix operations		
	Line regression using perceptron		
	MLP trained back propagation algorithm using XOR		
Bridging Courses	Expert lecture on Artificial Intelligence		
Assignments			
1	Linear Algebra		
2	AND,OR,XOR logic functions using MP model and Hebbian n/w		
Tutorials	Examples on MP model		
	Hebbian Network,		
	Linear regression		
Presentations	Soft topologies for neural network		
	Application of ANFIS		
	Practical examples of Fuzzy Control Systems		

Wireless Networks

Course Title: Wireless Networks		**Course Number:** 404192	**Course Name:C412 d**
Year: BE		**Semester: II**	
Designation of Course		Professional Core	
Teaching Scheme: 3Hrs/Week		**Laboratories:** -Nil	
Course Assessment Methods	**Direct methods**	In-sem. Examination: 30 Marks	End Semester Examination: 70 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Mobile Communication, Telecommunication Switching System, Digital Communication, Analog Communication, Computer Network		
Course Objectives			
1	To study the evolving wireless technologies and standards		
2	To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.		
3	To understand various protocols and services provided by next generation networks.		
Course Outcomes			
CO1	Keep himself updated on latest wireless technologies and trends in the communication field		
CO2	Understand the transmission of voice and data through various networks.		
CO3	Explain and apply concepts of GSM and CDMA system.		
Course Contents			
Unit-I	**Introduction to Wireless Networks**		
	Introduction, Technology and service trends of Emerging Wireless technologies, The Amazing Growth of Mobile Communications, A Little History, Mobile Communications Fundamentals, Mobile Data, WiFi, Bluetooth, Cable Systems, Wireless Migration Options, Harmonization Process.		
Unit-II	**WiFi and Next Generation WLAN**		
	WiFi (802.11), 802.11 Standards, WiFi Protocols, Frequency Allocation, Modulation and Coding Schemes, Network Architecture, Typical WiFi Configurations, Security, 802.11 Services, Hot Spots, Virtual Private Networks (VPNs), Mobile VPN, VPN Types, WiFi Integration with 3G/4G, Benefits of Convergence of WiFi and Wireless Mobile.		
Unit-III	**Third Generation Mobile Services**		
	Introduction, Universal Mobile Telecommunications Service (UMTS), UMTS Services, The UMTS Air Interface, Overview of the 3GPP Release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000, TD-CDMA, and TD-SCDMA		

Unit-IV	**LTE**		
	LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, User Equipment (UE), Enhanced Node B (eNodeB), Core Network (EPC), Radio Channel Components, TD-LTE, Multiple Input Multiple Output, LTE Scheduler, Carrier Aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover (X2, S1, Inter-MME), Self- Organizing Networks (SONs), Relay Cells, Heterogeneous Network (HetNET), Remote Radio Heads (RRH), VoLTE, LTE Advanced		
Unit- V	**WiMAX**		
	Introduction, Standards, Generic WiMAX Architecture, Core Network, Radio Network, WiMAX Spectrum, Modulation, Channel Structure, Mixed Mode, Interference Mitigation Techniques, Frequency Planning, Features and Applications, Security, QoS, Profiles, Origination, Handover, Femto and SON		
Unit-VI	**VOIP**		
	Why VoIP?, The Basics of IP Transport, VoIP Challenges, H.323, The Session Initiation Protocol (SIP), Distributed Architecture and Media Gateway Control, VoIP and SS7, VoIP Quality of Service.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Clint Smith, P.E., Daniel Collins	Wireless Networks: Design and Integration for LTE, EVDO, HSPA, and WiMAX	McGrawHill Education, Third Edition
T2	EldadPerahia, Robert Stacey	Next Generation Wireless LANs	Cambridge University Press, Second Edition
Reference Books			
R1	Yi-Bang Lin, ImrichChlamtac	Wireless and Mobile Network Architecture	Wiley India Edition
R2	DipankarRaychaudhary, Maria Gerla	Emerging Wireless Technologies and the Future Mobile Internet	Cambridge University Press
Self-Learning Facilities(OCW, Handouts, Web Recourses, Research papers etc.)	NPTEL Lecture Series on Mobile Communication by Prof. Sujoy Ghosh and Prof A. Pal, Department of Computer Science & Engineering, IIT Kharagpur.		
	www.Youtube.com (Lectures series by Experts)		
Contents beyond Syllabus	Understanding PSTN ,Telecommunication Traffic analysis ,Speech coding and decoding		
Additional Experiments	Nil		
Bridging Courses	Nil		
Assignments	How to create hotspot on laptop?		

	VOIP Implementation
	WiFi Implementation
Tutorials	Nil
Presentations	1. Cellular concepts
	2. Multiple access technique
	3. WiFi and next generation WLAN

Internet of Things

Course Title:	**Internet of Things**	**Course Number: 414464 D**	**Course Name:C412 e**
Designation of Course	Elective IV		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** --	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work ---	Practical/Oral ---
	Indirect Methods	Class Room Exam	
Prerequisites	Fundamentals of Computer Network		
Introduction of Course			
RFID basics,Internet			
Course Objectives			
1	To understand what Internet of Things is		
2	To get basic knowledge of RFID Technology ,sensor technology & satellite technology		
3	To make students aware of resource management and security issues in internet of things		
Course Outcomes			
CO1	Explain what Internet of Things is.		
CO2	Describe key technologies in Internet of Things.		
CO3	Understand wireless sensor network architecture and its framework along with WSN applications.		
CO4	Explain resource management in the Internet of Things.		
CO5	Understand business models for the Internet of Things.		
Course Contents			
Unit-I	**INTRODUCTION**		
	What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations		
	Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions		
	IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities		
Unit-II	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES**		
	Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics Traffic Characteristics, Scalability, Interoperability, Security and Privacy		
	Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power		
	Sensor Technology, RFID Technology, Satellite Technology		
Unit-III	**RADIO FREQUENCY IDENTIFICATION TECHNOLOGY**		
	RFID: Introduction, Principle of RFID, Components of an RFID system, Issues		

	EPCGlobal Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.		
	Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication		
	WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.		
Unit-IV	**RESOURCE MANAGEMENT IN THE INTERNET OF THINGS**		
	Clustering, Software Agents, Clustering Principles in an Internet of Things Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization		
	Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust		
Unit- V	**INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE**		
	Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases		
	IoT security tomography and layered attacker model, Identity establishment, Access control		
	Message integrity, Non-repudiation and availability, Security model for IoT		
Unit-VI	**BUSINESS MODELS FOR THE INTERNET OF THINGS**		
	Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things		
	Internet of Things Application : Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Daniel Minoli	Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications	Willy Publications
T2	Bernd Scholz-Reiter	Architecting the Internet of Things	Springer
T3	Parikshit N. Mahalle	Identity Management for Internet of Things	River Publishers
Reference Books			
R1	Hakima Chaouchi	The Internet of Things Connecting Objects to the Web	Willy Publications

R2	Olivier Hersent	The Internet of Things: Key Applications and Protocols	Willy Publications
Self-Learning Facilities	NPTEL Lecture Series		
Web Resources	EPC network architecture http://www.peterindia.net/TheInternetofThings.html http://www.llrx.com/features/internetofthingsresources.htm Internet of Things Consortium http://iofthings.org/ Internet of Things research report from Hammersmith group (Feb 2010) http://thehammersmithgroup.com/images/reports/networked_objects.pdf IoT European Research Cluster http://www.internet-of-things-research.eu/ A RESTful API for controlling air conditioners, light bulbs, cameras: Internet of Things API for device-driven applications https://www.crowsnest.io/ Connected devices for cars - the connected car http://www.moj.io/ MQTT is a machine-to-machine (M2M)/"Internet of Things" connectivity protocol. http://mqtt.org/ Smart Home automation http://www.smartthings.com/ Tools For the Open Source Internet of Things http://iot-toolkit.com/		