Semester - VI

Branch: Electronics & Communication Engineering

S.N.	Code	Course Title	Lecture	Tutorial	Practical	Credits
1	EC601	VLSI Design	3	1	0	4
2	PEC-III	**Professional Elective -III**	3	0	0	3
3	PEC-IV	**Professional Elective -IV**	3	0	0	3
4	OEC II	**Open Elective -II**	3	0	0	3
5	OEC III	**Open Elective -III**	3	0	0	3
6	IC601	Entrepreneurship	2	0	0	2
7	EC651	VLSI Lab	0	0	3	1
8	EC652	**Elective-III** Lab	0	0	3	1
9	EC653	**Elective-IV** Lab	0	0	3	1
				Total Credits		21

Code	**Professional Elective-III**	Code	**Professional Elective-IV**
EC611	Digital Signal Processing	EC621	Microcontrollers and their Applications
EC612	System on Chip Design	EC622	Microwave Engineering
EC613	Digital Image Processing	EC623	Wireless Communication

Code	**Open Elective-II (Any One)**	Code	**Open Elective-III**
EC631	Analog and Digital Communication*	EC641	Digital Signal Processing*
EC632	Nano Electronics	EC642	Value and Ethics
EC633	Communication Protocols for Instrumentation	EC643	Analog Integrated Electronics*

* Not for ECE Students

Vinoba Bhave University , Hazaribagh

RAMGARH ENGINEERING COLLEGE

(Estd. by Govt. of Jharkhand & run by Techno India under PPP)

Department of

Electronics and Communication Engineering

SEMESTER-VI

Electronics & Communication Engineering			
ECE601	**VLSI Design**	**L**	**T**
		3	**1**

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

CO1	APPLY the knowledge of semiconductor to review MOSFET characteristics, Small geometry effects and scaling.
CO2	DEVELOP voltage, current sources and amplifiers and Operational amplifier made by CMOS.
CO3	CONSTRUCT switched capacitor filters, ADC, DAC and interconnects
CO4	ANALYZE CMOS Inverter, Dynamic CMOS, Pass transistor and transmission gates
CO5	DESIGN CMOS combinational, sequential circuits and memories

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	1	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1

Detailed Syllabus:

Module	Content	No. of Lectures
1	**Introduction:** Review of MOSFET characteristics, scaling and small-geometry effects, and MOSFET capacitances. MOS resistor, MOS current source, current mirror circuits. MOS voltage source, linear voltage and current converters.	**6**

2	**CMOS operational amplifier (OPAMP) design:** Differential amplifier, level shifter, source follower, output stage voltage and power amplifiers. Cascode OP-AMP. Compensation techniques. **Analog Filters:** Switched capacitor (SC) fundamentals, first order SC circuits, second-order SC circuits and cascade design. Analog to digital and digital to analog converters, speed of conversion and over sampling issues. **VLSI Interconnects:** Distributed RC model, transmission line model. Future inter connect technologies.	**14**
3	**Digital VLSI Circuit Design:** MOS inverters, CMOS inverter, state characteristics, switching characteristics, power dissipation issues. **CMOS logic gates:** NAND, NOR, XOR, CMOS logic design of half and full adders. CMOS transmission gates, pseudo-nMOS, domino logic gates.	**9**
4	**Sequential MOS Logic Circuits:** The SR latch circuit, clocked latch and flip-flop, CMOS D-latch and edge-triggered circuits, Schmitt trigger circuit, Comparator. **Dynamic Logic Circuits:** Pass transistor logic, synchronous dynamic circuit techniques.	**8**
5	**Semiconductor Memories:** ROM circuits, SRAM circuits, DRAM circuits, drivers and buffers, Buffer scaling and design issues	**5**

Text Books:

1. Sung-Mo Kang, Yusuf Leblebici Chulwoo kim, Digital Integrated Circuits: Analysis and Design, 4th Edition, McGraw Hill Education, 2016.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd Edition, McGraw Hill Education, 2016.
3. Jan M RABAEY, Digital Integrated Circuits, 2nd Edition, Pearson Education, 2003.
4. Neil H.E. Weste and David Harris, CMOS VLSI Design: A circuits and systems perspective, 4th Edition, Pearson Education, 2015.

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Electronics & Communication Engineering			
ECE611	**Digital Signal Processing**	**L**	**T**
		3	**0**

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

CO1	Find DFT of a given signal through Fast Fourier Transform Techniques.
CO2	Design FIR and IIR type digital filters.
CO3	Identify various filter structures and evaluate the finite word length and the coefficient Quantization effects.
CO4	Understand the concepts of sample rate conversion techniques and its applications.
CO5	Compare the key architectural features of DSP Processors.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2		3	-	-	-	-	-	-	-	-	-	-
CO3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	-	1

Detailed Syllabus:

Module	Content	No. of Lectures
1	**Signals and systems:** Basic elements of DSP, concepts of frequency in Analog and Digital Signals, sampling theorem, Discrete time signals, systems analysis of discrete time LTI systems, Z transform, Convolution, Correlation.	**6**
2	**Frequency transformations:** Introduction to DFT, Properties of DFT, Circular Convolution, Filtering methods based on DFT, FFT Algorithms, Decimation in time Algorithms, Decimation in frequency Algorithms, Use of FFT in Linear Filtering, DCT, Use and Application of DCT.	**10**
3	**IIR filter design:** Structures of IIR, Analog filter design, Discrete time IIR filter from analog filter, IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives (LPF, HPF, BPF, BRF) filter design using frequency translation.	**10**
4	**FIR filter design:** Structures of FIR, Linear phase FIR filter, Fourier Series, Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.	**8**

5	**Finite word length effects in digital filters:** Binary fixed point and floating point number representations, Comparison, Quantization noise, truncation and rounding, quantization noise power, input quantization error, coefficient quantization error, limit cycle oscillations-dead band, Overflow error-signal scaling.	**8**

Text Books:

1. J.G.PROAKIS & D.G.MANOLAKIS, Digital Signal Processing - Principles, algorithms & Applications, PHI, 2000.
2. .B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003
3. A.V. Oppenheim and Ronald W. Schafer, Discrete Time Signal Processing, 2nd Edition, PHI, 2000.
4. S.K.MITRA, Digital Signal Processing – A computer Based Approach, 2nd Edition, MGH, 2001.
5. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
6. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.

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Electronics & Communication Engineering			
ECE622	**Microwave Engineering**	**L**	**T**
		3	**1**

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

CO1	Study the performance of specialized microwave tubes such as klystron, reflex klystron, magnetron and Travelling wave tube.
CO2	Understand the operation of passive waveguide components.
CO3	Analyze microwave circuits using scattering parameters
CO4	Identify and characterize different components of an Optical Fiber Communication link
CO5	Analyze optical source, Fiber and Detector operational parameters.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	2	-
CO2	1	2	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	-	-	-	-	-	-	-	2	2
CO4	2	-	-	-	1	-	-	-	-	-	2	2
CO5	1	-	-	-	2	1	-	-	-	-	2	2

Detailed Syllabus:

Module	Content	No. of Lectures
1	**Introduction:** RF and microwave spectrum, historical background, application of RF and Microwave Impedance Matching–Unknown impedance measurement using shift in minima technique and impedance matching using single and double stub matching.	**8**

2	**Microwave waveguides and components**: Rectangular waveguide and circular waveguide, mode structure, cutoff frequency, wall current, attenuation; microwave cavities – rectangular cavity resonator, Q factor, power divider, scattering matrix and transmission matrix, attenuator, phase shifter, directional coupler, Bethe hole coupler, magic tee, hybrid ring, circulator, isolator, Ferrite Devices	**10**
3	**Planar structures:** Strip line, microstrip line, coplanar structure **Microwave Tubes:** Limitations of conventional tubes, Multicavity Klystron, Reflex Klystron, Magnetron, Travelling Wave Tube, Backward Wave Oscillator Semiconductor Microwave Devices – Tunnel diode, Gunn diode and their waveguide mounts	**10**
4	**Avalanche diodes:** IMPATT, TRAPATT, Microwave bipolar transistor, heterojunction bipolar transistor. **Microwave field effect transistor:** JFET, MOSFET, MESFET **Applications of microwave:** Industrial Applications of microwave.	**8**
5	**Microwave Measurement:** VSWR measurement, power measurement, impedance measurement, frequency Measurement Equivalent RF circuit Parameters Low pass filter, high pass filter, band pass filter, RF amplifier.	**6**

Text Books:

1. Golio M, Golio J (2008) The RF and Microwave Handbook. CRC Press.
2. Pozar DM (2005) Microwave Engineering. John Wiley & Sons.
3. Hong JS, Lancaster MJ (2001) Microstrip Filters for RF/Microwave Applications. John Wiley & Sons.

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Electronics & Communication Engineering			
IC601	**Entrepreneurship**	**L**	**T**
		2	**0**

Course objective:

1. To have Understanding of the dynamic role of entrepreneurship and small businesses
2. To know about Organizing and Managing a Business
3. To know about Financial Planning and Control
4. To know about Business Plan Creation
5. To know about Forms of Ownership for Small Business

Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** An Overview of Entrepreneurs and Entrepreneurship, Definition, Concept of Entrepreneurship & Intrapreneurship, Characteristics and skills of entrepreneurs	08
2.	**Entrepreneurial Development:** Entrepreneurship & Economic development, Contribution of Small and big enterprises to the economy, Entrepreneurial environment, Types of Entrepreneurs.	08
3.	**Developing the Business Plan :** Identification of Business idea, Elements of a Business Plan, Building Competitive Advantage, Conducting feasibility Analysis, Strategy and Planning for Starting Your Small Business, Developing Marketing Strategies, Managing Human Resources.	08
4.	**Sources of Finance:** Equity vs. Debt Capital, Sources of Equity Finance, Institutional finance, Venture Capital, Lease Finance,Obtaining the Right Financing.	06
5.	**Forms of Business Ownership:** Forms of Ownership, Becoming an Owner , Sole Proprietorship, Partnership, Corporations and other forms of ownership.	04
6.	**Intellectual Property Management:** Importance of innovation, patents& Trademarks in small businesses, introduction to laws relating to IPR in India.	04
7.	**Institutional support for small businesses in India:** Support in areas of technology, finance, inputs & infrastructure, marketing, entrepreneurship Development.	04
	Total	**42**

Suggested Books:

[1].Hisrich & Peters, "Entrepreneurship", Tata McGraw Hill

[2].Roy, Rajeev, "Entrepreneurship", Oxford University Press

[3]. Norman M. Scarborough, "Essentials of Entrepreneurship & Small Business Management", 6th ed., Prentice Hal

[4]. Dutta, Bholanath, "Entrepreneurship management" ,Excel Books.

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Electronics & Communication Engineering			
ECE612	**System on Chip Design**	**L**	**T**
		3	**0**

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

CO1	To understand the basic concepts of SOC design.
CO2	To summarize and explain the performance evaluation methods**.**
CO3	To classify and understand the power management process and modeling design tools**.**
CO4	To understand and study the micro-architecture design and modeling, software and hardware design verifications**.**

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	2	1	2	-	-	-	-	2	2
CO2	1	-	-	1	2	2	-	-	-	-	2	2
CO3	-	-	-	-	2	2	-	-	-	-	2	2
CO4	1	-	-	-	3	2	-	-	-	1	2	2

Detailed Syllabus:

Module	Content	No. of Lectures
1	**System Level Design:** System level design-Tools & methodologies for system level design, System level space & modeling languages, SOC block based design & IP assembly, Performance evaluation methods for multiprocessor SOC design.	**8**
2	**Power Management And Synthesizing** : System level power management, Processor modeling & design tools, Embedded software modeling & design Using performance metrics to select microprocessor for IC design, Parallelizing High-Level Synthesize, A code transformational approach to High Level Synthesize.	**12**
3	**Micro-Architecture Design and Power Optimization**: Micro-architecture design, Cycle accurate system – level modeling, Performance evaluation, Micro architectural power estimation optimization, Design planning.	**8**
4	**Software Design Verification**: logical verification, Design & Verification languages, Digital simulation, using transactional, level models in an SOC design, Assertion based verification.	**8**
5	**Hardware Design Verification**: Hardware acceleration & emulation, Formal property verification, TEST, DFT, ATPG, Analog & mixed signal test.	**6**

Text Books:

1. Louis Scheffer Luciano Lavagno and Grant Martin, “EDA for IC System verification and Testing”,
   CRC, 2006.
2. Wayone Wolf, “Modern VLSI Design: SOC Design”
3. Prakash Rashnikar, Peter Paterson, Lenna Singh “System-On-A-Chip Verification methodology & Techniques”, Kluwer Academic Publishers.
4. Alberto Sangiovanni Vincentelli,” Surviving the SOC Revolution: A Guide to Platform based Design”, Kluwer Academic Publishers.

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Electronics & Communication Engineering			
ECE613	**Digital Image Processing**	**L**	**T**
		3	**0**

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

CO1	Understand the need for image transforms and their properties.
CO2	Choose appropriate technique for image enhancement both in spatial and frequency domains.
CO3	Identify causes for image degradation and apply restoration techniques.
CO4	Compare the image compression techniques in spatial and frequency domains.
CO5	Select feature extraction techniques for image analysis and recognition.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	2	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	2

Detailed Syllabus:

Module	Content	No. of Lectures
1	**Introduction**: Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital Image Processing Systems. **Digital image fundamentals**: Elements of Visual Perception, A Simple image model, Sampling and Quantization, Neighborhood of Pixels, Pixel Connectivity, Labeling of Connected Components, Distance Measures, Arithmetic and Logic Operations, Image Transformations, Perspective Transformations, Stereo Imaging.	**10**

2	**Image enhancement**: Spatial Domain Methods, Frequency Domain Methods, Point processing, Intensity Transformations, Histogram Processing, Spatial filtering, Smoothing Filters, Sharpening Filters, Enhancement in the Frequency Domain, Low Pass Filtering, High Pass Filtering, Homomorphic filtering.	**8**
3	**Wavelets and multi resolution processing**: Sub band Coding, Haar Transform, Multi resolution Series Expansions, Wavelet Transforms in One Dimension, Discrete Wavelet Transform, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image compression**: Fundamentals of Compression, Image Compression Model, Error free Compression, Lossy Predictive Coding, and Transform Coding.	**10**
4	**Image segmentation**: Detection of Discontinuities, Line Detection, Edge Detection, Edge Linking and Boundary Detection, Thresholding, Threshold Selection on Boundary Characteristics, Region Growing, Region Splitting and Merging, Use of motion in Segmentation. **Image representation and description:** Chain Codes, Polygonal Approximations, Signatures, Skeleton, Boundary Descriptions, Shape Numbers, Fourier descriptors, Moments, Topological Descriptors.	**10**
5	**Image recognition and interpretation**: Elements of Image Analysis, Pattern and Pattern Classes, Minimum Distance Classifier, Matching by Correlation, Baye‟s Classifier, Neural Network Training Algorithm, Structural methods.	**6**

Text Books:

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education Asia, New Delhi, 2000.
2. B. Chanda, D. Dutta Majumder, Digital Image Processing and Analysis, PHI, New Delhi, 2000.
3. A.K. Jain, Fundamentals of Digital Image Processing, PHI, New Delhi, 2001.

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Electronics & Communication Engineering			
ECE621	**Microcontrollers and their Applications**	**L**	**T**
		3	**0**

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

CO1	Understand the evolution of 8051 microcontroller and its Harvard architecture**.**
CO2	Understand the evolution and Harvard Architecture of RISC, CISC**.**
CO3	Analyze and understand the instruction set and Assembly language programming of 8051 microcontroller**.**
CO4	Understand the Interfacing of 8051 microcontroller with Different I/O and ADC and DAC Peripherals**.**
CO5	Understand the applications of microcontrollers in different area**.**

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	3	-	-	-	-	-	-	-	2
CO2	-	3	-	3	-	-	-	1	-	-	-	2
CO3	-	3	-	-	-	-	-	1	-	-	-	2
CO4	-	3	-	3	-	-	-	1	-	-	-	2
CO5	2	3	-	3	-	-	-	1	-	-	2	3

Detailed Syllabus:

Module	Course Content	No. of Lecture
1	**Introduction to Embedded Systems:** Introduction to 8051, Embedded systems, Microprocessor vs. Microcontrollers., Desirable Features of Embedded systems, Overview to 8051 family, Introduction to Harvard Architecture, RISC, and CISC.	**8**
2	**Architecture of 8051**: 8051 microcontroller hardware: Oscillator and Clock, Role of PC and DPTR, Flags and PSW, CPU registers, Internal RAM and RAM organization, Internal Memory, Special Function Registers, I/O pins, ports and circuits, External memory, Counter and Timers, Serial Transmission, Interrupts.	**9**
3	**Assembly Language Programming of 8051:** Assembly language programming, Jump Loop and Call Instructions, I/O Port Programming, Addressing Modes, Arithmetical and Logical Instructions, **8051: Programming in C:** Data types and time delays, I/O Programming in 8051, Logical operations in C Data conversion programs in C.	**10**

4	**Peripheral Programming and Interfacing.** 8051 timer programming, serial port and its programming, interrupt programming, LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory.	**7**
5	**Applications:** Interfacing with relays and Opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.	**4**

Text Books:

1. Kenneth J. Ayala, „The 8051 Microcontroller", Cengage Learning, 2004
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, „The 8051 Microcontroller
3. and Embedded Systems" , Second Edition , Pearson Prentice Hall,
4. 8051 Microcontrollers: MCS51 family and its variants by Satish Shah, Oxford University Press.
5. Programming and Customizing the 8051 Microcontroller by Myke Predko Tata McGraw Hill.

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Electronics & Communication Engineering			
ECE623	**Wireless Communication**	**L**	**T**
		3	**0**

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

CO1	Understand the evolution of cellular communication systems upto and beyond 3G.
CO2	Design a cellular link and estimate the power budget.
CO3	Choose proper multiple accessing methods depending on channel model.
CO4	Identify traffic channels for call processing.
CO5	Calculate key performance metrics of a cellular communication system.

Mapping of Course Outcomes with Program Outcomes:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	1	2	2	-	-	-	2	-
CO2	2	-	-	-	2	2	1	-	-	2	2	2
CO3	2	-	-	-	2	2	1	-	-	-	2	2
CO4	1	-	-	-	2	-	2	-	-	-	2	2
CO5	2	-	-	-	3	2	2	-	-	2	2	2

Detailed Syllabus:

Module	Content	No. of Lectures
1	Introduction to Wireless Communication Systems – evolution of mobile radio communications, mobile radio systems around the world, radio communication systems – paging systems, cordless telephone systems, cellular telephone systems; comparison of common wireless Communications, trends in cellular radio and personal communication.	**8**
2	Basics of mobile communication – Limitations of conventional mobile system, mobile cellular communication – introduction, concept of frequency reuse, cluster size, cellular system architecture – mobile station, base station, MSC, channel assignment strategies, call handover strategies, interference and system capacity, improving capacity in cellular systems – cell splitting, sectoring, repeaters, microcell zone Concept.	**12**
3	Second generation (2G) cellular networks, third generation (3G) wireless networks, introduction to radio wave propagation, free space propagation model	**4**
4	Global system for mobile communication – GSM services and features, system architecture, GSM radio subsystem, GSM channel types, location updating and call setup, introduction to CDMA digital cellular standard, comparison between GSM and CDMA.	**10**

5	Wireless networking – wireless local area network standards, technology RF and IR wireless LAN, diffuse, quasi-diffuse and point-to-point IR wireless LAN, advantages and applications of Wireless LAN, introduction to WI-FI, Bluetooth, 3G and 4G wireless systems	**8**

Text Books:

1. William C Y Lee, "Mobile Cellular Telecommunications, McGraw Hill.(Main Book)
2. Stallings, Wireless Communications and Networks, Prentice Hall.
3. Schwartz, Mobile Wireless Communications, Cambridge University Press.(Main Book)
4. Theodore S Rappaport, "Wireless Communications Principles and Practice", Prentice Hall.

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Electronics & Communication Engineering			
ECE631	**Analog and Digital Communication***	**L**	**T**
		3	**0**

(This course is not offered to Electronics and Communication Engg. students) Course

Outcomes: After completion of the course student must be able to:

CO1	UNDERSTAND the basic principles and fundamentals of analog & digital communication.
CO2	ANALYZE different types of modulation techniques and their performance in presence of noise.
CO3	APPLY analytical skills for error detection and correction in communication.
CO4	UNDERSTAND the concept of noise as a random process and its effect on communication receivers, ISI, Eye Pattern.
CO5	UNDERSTAND the concept of information theory and source encoding.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	-	-	-	-	-	2	3	1
CO2	3	3	2	3	3	2	-	-	-	-	-	-
CO3	2	-	2	3	3	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	2	3	-	-	-	-	3	2	-

Detailed Syllabus:

Module	Course content	No. of Lectures
1	Signals and Signal Analysis: Periodic and nonperiodic signals, Composite signals, Signal analysis, Time and frequency domain representation. Introduction to Data and signal fundamentals, Analog and digital signals.	**8**
2	Analog Transmission: Concepts of carrier signal, noise, modulating signal and modulated signal; Amplitude modulation – double sideband suppressed carrier, double sideband transmitted carrier, single sideband; Frequency modulation – Narrowband FM and wideband FM; Digital to analog conversion – Amplitude shift keying, Frequency shift keying, Phase shift keying, Quadrature amplitude modulation, Performance.	**8**
3	Digital Transmission: Problems with digital transmission, Different line coding schemes, Block coding schemes, Scrambling techniques; Analog to digital conversion – Sampling techniques, Sampling theorem, Pulse amplitude modulation, Pulse code modulation, Differential pulse code modulation, Delta modulation (along with advantages and disadvantages of each technique), Transmission modes (serial	**10**

	and parallel).	
4	Multiplexing and Spreading: Concept of multiplexing, Frequency division multiplexing, Time division multiplexing – Synchronous and Statistical time division multiplexing.	**10**
5	Error Detection and Correction: Types of errors, Basic concepts of error detection and correction, Redundancy, Hamming distance, Error detection – Simple parity check codes, Two-dimensional parity check, Cyclic redundancy check, Polynomials and cyclic code analysis, Checksum, Error correction – Hamming code.	**8**

Text Books:

1. S. Haykin, Digital Communications, John Wiley & Sons, 2009.
2. B. Sklar, Digital Communications, 2nd Edition, Pearson Education, New Delhi, 2009.
3. John G. Proakis, Digital Communications, 3rd edition, McGraw Hill, 1995.
4. BP Lathi Communication System BS Publication
5. Singh & Sapre, Analog Communication, TMH

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Electronics & Communication Engineering			
ECE632	**Nano Electronics**	**L**	**T**
		3	**0**

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

CO1	Understanding of Nano Computing.
CO2	Understanding of tunneling phenomenon.
CO3	Understanding of Spin transport.
CO4	Understanding of molecular electronics.
CO5	Simulation of Nano electronics computational methods.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	-	-	-	-	-
CO3	1	3	2	3	-	-	-	-	-	-	-	-
CO4	1	3	2	2	-	-	-	-	-	-	-	-
CO5	1	2		-	-	-	-	-	-	-	-	-

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Detailed Syllabus:

Module	Content	No. of Lectures
1	**Evolution of nanoelectronics:** Moore‟s Law, Silicon Electronics, Limitations, Discussion of the International Technology Roadmap characteristics: Need for new concepts in electronics, Silicon MOS Transistor from Micro to Nano, Future Opportunities Nano-computing.	**6**
2	**Tunnel junctions and applications of tunneling:** Tunneling Through a Potential Barrier - Potential Energy Profiles for Material Interfaces, Metal Insulator, Metal Semiconductor, and Metal – Insulator - Metal Junctions - Applications of Tunneling - Field Emission – Gate - Oxide Tunneling and Hot Electron Effects in MOSFETs - Double Barrier Tunneling and the Resonant Tunneling Diode	**10**
3	**Ballistic and spin transport:** Coulomb Blockade - Tunnel Junction Excited by a Current Source - Coulomb Blockade in a Quantum Dot Circuit – Single Electron Transistor - Ballistic Transport - Electron Collisions and Length Scales - Ballistic Transport Model Quantum Resistance and Conductance - Transport of Spin and Spintronics Devices, Applications.	**10**
4	**Molecular electronics:** Introduction to molectronics - An atomistic view of electrical resistance Schrodinger equation, Self - consistent field, Band structure, Level broadening, Coherent transport, Non-coherent transport in molecular electronics devices, Molecular Devices, Logic Switches, Interface Engineering-Issues.	**8**
5	**Nanoelectronics simulation:** Computational Methods – Molecular Wire Conductance: Some Theoretical and Computational Aspects, Monte Carlo Method, Simulations from ab initio to multiscale modeling, Modeling of nanodevices, Applications.	**6**

Text Books:

1) Advanced Nanoelectronics:- Sohail Anwar, Mohammad Taghi Ahmadi, Razali Bin Ismail CRC press
2) Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and applications, Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio,Cambridge press
3) Handbook of Nanotechnology,Bharat Bhusan,Springer Publications.

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Electronics & Communication Engineering			
ECE633	**Communication Protocols for Instrumentation**	**L**	**T**
		3	**0**

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

CO1	Understand and estimate errors in a measurement system
CO2	Understand PLC,SCADA & DCS
CO3	Estimate accurately the values of R,L and C employing suitable bridges
CO4	Understand the basic principles of transducers for displacement, velocity, temperature and pressure.
CO5	Operate special measuring instruments such as Wave Analyzer, Harmonic Distortion Analyzer and Spectrum Analyzer.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	2
CO3	1	2	-	-	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

Detailed Syllabus:

Module	Course content	No. of Lectures
1	**Overview:** Standards, OSI model, Protocols, Physical standards, Modern instrumentation and control systems, PLCs, Smart instrumentation systems, Communication principles and modes, error detection, Transmission, UART.	**6**
2	**Serial communication standards:** Standards, serial data communication interface standards, EIARS232 interface standard, RS-449, RS-422, RS-423 and RS-485 standards, Troubleshooting and testing with RS-485, GPIB standard, USB interface.	**8**

3	**Error Detection, Cabling and Electrical Noise**: Errors, Types of error detection, control and correction, copper and fiber cables, sources of electrical noise, shielding, cable ducting and earthling.	**7**
4	**Modems and Multiplexers:** Synchronous and Asynchronous modes, flow control, modulation techniques, types of a modem, modem standards, terminal and statistical multiplexers. **Communication Protocols:** Flow control protocols, XON/XOFF, BSC, HDLC and File transfer protocols, OSI model and layers, ASCII protocols, Modbus protocol.	**10**
5	**Industrial Protocols:** Introduction to HART protocol, Smart instrumentation, HART physical layer, HART data link layer, HART application layer, ASD_i interface, Seriplex, CANbus, Devicenet, Profibus, FIP bus, Fieldbus. **Local Area Networks**: Circuit and packet switching, Network topologies, Media access control mechanisms, LAN standards, Ethernet protocol, Token ring protocol.	**9**

Text Books:

1. Bernard M. Oliver and John M. Cage, Electronic Measurements and Instrumentation, McGraw Hill Inc., 1971.
2. W. D. Cooper and Felbrick, Electronic Instrumentation & Measurement Techniques, 2nd Edition, PHI, 2009.
3. D.A. Bell, Electronic Instrumentation and Measurements, Reston Pub. Co., 1983.
4. H S Kalsi, Electronic Instrumentation, McGraw Hill, 3rd Edition, 2011.

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Electronics & Communication Engineering			
ECE641	**Digital Signal Processing***	**L**	**T**
		3	**0**

(This course is not offered to Electronics and Communication Engg. students) Course

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

CO1	Find DFT of a given signal through Fast Fourier Transform Techniques.
CO2	Design FIR and IIR type digital filters.
CO3	Identify various filter structures and evaluate the finite word length and the coefficient quantization effects.
CO4	Understand the concepts of sample rate conversion techniques and its applications.
CO5	Compare the key architectural features of DSP Processors.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2		3	-	-	-	-	-	-	-	-	-	-
CO3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	-	1

Detailed Syllabus:

Module	Content	No. of Lectures
1	**Signals and systems:** Basic elements of DSP, concepts of frequency in Analog and Digital Signals, sampling theorem, Discrete time signals, systems analysis of discrete time LTI systems, Z transform, Convolution, Correlation.	**6**
2	**Frequency transformations:** Introduction to DFT, Properties of DFT, Circular Convolution, Filtering methods based on DFT, FFT Algorithms, Decimation in time Algorithms, Decimation in frequency Algorithms, Use of FFT in Linear Filtering, DCT, Use and Application of DCT.	**10**
3	**IIR filter design:** Structures of IIR, Analog filter design, Discrete time IIR filter from analog filter, IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives (LPF, HPF, BPF, BRF) filter design using frequency translation.	**10**
4	**FIR filter design:** Structures of FIR, Linear phase FIR filter, Fourier Series, Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.	**8**

5	**Finite word length effects in digital filters:** Binary fixed point and floating point number representations, Comparison, Quantization noise, truncation and rounding, quantization noise power, input quantization error, coefficient quantization error, limit cycle oscillations-dead band, Overflow error-signal scaling.	**8**

Text Books:

1. J.G.PROAKIS & D.G.MANOLAKIS, Digital Signal Processing - Principles, algorithms & Applications, PHI, 2000.
2. .B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003
3. A.V. Oppenheim and Ronald W. Schafer, Discrete Time Signal Processing, 2nd Edition, PHI, 2000.
4. S.K.MITRA, Digital Signal Processing – A computer Based Approach, 2nd Edition, MGH, 2001.
5. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
6. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.

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Electronics & Communication Engineering			
ECE642	**Value and Ethics**	**L**	**T**
		3	**0**

Course Outcomes: After completion of the course student must be able to:

CO1	Students are able to **analyze** the ethical use of energy and the necessity of sustainable development.
CO2	Students are able to **understand** the core values that shape the ethical behavior of an engineer and exposed awareness on professional ethics and human values.
CO3	Students are able to **estimate** the link between social values and happiness.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	1	-	3	3	3	-	1	-	1
CO2	-	-	2	1	-	3	3	3	-	1	-	1
CO3	-	-	1	1	-	3	3	3	-	1	-	1

Detailed Syllabus:

Module	Course content	No. of Lectures
1	Science, Technology and Engineering as knowledge and as Social and Professional Activities. Effects of Technological Growth. Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources Environmental degradation and pollution.	**8**
2	Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.	**8**
3	Ethics of Profession. Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies. Profession and Human Values.	**10**

4	Values Crisis in contemporary society Nature of values: Value Spectrum of a good life Psychological values: Integrated personality; mental health Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.	**8**
5	Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility. .	**6**

Text Books:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
6. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.

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Electronics & Communication Engineering			
ECE643	**Analog Integrated Electronics***	**L**	**T**
		3	**0**

(This course is not offered to Electronics and communication Engg. students) Course

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

CO1	Design op-amp circuits to perform arithmetic operations
CO2	Analyze and design linear and non-linear applications using op-amps
CO3	Analyze and design oscillators
CO4	Analyze and design filters
CO5	Understanding of PLL and Timers.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	-	-	-	-	-
CO3	1	3	2	3	-	-	-	-	-	-	-	-
CO4	1	2	2	2	-	-	-	-	-	-	-	-
CO5	1	1		-	-	-	-	-	-	-	-	-

Module	Course Content	No. of Lecture
1	Op-Amp equivalent circuits, ideal Op-Amp, Op-Amp DC characteristics, AC characteristics, non-ideal Op-Amp characteristics. DC and AC amplifiers, summing, scaling, and averaging amplifiers, instrumentation amplifiers, I/V, V/I converter, integrator, differentiator, differential amplifiers. Op-amp with negative feedback, voltage series, voltage shunt feedback amplifier.	**8**
2	Logarithmic Amplifiers, Rectifiers, Peak detection and voltage regulation.	**5**
3	Comparator and its applications, Schmitt trigger, free-running, one- shot multivibrators, Barkhausen Criterion, sine wave generators, phase- shift, wein-bridge oscillators, square/Triangular/saw tooth wave function generator.	**10**
4	Filter Classifications, Frequency and Impedance Scaling, First and second order Low Pass and High Pass Designs, Band-Pass Filter, Notch filter.	**8**
5	PLL and Timers, Voltage controlled Oscillator, Closed loop analysis of PLL, Astable and Monostable Multivibrators using 555 Timer, Voltage regulators-linear and switched mode types.	**8**

Text Books:

1. OP-Amps and Linear Integrated Circuits: - Ramakant Gayakwad (Pearson Education)
2. Linear Integrated Circuits: - D Roy Choudhury, Shail Bala Jain (New Age International Publishers
3. Design with Operational amplifiers and Analog integrated circuits: - Sergio Franco (TATA McGraw-Hill 3rd Edition)

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