VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For

Third year

of

Four Year Undergraduate Programme Leading to

Bachelor of Technology (B. Tech.) Degree

in

Electronics Engineering

Implemented from Academic Year 2014-15

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For
Third
Year of

Four Year Undergraduate Programme Leading to
Bachelor of Technology (B. Tech.)
in

106- Electronics Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

APPLY ANALYSIS, DESIGN, OPTIMIZATION AND IMPLEMENTATION SKILLS IN ORDER TO FORMULATE AND SOLVE ELECTRONICS ENGINEERING AND MULTIDISCIPLINARY PROBLEMS.

TAKE UP HIGHER STUDIES, INNOVATION, RESEARCH & DEVELOPMENT AND OTHER SUCH CREATIVE EFFORTS IN TECHNOLOGY.

USE THEIR SKILLS IN PROFESSIONAL MANNER TO RAISE THE SATISFACTION LEVEL OF STAKE HOLDERS.

PROGRAM OUTCOMES (POS)

ENGINEERING GRADUATE WILL BE ABLE TO:

1. **ENGINEERING KNOWLEDGE**: APPLY THE KNOWLEDGE OF MATHEMATICS, SCIENCE, ENGINEERING FUNDAMENTALS, AND AN ENGINEERING SPECIALIZATION TO THE SOLUTION OF COMPLEX ENGINEERING PROBLEMS.
2. **PROBLEM ANALYSIS**: IDENTIFY, FORMULATE, REVIEW RESEARCH LITERATURE, AND ANALYZE COMPLEX ENGINEERING PROBLEMS REACHING SUBSTANTIATED CONCLUSIONS USING FIRST PRINCIPLES OF MATHEMATICS, NATURAL SCIENCES, AND ENGINEERING SCIENCES.
3. **DESIGN/DEVELOPMENT OF SOLUTIONS**: DESIGN SOLUTIONS FOR COMPLEX ENGINEERING PROBLEMS AND DESIGN SYSTEM COMPONENTS OR PROCESSES THAT MEET THE SPECIFIED NEEDS WITH APPROPRIATE CONSIDERATION FOR THE PUBLIC HEALTH AND SAFETY, AND THE CULTURAL, SOCIETAL, AND ENVIRONMENTAL CONSIDERATIONS.
4. **CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS**: USE RESEARCH-BASED KNOWLEDGE AND RESEARCH METHODS INCLUDING DESIGN OF EXPERIMENTS, ANALYSIS AND INTERPRETATION OF DATA, AND SYNTHESIS OF THE INFORMATION TO PROVIDE VALID CONCLUSIONS.
5. **MODERN TOOL USAGE**: CREATE, SELECT, AND APPLY APPROPRIATE TECHNIQUES, RESOURCES, AND MODERN ENGINEERING AND IT TOOLS INCLUDING PREDICTION AND MODELING TO COMPLEX ENGINEERING ACTIVITIES WITH AN UNDERSTANDING OF THE LIMITATIONS.
6. **THE ENGINEER AND SOCIETY**: APPLY REASONING INFORMED BY THE CONTEXTUAL KNOWLEDGE TO ASSESS SOCIETAL, HEALTH, SAFETY, LEGAL AND CULTURAL ISSUES AND THE CONSEQUENT RESPONSIBILITIES RELEVANT TO THE PROFESSIONAL ENGINEERING PRACTICE.
7. **ENVIRONMENT AND SUSTAINABILITY**: UNDERSTAND THE IMPACT OF THE PROFESSIONAL ENGINEERING SOLUTIONS IN SOCIETAL AND ENVIRONMENTAL CONTEXTS, AND DEMONSTRATE THE KNOWLEDGE OF, AND NEED FOR SUSTAINABLE DEVELOPMENT.

8. **ETHICS**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **INDIVIDUAL AND TEAM WORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **COMMUNICATION**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **PROJECT MANAGEMENT AND FINANCE**: Demonstrate knowledge and understanding of the engineer**ING AND MANAGEMENT PRINCIPLES AND APPLY THESE TO ONE'S OWN WORK, AS A MEMBER AND** leader in a team, to manage projects and in multidisciplinary environments.
12. **LIFE-LONG LEARNING**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OBJECTIVES (PSOS)

ELECTRONICS ENGINEERING GRADUATE WILL BE ABLE TO:

1. Design, develop and test electronic systems in the areas related to analog and digital electronics, electronic instrumentation, signal processing and VLSI design.
2. Analyze, design and implement electronic systems to strive balance between increasing complexity, robustness and performance of systems.
3. Design electronic software and hardware systems, components or process to meet desired needs within realistic constraints.

T Y B. Tech (Electronics Engineering) SEMESTER V								
Scheme of Instruction				Scheme of Evaluation				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.	EC3003T	Principles of Communication Systems	3-0-0=3	3	10	30	60	3
	EC3003P	Principles of Communication Systems Lab	0-0-2=2	1	100% CIE			
2.	EC3001S	Probability and Statistics	3-1-0=4	4	10	30	60	3
3.	EC3002S	Electromagnetic Field and Waves	3-1-0=4	4	10	30	60	3
4.	EC3004T	Analog Integrated Circuits	3-0-0=3	3	10	30	60	3
	EC3004P	Analog Integrated Circuits Lab	0-0-2=2	1	100% CIE			
5.	EC3005T	Microprocessor Systems	3-0-0=3	3	10	30	60	3
	EC3005P	Microprocessor Systems Lab	0-0-2=2	1	100% CIE			
6.	EC3006T	Power Electronics	3-0-0=3	3	10	30	60	3
	EC3006P	Power Electronics Lab	0-0-2=2	1	100% CIE			
7.	EC3007L	Electronic Engineering Practice	0-0-2=2	1	100% CIE			
		Total	**31**	**25**				

T Y B. Tech (Electronics Engineering) SEMESTER VI								
Scheme of Instruction				**Scheme of Evaluation**				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.	EC3011S	Control Systems	3-0-0=3	3	10	30	60	3
2.	EC3013T	Computer Organization	3-0-0=3	3	10	30	60	3
	EC3013P	Computer Organization Lab	0-0-2=2	1	100% CIE			
3.	EC3014T	Digital Communication	3-0-0=3	3	10	30	60	3
	EC3014P	Digital Communication Lab	0-0-2=2	1	100% CIE			
4.	EC3015T	Filter Theory	3-0-0=3	3	10	30	60	3
	EC3015P	Filter Theory Lab	0-0-2=2	1	100% CIE			
5.	EC3016L	Electronics in Service to Society	0-0-4=4	2	100% CIE			
6.		Advanced Business Communications	0-0-2=2	1	100% CIE			
7	EC3012S	Transducers and Sensors	3-0-0=3	3	10	30	60	3
8.		Elective I	3-0-0=3	3	10	30	60	3
		Elective I Lab	0-0-2=2	1	100% CIE			
9.	EC3017A	Intellectual Property Rights	3	3 units	100% CIE			
		Total	**30**	**25**				

*Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation*

B. Tech (Electronics Engineering)
Elective

S. No.	Course Code	Course Title
1.	EC3101T	Image and Video Processing
	EC3101P	Image and Video Processing Lab
2.	EC3102T	Neural network and Fuzzy Logic
	EC3102P	Neural network and Fuzzy Logic Lab
3.	EC3103T	Audio, Video and Image Compression
	EC3103P	Audio, Video and Image Compression Lab
4.	EC3104T	Virtual Instrumentation
	EC3104P	Virtual Instrumentation Lab

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - V**
Course Code	EC3003T
Course Title	**PRINCIPLES OF COMMUNICATION SYSTEMS**

COURSE OUTCOMES

After completion of course, the student should be able to:

- Compute noise figure and system equivalent noise temperature for communication systems.
- Describe amplitude modulators and demodulators, and different types of amplitude modulation.
- Describe frequency and phase modulation, along with FM modulators and demodulators.
- Describe the operation of receiver circuits, such as TRF and super-heterodyne receivers..
- Compute quantization noise and analyze signal-to-noise ratio in PCM, DPCM, DM and ADM systems, along with bandwidth considerations.

COURSE CONTENTS

Module 1	**Introduction**
	Elements of a communication system, modulation and demodulation, Noise in Communication systems, Signal-to-Noise ratio, Noise factor and Noise Figure, Equivalent Noise Temperature.
Module 2	**Amplitude Modulation**
	DSB Full carrier AM – principles, modulator circuits, transmitters, different types of AM modulators, Suppressed – carrier AM, SSB, ISB – Principles, transmitters, VSB Modulation. Effect of noise.
Module 3	**Angle Modulation**
	Frequency modulation, Phase modulation, Effect of noise, FM modulators, Transmitters, FM demodulators. Pre-emphasis & De-emphasis.
Module 4	**Radio Receivers**
	Receiver characteristics, TRF and Super-heterodyne receivers, AM detectors, FM detectors, Receiver circuits.
Module 5	**Radio Wave Propagation**
	Electromagnetic waves, Properties of radio waves, Propagation of waves, Propagation terms and definitions.
Module 6	**Analog Pulse Modulation**
	Sampling Theorem for Low – pass and Band – pass signals – proof with spectrum, Aliasing. Sampling Techniques – principle, generation, demodulation, spectrum. PAM, PWM, PPM – generation and detection.

Module 7	**Digital Transmission**
	Quantization, Quantization error, Non-uniform quantizing, Encoding. PCM, DPCM, Delta modulation, Adaptive Delta modulation – transmission system, bandwidth.
Module 8	**Multiplexing**
	TDM, FDM – Principles, Hierarchy.
	TEXT BOOKS:
1	Herbert Taub and Donald Schilling, Principles of Communication Systems, Tata McGraw-Hill, second edition.
2	Roy Blake, Electronic Communication Systems, Thomson Asia Pte. Ltd., Singapore, second edition, 2002.
	ADDITIONAL READING
1	Leon W Couch, Digital and Analog Communication Systems, Pearson Education, sixth edition
2	Herbert Taub and Donald Schilling, Principles of Communication Systems, Tata McGraw-Hill, second edition.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - V**
Course Code	EC3003P
Course Title	**PRINCIPLES OF COMMUNICATION LAB**

COURSE OUTCOMES

After completion of course,the student should be able to:

- Describe AM and FM transmission and reception.
- Compute Sensitivity, Selectivity, Fidelity, Image frequency rejection ratio of AM receiver.
- Verify sampling theorem and describe companding.
- Describe generation and detection in PCM and DM.

COURSE CONTENTS

Module 1	**Amplitude Modulation**
	AM generation for modulation index <1,>1 & =1. Generation of double sided suppressed carrier. AM detection.
Module 2	**Frequency Modulation**
	Frequency modulation Generation. FM Demodulation
Module 3	**Radio receivers: AM Receiver characteristics**
	Sensitivity, Selectivity, Fidelity, Image frequency rejection ratio
Module 4	**Analog Pulse Modulation:**
	Pulse Amplitude Modulation Generation and detection. Pulse Width Modulation Generation and detection. Pulse Position Modulation Generation and detection.
Module 5	**Digital Transmission**:
	Sampling Theorem Verification. μ- Law implementation. Pulse Code Modulation Generation and detection. Delta Modulation Generation and detection
	TEXT BOOKS:
1	Herbert Taub and Donald Schilling, Principles of Communication Systems, Tata McGraw-Hill, second edition.
2	Roy Blake, Electronic Communication Systems, Thomson Asia Pte. Ltd., Singapore, second edition, 2002.
	ADDITIONAL READING
1	Leon W Couch, Digital and Analog Communication Systems, Pearson Education, sixth edition
2	Herbert Taub and Donald Schilling, Principles of Communication Systems, Tata McGraw-Hill, second edition.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - V**
Course Code	EC3001S
Course Title	**PROBABILITY AND STATISTICS**

COURSE OUTCOMES

After completion of course, the student should be able to:

- Apply probability theory to practical applications.
- Characterize random variables by using distribution and density functions and apply them to various practical engineering problems
- Apply the central limit theorem to various engineering problems.
- Model random sequences and apply these models to practical problems.
- Use Monte-Carlo simulations and perform hypothesis testing, curve fitting and regression parameter estimation.

COURSE CONTENTS

Module 1	**Introduction to Probability**
	Sets, axioms of probability basic combinatorics and counting independence, conditional probability inference using Bayes'?? rule Applications: radar detection, transmission of digital information, network connectivity and reliability
Module 2	**Random Variables**
	densities and distribution functions (discrete and continuous) expectation and moments the moment generating function example distributions (Bernoulli, Binomial, Geometric, Poisson, Gaussian, Exponential, etc) Application: noise in electronic circuits, queueing in networks, cache in computers, bit errors in communications, modeling failure times, probability model for speech and optical character recognition, modeling optical communication systems
Module 3	**Multiple Random Variables**
	joint densities and distributions conditional densities and conditional expectation independence, correlation, and covariance multidimensional Gaussians, covariance matrices joint functions of random variables sums of random variables Applications: modeling manufacturing variation,

	modeling dependencies in natural language, signal detection, signals in additive and multiplicative noise
Module 4	**Limit Theorems**
	the central limit theorem law of large numbers Applications: analysis and modeling of photodetectors, polling, modeling noise in instrumentation
Module 5	**Random Sequences**
	the Bernoulli process the Poisson process Markov chains and random walks Applications: task scheduling ,Markov models of language for speech processing, queueing in network routers
Module 6	**Basic Statistics**
	sample mean and variance confidence intervals hypothesis testing curve-fitting and regression parameter estimation Applications: detection in digital communications, direction-of-arrival estimation, target tracking generating random numbers Monte Carlo simulations entropy and information average case analysis of algorithms
	TEXT BOOKS
1.	Papoulis, Athanasios and Pillai, S Unnikrishna, *Probability, random variables, and stochastic processes*, Tata McGraw-Hill Education, 2002.
	ADDITIONAL READING
1	Bertsekas & Tsitsiklis, *Introduction to Probability* (2nd edition), Athena Scientific, 2008.
2	Stark, Henry and Woods, *Probability, random processes, and estimation theory for engineers*, Prentice Hall, 1986.

Programme Name	T Y B Tech (Electronics Engineering), SEMESTER - V
Course Code	EC3002S
Course Title	ELECTROMAGNETIC FIELDS AND WAVES

COURSE OUTCOMES

After completion of course, the student should be able to:

- Represent a vector in different coordinate systems and compute area, volume, divergence and curl.
- State the Coulomb's and Gauss' laws and the Maxwell's equation.
- Describe conduction and convection current in conductors and polarization in dielectrics. Demonstrate understanding of continuity equation and boundary condition.
- State Faraday's law and demonstrate understanding of Maxwell's equations and analogies between electric and magnetic fields
- Describe electromagnetic wave propagation and define various terms related to it.

COURSE CONTENTS

Module I	Vector calculus, coordinate systems and transformations
	Cartesian coordinates, Cylindrical coordinates, Spherical coordinates, Differential length, Area and volume, Line surface and volume integral, Del operator and gradient of scalar, Divergence of vector, Curl of vector.
Module II	**Electrostatics and Magnetostatics**
	Review of Coulomb's law and field intensity, Electric flux density, Applications of Gauss's law, Relation between E and V Maxwell's equation, Applications of Ampere's law, Magnetic flux density - Maxwell's equation, Maxwell's equation for static fields, Magnetic scalar and vector potentials
Module III	**Electric fields in Material's space and Boundary value problems**
	Properties and materials, Convection and conduction current, Current density, Conductors, Polarization in dielectrics, Dielectric constant and strength, Continuity equation and boundary condition, Poisson's and Laplace equation, Uniqueness theorem, Resistance, capacitance and superconductance, The Earth capacitor : an automatic electrostatic pilot.
Module IV	**Maxwell's equations**
	Faraday's law, Transformer and motional electromotive forces, Displacement current, Inconsistency of Ampere's law, Maxwell's equation in time varying and harmonic form, Analogies between electric and magnetic fields,

Module V	Electromagnetic wave propagation
	Waves in general, Comparison and relation between permittivity & permeability, Propagation in lossy dielectric, Plane wave in lossless dielectrics, Plane waves in free space, Plane waves in good conductors, Power and Poynting vector, Propagation based on frequency variation, Reflection of plane wave at normal incidence.
	TEXT BOOKS
1.	Matthew N. O. Sadiku, "Elements of Electromagnetics", second edition, 1985, Oxford university press.
2.	Edminister, "Schaum's series in Electromagnetics", McGraw Hill, third edition, 1986.
	ADDITIONAL READING
1.	William Hayt, "Engineering Electromagnetics", McGraw Hill, fourth edition, 1987
2.	Edward C. Jordan, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", Second edition, Prentice-Hall

Programme Name	Bachelor of Technology in Electronics Engineering	SEMESTER – V
Course Code	EC3004T	
Course Title	ANALOG INTEGRATED CIRCUITS	

COURSE OUTCOMES

After completion of the course, the students should be able to:

- Analyze differential amplifier circuits and describe basic OPAMP configuration and characteristics
- Design linear and nonlinear circuits using OPAMPS.
- Design active filters and waveform generators using OPAMPS.
- Describe the operation of various voltage regulators.

COURSE CONTENTS

Module 1	**Fundamentals for OPAMP**
	Analysis of differential amplifiers using current mirror circuits with active loads. Basic OPAMP configuration, Ideal OPAMP circuit characteristics and analysis. Feedback in OPAMP circuits, IC741 study.
Module 2	**Linear applications of OPAMP**
	Amplifiers, Current to Voltage converters, Voltage to Current converters, Difference amplifier, Instrumentation amplifiers, Summing and scaling amplifiers, Integrator, Differentiator.
Module 3	**Non Linear Circuit Applications**
	Voltage Comparators, Comparator applications, Schmitt triggers, Precision rectifiers (Half wave & Full wave), Peak detectors, Sample & Hold circuits, Clippers and clampers using OPAMP, Log - Antilog amplifiers, PLL (IC565), Analog MUX and DEMUX
Module 4	**Active Filters**
	Classification, Transfer Function, First order Butterworth filters, Standard second order response, KRC filters (Low pass, High pass, Band pass filters, band stop filters, notch filters), Multiple feedback filters, State variable and Biquad filters.
Module 5	**Waveform Generation using OPAMP and Special ICs (IC-555, IC XR-2206)**
	Sine wave generation using OPAMP, Multivibrators using OPAMPs, Timer IC 555 in detail with internal diagram, applications of IC 555 in monostable & astable mode. Triangular & Sawtooth waveform generator, Monolithic Waveform Generator IC XR – 2206.

Module 6	**Analog to Digital and Digital to Analog Convertors**
	Analog switches, Digital to analog conversion techniques (R-2R, Binary Weighted). Analog to Digital Conversion techniques (Dual Slope ADC, Flash type ADC, Ramp ADC, Successive Approximation ADC, Delta modulation etc)
Module 7	**Voltage Regulators**
	Performance Specification, Linear Regulator (IC 78xx & IC 79xx, LM317), Voltage reference and its applications, Adjustable voltage regulators, switching regulators, monolithic switching regulator IC LM337, Special regulator and ICs.
	TEXT BOOKS
1	William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, Pearson Education, fourth edition, 2004
2	Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall/Pearson Education, fourth edition, 2002
3	Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, TATA McGraw-Hill fourth edition, 2014
	ADDITIONAL READING
1.	Millman, Microelectronics, TATA McGraw-Hill fourth edition

Programme Name	**:**	**Bachelor of Technology in Electronics Engineering**	**SEMESTER – V**
Course Code	**:**	EC3004P	
Course Title	**:**	**ANALOG INTEGRATED CIRCUITS LAB**	

COURSE OUTCOMES

After completion of the course, the students should be able to:

- Analyze and design various linear, non-linear applications of OPAMP using IC741, IC311.
- Design first-order active filters using OPAMPS.
- Design and construct waveform generator using OPAMP, timer IC 555, XR -2206.
- Design a regulator using IC 78/79xx, LM337.
- Design PLL using IC565.

COURSE CONTENTS

Module 1	**Linear applications of OPAMP**
	Design inverting and non-inverting amplifier using IC 751, Calculation of OPAMP bandwidth in inverting and non-inverting configuration mode, design of summing and difference amplifiers with gain.
Module 2	**Differentiator and Integrator Circuits**
	Design of integrator and differentiator, for specific cutoff frequencies and find out the range in which circuit will act as differentiator and integrator.
Module 3	**Non-Linear Operational amplifier circuits**
	Voltage comparators, Schmitt triggers, window detectors using IC 311, Precision rectifiers, Peak detectors, sample and hold circuit.
Module 41.	**Active Filters:**
	First order active filters, second order low pass and high pass butterworth KRC filters, standard second order band pass and bandstop filters.
Module 51.	**Waveform Generators:**
	Sine wave generation using IC 741 (Oscillators), Multivibrators using OPAMP and timer IC555, triangular waveform generation using OPAMP, Monolithic waveform generator IC XR-2206.
Module 6	**Nonlinear Amplifiers and PLL**
	Regulator design using IC 78/79xx, IC723 low voltage and high voltage designs, switching regulators.

Module 7	**Voltage Regulators**
	Log, antilog amplifiers, Phase Lock Loop using IC565
Module 81.	**ADC and DAC:**
	Dual slope ADC, staircase RAMP type ADC, flash type ADC, successive approximation ADC, R-2R DAC, weighted resistor DAC.
	TEXT BOOKS
1	William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, Pearson Education, fourth edition, 2004
2	Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall/Pearson Education, fourth edition, 2002
3	Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, TATA McGraw-Hill fourth edition, 2014
	ADDITIONAL READING
1.	Millman, Microelectronics, TATA McGraw-Hill fourth edition

Programme Name	Bachelor of Technology in Electronics Engineering	Semester – V
Course Code	EC3005T	
Course Title	MICROPROCESSOR SYSTEMS	
Prerequisites	Digital Design I & II, Microprocessors and Microcontrollers	

COURSE OUTCOMES

After completion of the course, the students should be able to:

- Describe architecture of 16-bit microprocessors.
- Design microprocessor systems consisting of a 16-bit microprocessor/microcontroller, memory , I/O and other relevant devices.
- Design and implement assembly language programs for 8086/ARM 7 microprocessors.
- Design and implement I/O data transfer techniques.

COURSE CONTENTS

Module 1	**Intel 8086/8088 microprocessor family**
	Architecture and organisation of 8086/8088 microprocessor family. Study of its Instruction set. Assembly language programming, 8086 family minimum and maximum mode operation. Timing diagram for 8086 family, detailed study of maximum mode connection: study of 8288 bus controller. 8086 interrupt structure.
Module 2	**8086 Memory & I/O design:**
	Memory system design for 8086 family, timing considerations for memory interfacing. Connection of I/O Controllers 8255AH programmable peripheral Interface, Programmable Interrupt Controller 8259A, programmable D.M.A. Controller 8237
Module 3	**8087 Math Co-processor**
	Study of architecture of 8087 floating point co- processor. Data types supported by 8087. Host and co - processor interface, Assembly language Programming for 8086 - 8087 based systems.
Module 4	**Introduction to 8086 based Multiprocessor systems:**
	Multiprocessor configurations. Study of the 8289 bus arbiter. Design of 8086 based multiprocessor systems (without timing considerations).
Module 5	**ARM7TDMI Architecture**
	Architectural Block diagram and Features of ARM 7 TDMI, processor operating states, Memory formats, Data types, Operating modes, registers , Pipelining, Program status registers, exceptions, interrupt latencies. Memory system design.

Module 6	ARM7TDMI Assembly Language Programming
	8,16,32 bit and floating point numbers processing, Conversions between Hexadecimal, BCD, ASCII, Data movement/copy operations, block transfer of data, data swap/exchange Arithmetic, Logical, and Stack operation, loops, condition evaluation and decision making based on flags, control transfers (Call, Return, Jumps), processor state changing between ARM and THUMB, Exceptions, interrupts and its handling.

	TEXT BOOKS
1	John Uffenback, 8086 / 8088 Design, Programming and Interfacing, second edition, ninth Indian reprint, Prentice Hall of India, 2001
2	Sloss, Symes, Wright, ARM System Developers Guide- Elsevier Morgan Kaufman, first edition, 2004
	RECOMMENDED READING
1	Douglas Hall, Microprocessors Interfacing and Programming, Tata McGraw Hill, third edition, 2002
2	William Hohl, ARM Assembly Language: Fundamentals and Techniques, CRC press, 2009

Programme Name	**Bachelor of Technology in Electronics Engineering**	**Semester – V**
Course Code	EC3005P	
Course Title	**MICROPROCESSOR SYSTEMS LAB**	
Prerequisites	**Microprocessors and Microcontrollers**	

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Write programs for data transfer, arithmetic and logic operations and floating point operations for 8086 / 8087 and ARM 7 microprocessors

COURSE CONTENTS

Module 1	Any five programs on data transfer operations, Arithmetic & Logic operations for 8086
Module 2	Any three programs on floating point operations involving 8087
Module 3	Any three programs on data transfer operations, arithmetic & logic operations and I/O involving ARM 7
	TEXT BOOKS
1	John Uffenback, 8086 / 8088 Design, Programming and Interfacing, second edition, ninth Indian reprint, Prentice Hall of India, 2001
2	William Hohl, ARM Assembly Language: Fundamentals and Techniques, CRC press, 2009

Programme Name	**:**	**T. Y. B. Tech. (Electronics Engineering)**	**SEMESTER – V**
Course Code	**:**	EC3006T	
Course Title	**:**	**POWER ELECTRONICS**	

COURSE OUTCOMES

After completion of this course, students should be able to

- Make a comparative study of performance of various devices on the basis of the circuit requirement including its rating and specifications.
- Analyse single phase and three phase converters with different loads and solve problems related to it.
- Comprehend the inverters with different loads and configurations and solve related problems.
- Describe the concept of chopper with its types and solve the problems.

COURSE CONTENTS

Module 1	**Switching devices**
	SCR: Principle of operation, Static, dynamic and gate characteristics, Methods of turning on , firing circuits, commutation circuits, Protection of SCR Other power switches –(TRIAC, DIAC, GTO, MOSFET, IGBT, power BJT etc.): Principle of operation, Characteristics (v-I, switching), Rating, specifications and applications, Driver circuits
Module 2	**Converters – Controlled rectifiers**
	Half wave controlled rectifier with R and R-L load, Full wave controlled rectifiers(half controlled and fully controlled) with R, R-L Load, Single phase dual converter, Three phase half controlled and fully controlled rectifier, Numerical analysis essential Converters – Cyclo converters: Introduction, Single phase and three phase cyclo-converters, Applications
Module 3	**Inverters**
	Introduction to VSI and CSI, Single phase half / full bridge VSI with R and R-L load, Three phase bridge inverters with R and R-L load (120 and 180), Voltage control of single phase inverter using PWM techniques, Numerical analysis
	essential, Introduction to multi level inverters.
Module 4	**Choppers**
	Introduction to DC-DC switching mode regulators, Buck, Boost, Buck-Boost, Cuk, SEPIC, Flyback, forward, push-pull regulators, Numericals essential

	TEXT BOOKS
1	M. H. Rashid, "Power Electronics" , Academic Press,2001 Pearson Education India, 2009.
	ADDITIONAL READING
2	P. C. Sen "Power Electronics" Tata McGraw-Hill Education, 1987.
3	N. Mohan, T.M. Undeland, W.P Robbins, "Power Electronics, Converters, Applications & Design," Wiley India Pvt. Ltd. 2002.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - V**
Course Code	EC3006P
Course Title	**POWER ELECTRONICS LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Make a comparative study of performance of various power electronic devices and its driver circuits on the basis of the circuit requirement.
- Design and analyse the waveforms of converters and cycloconverters.
- Design a AC voltage controllers
- Design and analyse the waveforms of different inverters.
- Design and analyse the waveforms of choppers

COURSE CONTENTS

Module 1	**Characterictics, triggring/ driver circuits and protection of power devices**
	1. Switching characteristics of a) power MOSFET b) SCR & TRIAC c) IGBT 2. Commutation circuit for SCR 3. Protection circuits of power devices
Module 2	**Controlled rectifier**
	1. Single phase half controlled rectifier. 2. Single phase fully controlled bridge rectifier.
Module 3	**AC voltage controller**
	Single phase ac voltage controller (using TRIAC or anti parallel thyristors)
Module 4	**Inverter**
	1. Single phase series inverter using SCR 2. Single phase parallel inverter using SCR 3. Single phase voltage source inverter using PWM technique 4. Three phase voltage source inverter using PWM technique (simulation)
Module 5	**Converters**
	1. Buck Converter 2. Boost Converter 3. Morgan Chopper

Module 6	**Cycloconverter**
	1. Single phase cycloconverter with resistive load 2. Three phase Cycloconverter (simulation)
Module 7	**Speed control of AC Motors**
	1. Speed control of single phase AC motor using PI controller Speed control of single phase AC motor using PID controller
	TEXT BOOKS
1.	M.H.Rashid, "Power Electronics" , Academic Press,2001 Pearson Education India, 2009.
2	P.C.Sen "Power Electronics" Tata McGraw-Hill Education, 1987.

Programme Name	Bachelor of Technology in Electronics Engineering	Semester – V
Course Code	EC3007L	
Course Title	ELECTRONIC ENGINEERING PRACTICE	
Prerequisites	Digital Design I & II, Microprocessors and Microcontrollers	

COURSE OUTCOMES

After completion of course, the student should be able to:

- Implement digital circuits in a high level descriptive language
- Program Arduino and Raspberry Pi boards and implement mini projects
- Design, implement and program 8/16 bit microcontroller and microprocessor systems

COURSE CONTENTS

Module 1	Design and implement in VHDL / Verilog, digital circuits like Arithmetic / Logic Unit, Finite state machines
Module 2	Program Arduino boards / Raspberry Pi boards, interface shields / daughter boards
Module 3	Mini Project: Design, fabricate, implement and test an 8 bit / 16 bit microcontroller or microprocessor based system.
	TEXT BOOKS
1.	John F. Wakerley, Digital Design Principles and Practices, fourth edition, Pearson Education India, 2008
2.	Kenneth Ayala, The 8051 Microcontroller & Embedded Systems Using Assembly and C, Cengage Learning, first edition, 2010
3.	Massimo Banzi, Getting Started with Arduino: The Open Source, Shroff Publishers & Distributors Pvt Ltd, first edition, July 2014

SEM VI

PROGRAMME	**T.Y. B.Tech. (Electronics), SEMESTER : V**
COURSE CODE	EC3011S
COURSE TITLE	**CONTROL SYSTEMS**

COURSE OUTCOMES

After completion of course, the student should be able to:

- Model systems in the frequency domain and compute transfer functions of various electrical and mechanical systems
- Represent a system by means of block diagram and signal flow graph
- Compute steady-state errors of systems and perform their root-locus analysis.
- Sketch Nyquist diagrams and compute stability.
- Perform state-space analysis of systems.

COURSE CONTENTS

Module 1	**Introduction to Control Systems**
	Analysis and design objectives, Open loop systems, Closed loop systems, The design process,
Module 2	**Modeling in Frequency Domain**
	Laplace transform review, Transfer function, Electric network transfer function, Translational mechanical system transfer function, Rotational mechanical system transfer function, Electromechanical system transfer function, Electrical circuit analogs.
Module 3	**Time Response Analysis**
	Poles, Zeros, System response, First order system, Second order system : Introduction, The general second order system, Underdamped second order system, System response with additional poles, System response with zeros.
Module 4	**Reduction of Multiple Subsystems**
	Block diagrams, Analysis and design of feedback system, Signal flow graphs, Mason's rule, Signal flow graphs of state equations.
Module 5	**Stability of the Systems**
	Introduction to concept of stability, Routh Hurwitz criterion, Special cases in RH criterion, Absolute stability, Relative stability.
Model 7	**Root Locus Analysis**
	Introduction, Root locus plots, Summary of general rules for constructing root loci, Root locus analysis for control systems, Root loci for systems with transport lag.
Module 6	**Steady State Errors**
	Steady state error for unity feedback systems, Static error constants and system type, Steady state error specification, Steady state error for disturbances, Steady state error for non unity feedback systems, Sensitivity.

Model 8	**Frequency Response Techniques**
	Asymptotic approximations: Bode plots, Introduction to the Nyquist criterion, Sketching the Nyquist diagram, Stability via the Nyquist diagram, Gain margin and Phase margin via the Nyquist diagram, Stability gain margin and phase margin via the Bode-plots, Relation between closed loop transient and closed loop frequency response, Constant gain and phase loci, Nichol's chart and their use in stability study of systems.
Module 9	**State Space Analysis of the System**
	The General state-space representation, Applying the state-space representation, Converting the transfer function to state-space, Converting from state-space to transfer function, Stability in State Space.
	TEXT BOOKS
1.	Norma S. Nise, Control Systems Engineering, John Wiley and Sons, third edition
	ADDITIONAL READING
1.	K. Ogata, Modern Control Engineering, Prentice Hall of India, third edition
2.	Benjamin C. Kuo, Automatic Control Systems, Prentice Hall of India, seventh edition
3.	Madan Gopal, Control Systems Principles and Design, Tata McGraw Hill, seventh edition, 1997

Programme Name	Bachelor of Technology in Electronics Engineering	Semester – VI
Course Code	EC3013T	
Course Title	COMPUTER ORGANIZATION	
Prerequisites	Microprocessor and Microcontroller, Microprocessor Systems	

COURSE OUTCOMES

After completion of course, the student should be able to:

- Analyze number representation in computer arithmetic and different algorithms
- Describe instruction types, addressing modes and carry out case study of typical microprocessor
- Analyze processor unit components, pipelining, instruction sets
- Analyze memory organization and cache implementation

COURSE CONTENTS

Module 1	**Performance measure**
	Definition, Throughput and Response time, Measuring performance (MIPs, FLOPs etc.).
Module 2	**Preliminaries:**
	Computer Arithmetic – Number representation and Arithmetic, Floating-point representation, Multiplication and Division algorithms and circuits. Operation on Data structures like Arrays, Lists, Stacks, and Queues.
Module 3	**Instruction types and sequencing, addressing modes with case study for Pentium processor Input / Output Organization**
	I/O devices types and access methods, interrupts, DMA, I/O processors, types of busses and bus arbitration, various bus standards, I/O interface – serial and parallel ports
Module 4	**Basic Processing Unit:**
	The data path and components of Instruction Execution, Bus Organization, Hardwired control, Micro-programmed control, Exceptions and their handling. Performance Enhancement using pipelining – Pipelining Introduction, Instruction set, Hazards, Case study.
Module 5	**Memory organization**
	RAM organization – SRAM and DRAM, ROM and Flash memory, addressing, Cache – mapping, handling cache miss , multi level caches, Virtual memory – Concept , Address translation, paging, TLB, segmentation
Module 6	**Peripherals:**
	Storage Devices – Organization, Access techniques, Input and Output devices - Organization, Access techniques, Network devices – modems, serial communication links

Model 7	**Multiprocessor systems:**
	Introduction to Multiprocessor systems, Connection techniques, Cache issues
	TEXT BOOKS
1.	Hamacher , Vranesic, Zaky ,Computer Organization , Fifth Edition, Tata McGraw-Hill, 2002.
	ADDITIONAL READING
1	Patterson & Hennessy, Computer Organization, Second Edition, Morgan Kaufmann Publishers, 1998
2	John Carpinelli, Computer Systems Organization and Architecture, first Indian reprint, Addison Wesley Longman – Indian Branch, 2001.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3013P
Course Title	**COMPUTER ORGANIZATION LAB**

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Implement computer arithmetic circuits
- Simulate Virtual memory implementation
- Simulate Cache memory
- Design and implement a four bit CPU

COURSE CONTENTS

Module 1	Any three practicals implementing Computer Arithmetic operations like Fast adder / subtractor, Multiplier, Divide
Module 2	Any three practicals simulating virtual memory implementation techniques
Module 3	Any two practicals simulating cache memory
Module 4	Mini Project: Implement a four bit Central Processing Unit
	TEXT BOOKS
1.	Hamacher , Vranesic, Zaky ,Computer Organization , Fifth Edition, Tata McGraw-Hill, 20021
	ADDITIONAL READING
1	Patterson & Hennessy, Computer Organization, Second Edition, Morgan Kaufmann Publishers, 1998
2	John Carpinelli, Computer Systems Organization and Architecture, first Indian reprint, Addison Wesley Longman – Indian Branch, 2001

Programme Name	**:**	**B. Tech. (Electronics)**	**SEMESTER - VII**
Course Code	**:**	EC3014T	
Course Title	**:**	**Digital Communication Systems**	

COURSE OUTCOMES

After completion of course, the student should be able to:

- Describe random variables and characterize them by distribution and density functions
- Compute the amount of information, entropy and information rate, and use various coding schemes.
- Use various error control coding techniques
- Describe correlation and matched receivers, equalization and GS orthogonalization procedure.
- Compare various modulation techniques on the basis of power spectra and bandwidth efficiency.
- Describe spread-spectrum modulation techniques and their applications.

Module 1	**Random Variables**
Review of probability theory, communication examples, Random variables, probability distribution function, probability density function, joint cumulative distribution and probability density, Average value and variance of a random variable, the error function, The Gaussian probability density, The Rayleigh probability density, the central limit theorem.	

Module 2	**Information Theory**
Discrete messages, the concept of amount of Information, Entropy, Information rate, coding to increase average Information per bit – Huffman coding, Lempel-Ziv coding, Shannon's Theorem, Channel capacity, Capacity of a Gaussian channel, Bandwidth – S/N trade-off.	

Module 3	**Error control coding**
Rationale for coding and types of codes, Discrete memory-less channel, some Algebraic concepts-code efficiency and Hamming bound, Linear block codes, Cyclic codes, Convolution codes, maximum likelihood decoding of convolution codes.	

Module 4	**Base band shaping for data transmission**
Discrete PAM signals (Line Coding), Power spectra of discrete PAM signals, Inter symbol Interference, Nyquist's criteria for distortion less base band, Concept of Raised Cosine pulse, Binary transmission, Correlative coding eye pattern, Base band M-ary PAM systems.	

Module 5	**Base band Detection**
Correlation receiver, Matched filter receiver, Detection of signals with unknown phase in noise, Equalization concepts [No Algorithms expected], Trapped-Delay Lines equalization, linear predictive vocoders, Likelihood functions, Schwartz Inequality, Gram-Schmidt Orthogonalization procedure.	

Module 6	**Digital Modulation Techniques**
Digital Modulation formats, coherent binary modulation Techniques, Coherent quadrature modulation Techniques, Non coherent binary modulation techniques, Comparison of binary and quaternary modulation techniques, M-Ary modulation, Power spectra, Bandwidth efficiency, Applications of Digital modulation Techniques, Introduction to OFDM.	
Module 7	**Spread spectrum modulation**
Pseudo-noise sequences, Base band spread spectrum system, DS-BPSK, Processing gain, Probability of error, concept of Jamming, Frequency–Hop spread spectrum, Applications.	
TEXT BOOKS:	
1	Symon Haykin - Digital Communication John Wiley and Sons (Topics 3, 4, 5, 6, 7)
2	Taub and Schilling - Principles of Communication Systems - Tata Mc Graw Hill 2nd Edition.
REFERENCE BOOKS:	
1	John G. Proakis, Digital Communications, McGraw Hill.
2	Bernad Sklar, Digital Communications, Pearson Education.
3	K. Sam Shanmugam - Digital and Analog Communication Systems – PRISM Indian Edition.

Programme Name	**:**	**B.Tech (Electronics)**	**SEMESTER – VII**
Course Code	**:**	EC3014P	
Course Title	**:**	**Digital Communication Systems Lab**	

COURSE OUTCOMES

After completion of course, the student should be able to:

- Implement PCM systems with uniform and nonuniform quantization
- Implement DITFFT and DIFFFT
- Implement DM and ADM systems
- Generate digitally modulated signals and perform their detection in the presence of noise.

COURSE CONTENTS

Module 1	Verification of sampling theorem
Module 2	Study of PCM with uniform & non-uniform quantization, SNR measurement for PCM system with uniform quantization
Module 3	Implementation DITFFT and DIFFFT
Module 4	Study of DM & ADM systems
Module 5	Generation and Detection of B-ASK & its spectral analysis.
Module 6	**Generation and Detection Communication circuits**
	Generation and Detection of B-FSK & its spectral analysis. Generation and Detection of B-PSK & its spectral analysis. Generation and Detection of Q-PSK & its spectral analysis
Module 7	Spectral analysis of line codes
Module 8	Detection of digital baseband signal using matched filter in the presence of noise.
Module 9	Generation & detection of DS-SS BPSK.
Module 10	Simulation of any digital communication system using MATLAB

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3015T
Course Title	**FILTER THEORY**

COURSE OUTCOMES

After completion of course, the students should be able to:

- Analyze DT systems in the frequency domain, using analytical and graphical techniques.
- Design linear phase systems to meet the desired specifications.
- Compute DFT using FFT algorithms
- Design FIR and IIR filters to meet the given specifications and determine the extent of quantization effects due to finite processor word length.

COURSE CONTENTS

Module 1	**Frequency Domain Analysis of DT Systems**
	Pole-zero diagram, Frequency domain analysis using Analytical & graphical techniques, System classification based on pass-band as low pass, high pass, Band pass & band reject, System classification based on phase response as Minimum phase , maximum phase , mixed phase or linear phase systems, Finite word-length effect on system poles
Module 2	**Linear Phase FIR Systems**
	Need for linear phase, concept of phase delay & group delay, Condition for Linear Phase, Magnitude & phase response for Four types of Linear Phase systems, Location of zeros.
Module 3	**Discrete Fourier Transform and Fast Fourier Transform**
	DFT and its Properties, Relation between DFT and Z-Transform, FFT: Decimation in Time (DIT) and Decimation in Frequency (DIF), 8-point DFT using Radix-2 DIT FFT and Radix-2 DIF FFT, Computation of Inverse DFT using FFT.
Module 4	**FIR Filter Design**
	FIR versus IIR filters, Design of FIR filters by windowing technique: (Gibb's phenomenon, Use of different windows: rectangular, triangular, hamming, hanning, Kaiser), Design of FIR filters using Frequency sampling techniques, Design of optimal linear phase FIR filters, Structures for implementation: canonic and lattice

Module 5	**Design of IIR filters**
	The design process Methodology, Different types of analog approximations: Butterworth, chebyshev, inverse chebyshev, elliptical, Bessel etc., Spectral transformations, Conversion techniques like bilinear transformation, impulse invariance, matched Z-transform, Intuitive approaches ,Structures for implementation: canonic and lattice,
Module 6	**Quantization Effects**
	Quantization methods, Limit cycle oscillations due to Quantization, Errors in frequency response due to coefficient Quantization.
	TEXT BOOKS
1	J. G. Proakis, D. G. Manolakis, Digital Signal Processing : Principles, Algorithms and Applications, Prentice Hall of India, third edition, 1995
	ADDITIONAL READING
1	Oppenheim and Schafer with Buck, Discrete- Time Signal Processing, Prentice Hall of India, 2000
2	A. Nagoor Kani, Digital Signal Processing, McGraw-Hill Education Second edition 2013
3	A. Antoniou, Digital Filters: Analysis Design and Applications, Tata McGraw-Hill, .2001.
4	Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning, second edition, 2001

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3015P
Course Title	**FILTER THEORY LAB**

COURSE OUTCOMES

Students will be able to write programs to

- Implement and plot frequency response of FIR and IIR systems and obtain their transfer functions
- Implement DITFFT and DIFFFT
- Implement simple programs on DSP processors

COURSE CONTENTS

Module 1	Frequency response of FIR and IIR system
Module 2	Transfer function and pole-zero plots of FIR and IIR systems
Module 3	Implementation DITFFT and DIFFFT
Module 4	**Linear Phase FIR filters**
	Magnitude & phase response for Four types of Linear Phase systems
Module 5	**FIR Filter Design**
	a) Design of FIR filters by windowing technique: b) Use of different windows: rectangular, triangular, hamming, hanning, Kaiser c) Design of FIR filters using Frequency sampling techniques
Module 6	**Design of IIR filters**
	a) Different types of analog approximations: Butterworth, Chebyshev, Inverse Chebyshev b) Conversion techniques like bilinear transformation, impulse invariance, matched Z-transform
Module 7	Implementation of simple programs on DSP processors
	TEXT BOOKS
1	J. G. Proakis, D. G. Manolakis, Digital Signal Processing : Principles, Algorithms and Applications, Prentice Hall of India, third edition, 1995
	ADDITIONAL READING
1	Oppenheim and Schafer with Buck, Discrete- Time Signal Processing, Prentice Hall of India, 2000
2	A. Nagoor Kani, Digital Signal Processing, McGraw-Hill Education Second edition 2013
3	A. Antoniou, Digital Filters: Analysis Design and Applications, Tata McGraw-Hill, .2001.
4	Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning, second edition, 2001

Programme Name	Bachelor of Technology in Electronics Engineering	Semester – VI
Course Code	EC3016L	
Course Title	ELECTRONICS IN SERVICE TO SOCIETY	
Prerequisites	Electronic Engineering Practice	

COURSE OUTCOMES

After completion of course, the students should be able to:

After successful completion of this course, students should be able to

1. Analyze the needs of various sections of society who can benefit from Electronic interventions.
2. Translate the need into an idea of electronic systems
3. Design and implement electronic systems using analog and digital components and sensors / transducers.

COURSE CONTENTS

Module 1	Analysis of an electronic aid / instrument / system
	Requirements analysis to gather inputs to understand needs of various sections of society. Understand "Make in India" Initiative of Government of India, Facilities and support provided by various government agencies for Make in India initiative.
Module 2	Design, fabricate and test an electronic system
	Design, fabricate, implement and test an electronic system with both analog and digital electronic components which will be a prototype of a product useful to society.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	
Course Title	**ADVANCECD BUSINESS COMMUNICATION**

COURSE OUTCOMES

After completion of course, the students should be able to:

- Draft technical document for specific purposes.
- Create various types of technical reports.
- Analyze standard practices of business ethics and culture for development of self and for the organization
- Conduct effective meetings with proper documentation.

COURSE CONTENTS

Module I	**Technical Writing**
	a) Framing definitions writing instructions b) description of objects c) explaining a process
Module II	**Report Writing**
	a) Objectives of report writing b) Language and Style in a report. c) Types of reports d) Formats of reports: Memo, letter, project and survey based
Module III	**Work Culture**
	a) Corporate ethics/Ethical codes of conduct in business and corporate activities b) Etiquette in social and business settings c) Email etiquette d) Telephone Etiquette e) Cross-cultural awareness
Module IV	**Strategies for conducting effective meetings**
	a) Notice b) Agenda c) Minutes of the meeting
Module V	**Interpersonal Skills**
	a) Emotional Intelligence b) Leadership and team-building c) Assertiveness d) Conflict Resolution e) Negotiation Skills Time Management
Module VI	**Writing and Presenting Research Paper.**

Text Books:		
1.	*Report writing for Business*	Lesikar and Petit,
2.	*Effective Technical Communication*	Asharaf Rizvi, The McGraw Hill
3.	*Professional Ethics*	R. Subramanian.
4.	*Business Communication*	Hory Shankar Mukharjee,OUP
5.	*Effective Technical Communication*	Anne Eisenberg.
References:		
1.	Basic Managerial Skills for All	E.H. McGrath, PHI Learning Pvt Ltd
2.	MLA Handbook for Writers of Research Papers	
3.	*https://learnenglish.britishcouncil.org/en/english-grammar*	

Programme Name	**T Y B Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3012S
Course Title	**TRANSDUCERS AND SENSORS**

COURSE OUTCOMES

After learning the course students should be able to:

- Classify and characterize different types of transducers and sensors.
- Identify transducers and sensors for measurement of various quantities.
- Analyze the use of transducers and sensors for various applications in electronics engineering.
- Design schematic diagrams and circuits using transducers and sensors for various applications.

COURSE CONTENTS

Module 1	**Introduction**
	Measurement systems, Basic electronic measuring system, Classification of transducers, General transducer characteristics, Criteria for transducer and sensor selection.
Module 2	**Resistive, Capacitive and Inductive Transducers**
	• Resistance Potentiometers-Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers • Strain gauges, (metallic and semi-conductor type) • Resistance Thermometer and Thermistors. • Types of Inductive transducer, Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT (Linear variable differential transformer). • Types of capacitive transducer, Principles of operation, construction, advantages,disadvantages and applications of capacitive transducers .
Module 3	**Elastic and Active Transducer**
	Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: • Thermocouple, Piezo-electric transducer. • Spring bellows, diaphragm, bourdon tube – their special features and application.
Module 4	**Other Important Transducers**
Module 5	**Capacitive Sensors**
	• Capacitive sensors: variable distance-parallel plate type, variable area-parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type. • Stretched diaphragm type: microphone.

	• Proximity sensor.
Module 6	**Thermal sensors**
	• Various types and applications
Module 7	**Magnetic sensors:**
	• Sensors based on • Villari effect.Wiedemann effect , Thomson effect, Hall effect and applications • Radiation sensors.
Module 8	**Introduction to smart sensors**
	• Introduction • Components of smart sensors • Architecture and evolutions of smart sensors • Advantages and disadvantages • Industrial applications
	TEXT BOOKS
1	Sensor & transducers, D. Patranabis, 2nd edition, PHI 2009 .
2	Transducers and Instrumentation by D. V. S. Murthy, **Publisher**: Prentice Hall India Learning Private Limited; 2 **edition** (2008); Language: English; ISBN-10: 8120335694; ISBN-13:
	ADDITIONAL READING
1	Instrument transducers, H. K. P. Neubert, Oxford University press 1975.
2	Measurement systems: application & design, E. A. Doebelin, Mc Graw Hill, Publisher: **McGraw-Hill** Higher Education; 5 edition (1 September 2003); Language: English; ISBN-10: 0071194657; ISBN-13: 978-
3	Electrical and Electronics Measurements and Instrumentation, by Sawhney A K, Dhanpat Rai and Sons, New Delhi,2010.
4	Electronic Instrumentation by Kalsi H S, Tata McGraw Hill, New Delhi, 4th Ed 2010.

Programme Name	T.Y. B.Tech (Electronics Engineering), SEMESTER - VI
Course Code	EC3017A
Course Title	INTELLECTUAL PROPERTY RIGHTS

COURSE OUTCOMES:

After completion of course, the students should be able to:

- Describe legal aspects of patent infringement and trademarks.
- Describe legal aspects of copyright and industrial designs and procedures for obtaining copyrights and registration of designs.
- Describe different types of registration process of Industrial designs and trademarks.
- Describe legal aspects in commercialization and transfer of Intellectual Property rights

COURSE CONTENTS

Module I	Introduction
	Meaning, Relevance, Business Impact, Protection of Intellectual property, Copy rights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical indications, Bio-diversity and IPR, Competing rationales for protection of Intellectual Property Rights(IPR), Introduction to the leading International instruments concerning Intellectual Property rights: the Berne convention, Universal Copyright convention, the Paris Convention, Patent Co-operation Treaty, Trade-Related Aspects of Intellectual Property Rights(TRIPS), The World Intellectual Property Organization (WIPO) and the UNESCO
Module II	**Patents**
	Concept of Patent, product/process Patents & Terminology, Duration of Patents-Law and Policy consideration Elements of Patentability - Novelty and Non Obviousness(Inventive steps and Industrial application, Non-patentable subject matter), Procedure for filing of patent application and types of applications., procedure for Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Assignment and licensing of Patents, Working of Patents- compulsory licensing, patent agent - qualification and registration procedure, Patent Offices in India

Module III	**Preparation of Patent documents**
	Lab notebooks/Log books/Record books, methods of Invention disclosures, Patents application and its contents, writing of the Patent document
Module IV	**Patent Infringement**
	Literal Infringement, Doctrine of Equivalence and Doctrine of Colorable Variation, Legal Aspects(Act, Rules, Procedures)
Module V	**Trademarks**
	The rationale of protection of trademark as (A) an aspect of commercial and (B) of consumer rights, Definition and concept of trademarks, Different kinds of marks(brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable trademarks
Module VI	**Copyrights**
	Nature of Copyright, Works in which copyrights subsist, author & ownership of copyright, Rights conferred by copyright
Module VII	**Industrial Designs**
	What is a registrable design, What is not a design, novelty & Originality, Procedure for registration of Designs
Module VIII	**Key business concerns in commercializing Intellectual property Rights**
	Competition and confidentiality issues, Antitrust laws, Assignment of Intellectual Property Rights, Technology Transfer Agreements, Intellectual Property Issues in the Sale of Business, Legal auditing of Intellectual Property
	TEXT BOOKS
1	Law Relating to Intellectual Property Rights (English) 2nd Edition, by V. K. Ahuja, Lexis Nexis
2	Intellectual Property Rights ,by E. T. Lokganathan, Neha Publishers & Distributors
3	Intellectual Property Right In India, by V. K. Ahuja, Lexis Nexis
4	Handbook on Intellectual Property Rights in India, by Rajkumar S. Adukia
5	Law relating to patents, trademarks, copyright, desigs and geographical

	indications, B.L.Wadehra
6	Intellectual Property Rights, by S.B.Verma, Neha Publishers & Distributors
	ADDITIONAL READING
1	Law of trademarks in India, by Aswani kumar Bansal
2	the law of trademarks, copyright, patents and design, by G.V.G Krishnamurthy
3	The management of Intellectual property, by Satyawrat Ponkse
4	Manual of patent office practice and procedure, by Office of the controller general of patnets, designs and trade(CGPDTM)

Elective 1

Programme Name	**T Y B Tech(Electronics Engineering), SEMESTER - VI**
Course Code	EC3101T
Course Title	**IMAGE AND VIDEO PROCESSING**

Course Outcomes:

After completion of course, the students should be able to:

- Perform convolution, filtering and Fourier transform in 2-D, and summarize the human visual system
- Perform 2-D decomposition using various transforms.
- Describe different image and video compression and motion estimation techniques.
- Describe various image enhancement and restoration techniques.
- Summarize morphological image analysis.

COURSE CONTENTS

Module I	**Introduction to multidimensional signal processing**
	2-D convolution and filtering 2-D discrete-time Fourier transform 2-D filter design 2-D sampling and reconstruction The human visual system: Brightness perception, acuity Temporal properties of vision
Module II	**2-D Block transforms, Filter banks and Wavelets**
	DFT DCT, types I-IV Walsh-Hadamard transform Karhunen Loeve transform Discrete Hartley transform 2-D two-band decompositions 2-D tree structured decompositions 2-D implementation issues.
Module III	**Image Compression**
	Concept and techniques for entropy coding Scalar and vector quantization methods for image coding JPEG ima ge compression standard Subband/wavelet image compression
Module IV	**Motion Estimation**
	Block matching algorithms Fast search techniques Optical flow schemes

Module V	**Compression of video**
	Motion compensated prediction methods MPEG standards 3-D subband coding methods
Module VI	**Image Enhancement**
	Noise reduction methods Contrast enhancement methods Edge sharpening methods
Module VII	**Image Restoration**
	Inverse filtering Least squares restoration Constrained least squares method Iterative methods Extrapolation and super resolution methods
Module VIII	**Morphological Analysis**
	Dilation, Erosion Introduction to color image processing
	Text books
1	Gonzalez, Rafael C, Digital image processing, Pearson Education India, 2009.
2	Schalkoff, Robert J, Digital image processing and computer vision, Wiley New York, 1989.
3	Jain, Anil K, Fundamentals of digital image processing, Prentice-Hall, Inc., 1989.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3101P
Course Title	**IMAGE AND VIDEO PROCESSING LAB**

COURSE OUTCOMES

After successfully completing this course, students will be able to:

1) Perform software implementation of algorithms for image enhancement, restoration and compression

2) Implement filter bank concepts for image analysis.

3) Perform image analysis using binary morphology.

COURSE CONTENTS

Module 1	Image Enhancement Techniques in Spatial Domain
Module 2	Image Enhancement Techniques in Frequency Domain
Module 3	Image Analysis using Wavelets, Denoising, Filtering, Segmentation Applications
Module 4	Image Compression Techniques
Module 5	Image Analysis using binary morphology
Module 6	Analysis of motion estimation and video compression standards
	TEXT BOOKS
1	Gonzalez, Rafael C, Digital image processing, Pearson Education India, 2009.

Programme Name	**T.Y. B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3102T
Course Title	**NEURAL NETWORK AND FUZZY LOGIC**

COURSE OUTCOME

After completion of course, the students should be able to:

- Summarize the concepts of supervised and unsupervised learning, and different application areas of ANNs.
- Design suitable network architecture and use appropriate learning algorithm (supervised and unsupervised) for a given application.
- Summarize different learning methods and their application areas, including graphical and MEM models.

COURSE CONTENTS

Module 1 **Introduction: Biological neurons and memory**	
	Motivations for Studying ML, Supervised and Unsupervised learning, Machine Learning in the Large Structure and function of a single neuron; Artificial Neural Networks (ANN); Typical applications of ANNs: Classification, Clustering, Vector Quantization, Pattern Recognition, Function Approximation, Forecasting, Control, Optimization.
Module 2: **Supervised Learning**	
	Single-layer networks; Perceptron-Linear separability, Training algorithm, Limitations; Multi-layer networks-Architecture, Back Propagation Algorithm (BTA) Adaptive Multi-layer networks-Architecture, training algorithms; Recurrent Networks; Feed-forward networks; Radial-Basis-Function (RBF) networks;
Module 3: **Unsupervised Learning**	
	Winner-takes-all networks; Hamming networks; Maxnet; Simple competitive learning; Vector-Quantization; Counter propagation networks; Adaptive Resonance Theory; Kohonen's Self-organizing Maps; Principal Component Analysis;
Module 4: **Classical and Theoretical ML Topics**	
	Concept Learning (also called Learning from Examples), Learning from Analogy, Explanation Based Learning, Structure Learning, Reinforcement Learning, Decision Tree Learning, Decision List Learning , Oracle Based Learning, Probably Approximately Correct (PAC) Model, Boosting, Bayesian Learning: Maximum Likelihood Estimates, Parameter Estimation, Bayesian Belief Networks

Module 5: **Introductory Graphical Models Based Learning**	
	Expectation Maximization as a fundamental technique, Hidden Markov Models (HMM): Motivation for Generative Models, Forward-backward Algorithm, Baum Welch Iteration, Feature Enhanced HMM.
Module 6: **Maximum Entropy Markov Models (MEMM)**	
	Motivation for Discriminative Models, Training of MEMMs (v) Introductory Optimization Based Methods: Neural Nets, Support Vector Machines, Genetic Algorithms (v) Applications: Text Learning, Speech Processing, Data Mining, Bioinformatics.
	TEXT BOOKS
1	Simon Haykin, "Neural Networks - A Comprehensive Foundation", Macmillan Publishing Co., New York, 1994.
2	A Cichocki and R. Unbehauen, "Neural Networks for Optimization and Signal Processing", John Wiley and Sons, 1993.
3	J. M. Zurada, "Introduction to Artificial Neural Networks", (Indian edition) Jaico Publishers, Mumbai, 1997.

Programme Name	T Y B Tech(Electronics Engineering), SEMESTER - VI
Course Code	EC3102P
Course Title	Neural networks and fuzzy logic LAB

COURSE OUTCOME

After completion of course, the students should be able to:

- Implement linear, polynomial and logarithmic regression
- Implement gradient descent algorithm with boosting
- Implement gradient descent algorithm with boosting
- Implement back propagation and radial basis function based neural net
- Implement various clustering nets

Course Contents

I- Linear and Polynomial Regression
II- Logarithmic Regression
III- Gradient Descent Algorithm with Boosting
IV- Back propagation and Radial basis function based neural net implementation
V- k-means, fuzzy c- means clustering
VI- ISO data map unsupervised methods

Text Book

Simon Haykin, “Neural Networks and Learning Machines”, Pearson Publiction, New Delhi, 2012.

Programme Name	**T.Y.B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3103T
Course Title	**AUDIO, VIDEO AND IMAGE COMPRESSION**

COURSE OUTCOMES

After completion of course, the students should be able to:

- Implement text, audio and video compression techniques.
- Use algorithms to encrypt information.
- Describe how how encryption algorithms work
- Describe threats to system security and ways to mitigate them.

COURSE CONTENTS

Module 1	**COMPRESSION TECHNIQUE**
	Loss less compression, Lossy compression, measure of performance, modeling and coding, different types of models, and coding techniques.
Module 2	**AUDIO COMPRESSION**
	Digital audio, frequency and temporal masking, µ- Law and A-Law companding and MP3, MPEG audio standard, DPCM and ADPCM audio compression.
Module 3	**IMAGE AND VIDEO COMPRESSION**
	PCM, DPCM, JPEG, JPEG 2000, Predictive techniques PCM and DPCM. Loss less techniques of image compression, MPEG industry standard.
Module 4	**CONVENTIONAL ENCRYPTION**
	Introduction, types of attacks, security goals, OSI security architecture, cryptographic attacks, services and mechanism, Model for network security, classical encryption technique, Block cipher and Data Encryption standard, Advanced Encryption standard, key distribution
Module 5	**PUBLIC KEY ENCRYPTION AND NUMBER THEORY**
	Fermat and Euler's theorem, Chinese remainder theorem, principal of public key cryptography, RSA algorithm, Diffie-Hellman key Exchange, key Exchange mechanism, Message authentication, Message integrity and Hash function, Hash and MAC algorithms, Digital Signature and Authentication
	algorithm .
Module 6	**SYSTEM SECURITY**
	Intruders, Viruses, firewall design, antivirus techniques, digital Immune System, Certificate based and biometric authentication system.

	TEXT BOOKS
1	Data Compression. David Salomon, Springer Publication, 4th Edition.
2	Introduction to Data Compression. Khalid Sayood, Morgan Kaufmann series, 3rd Edition.
3	Cryptography and Network Security. William Stallings, Pearson Education Asia Publication, 5th Edition.
4	Cryptography and Network Security. Behrouz Forouzan, Mcgraw- Hill, 1st Edition.

Programme Name	**T.Y.B.Tech (Electronics Engineering), SEMESTER - VI**
Course Code	EC3103P
Course Title	**AUDIO, VIDEO AND IMAGE COMPRESSION LAB**

COURSE OUTCOMES

After completion of course, the students should be able to:

1. Implement various techniques for audio compression.
2. Implement image and video compression techniques such JPEG and MPEG, respectively.

Title of Experiments

1. Study of Huffman Coding
2. Demonstration of arithmetic coding
3. LZW coding
4. JPEG and MPEG decoder
5. DPCM Encoder and Decoder

Programme Name	T.Y.B.Tech (Electronics Engineering), SEMESTER - VI
Course Code	EC3104T
Course Title	Virtual Instrumentation

COURSE OUTCOMES

After completion of course, the students should be able to:

1. Implement virtual instrumentation with LabVIEW programming
2. Write programs involving use of structures, arrays, file IO and data acquizition..

COURSE CONTENTS

1. Introduction to Virtual Instrumentation- LabVIEW
2. SubVI and Express VI
3. Structures
4. Arrays and Clusters
5. Charts and Graphs
6. Signal generation, processing and analysis using LabVIEW
7. File input and outputs
8. Data acquisition
9. Basic applications of Virtual Instruments.

References:

1. www.ni.com
2. Virtual Instrumentation using LABVIEW-Sanjay Gupta and Joseph John, TMH Publications, 2013.
3. LabVIEW for Everyone: Graphical Programming Made Easy and Fun by Jeffrey Travis , Jim Kring, Prentice Hall Publications,2006.
4. Learning with LabVIEW 2009,by Robert H. Bishop Prentice Hall Publication,1st edition,2009
5. LabVIEW Applications and Solutions by Rahman Jamal, Herbert Pichlik ,Prentice Hall Publications,1999.
6. LabVIEW Signal Processing by Mahesh L. Chugani,Abhay.R.Samant, Michael Cerna,
   Prentice Hall Publications,1998.
7. Basic Concepts of LabVIEW, by Leonard Sokoloff ,Prentice Hall publications,1997.