PUNE VIDYARTHI GRIHA'S

COLLEGE OF ENGINEERING AND TECHNOLOGY, PUNE-9

(AFFILIATED TO SAVITRIBAI PHULE PUNE UNIVERSIT, PUNE)

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

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

CURRICULUM BOOK

ACADEMIC YEAR: 2019-20

FOR THE PROGRAMME

T. E. (ELECTRONICS & TELECOMMUNICATION ENGINEERING)

PUNE VIDYARTHI GRIHA'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

VISION

TO ACHIEVE EXCELLENCE IN ENGINEERING EDUCATION

MISSION

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

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

VISION

To achieve academic excellence in Electronics and Telecommunication Engineering and Technology

MISSION

To impart quality education in Electronics and Telecommunication engineering (IM4, IM5) (DPEO1)

To facilitate techno-social and economic growth (IM5, IM6) (DPEO3) (DPEO1)

To develop active learners and competitive engineers for sustainable technical growth through lifelong learning and ICT based education (IM3, IM6) (DPEO1)

To provide skill and value-based education to address societal issues (IM1, IM2) (DPEO2, DPEO3)

PROGRAM EDUCATIONAL OBJECTIVES

PEO1 To provide engineering solutions by applying domain knowledge

PEO2 To instill professionalism and ethical values among engineers towards cultured and developed society

PEO3 To develop interpersonal skills to meet the aspirations of the stakeholders

PROGRAMME SPECIFIC OUTCOMES

PSO1 Demonstrate reasonable amount of proficiency to understand the engineering problems to design and develop the electronic and communication systems through collaborative efforts

PSO2 Utilize modern simulation and hardware tools to analyze the performance of electronic and communication systems.

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PO8. Ability to comprehend management and entrepreneurship skills

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

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

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

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

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Third Year

Curriculum Book

Syllabus Structure of Savitribai Phule Pune University, Pune
Course Structure for T. E. (Electronics & Telecommunication Engineering)
2015 Course

Course Code	Course	Teaching Scheme Hrs/Week			Examination Scheme					Marks Total	Credit	
					Theory		TW	P	O			
		L	T	P	In-Sem	End-Sem					TH /TUT	PR+OR
Legends:												
L: Lectures T: Tutorial P: Practical TW: Term Work O: Oral												
Semester –III												
304181	Digital Communication	4	--	--	30	70	--	--	--	100	4	--
304182	Digital Signal Processing	4	--	--	30	70	--	--	--	100	4	--
304183	Electromagnetics	3	1	--	30	70	--	--	--	100	4	--
304184	Microcontrollers	3	--	--	30	70	--	--	--	100	3	1
304185	Mechatronics	3	--	--	30	70	--	--	--	100	3	1
304191	Signal Processing and Communications Lab (DC/DSP)	--	--	4	--	--	50	50		100	--	2
304192	Microcontrollers and Mechatronics Lab	--	--	4	--	--	50	50		100		
304193	Electronics System Design	2	--	2	--	--	-	--	50	50	2	1
	Audit Course 3	--	--	--	--	--	--	--	--	--	----	
	Total of Semester-I	**19**	**1**	**10**	**150**	**350**	**100**	**100**	**50**	**750**	**20**	**05**
									Total Credits		**25**	
Semester-IV												
304186	Power Electronics	4	--	--	30	70	--	--	--	100	4	--
304187	Information Theory,Coding & Communication N/W	4	--	--	30	70	--	--	--	100	4	--
304188	Business Management	3	--	--	30	70	--	--	--	100	3	--
306189	Advanced Processors	4	--	--	30	70	--	--	--	100	4	1
304190	System Prog. & Operating Systems	3	--	--	30	70		--	--	100	3	1
304194	Power and ITCT Lab	--	--	4	--	--	50	50	--	100	--	2
304195	Advanced Processors and System Prog. Lab	--	--	4	--	--	50	50	--	100		
304196	Employability Skills and Mini Project	2	--	2	--	--	--	--	50	50	2	1
	Audit Course 4	--	--	--	--	--	--	--	--	--		
	Total of Semester-II	**20**	**--**	**10**	**150**	**350**	**100**	**100**	**50**	**750**	**20**	**05**
									Total Credits		**25**	

TE (E&TC)

Semester I

Digital Communication

Course Title:	**Digital Communication**	**Course Number: 304181**	**Course Name:C301**
Designation of Course	Professional Core		
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In sem: 30 Marks	End Sem: 70 Marks
			Practical: 50 Marks(DCDSP)
	Indirect Methods	Assignments, Presentations	Q&A session, Group Discussion
Prerequisites	Analog Communication		

Introduction of Course : Communication has been one of the deepest needs of the human race throughout recorded history. The various communication disciplines in engineering have the purpose of providing technological aids to human communication. Digital communication systems uses digital sequence as an interface between the source and the channel. Digital communication course gives insight on various modulation techniques to convert analog information into digital form. Various multiplexing techniques are discussed for transmitting baseband signal on the channel. Various filters suitable for optimum reception are discussed in the course. Techniques for passband digital data transmission with their performance analysis are included. Direct Sequence spread spectrum technique to improve SNR is introduced in the course.

Course Objectives	
1	To understand the building blocks of digital communication system.
2	To perform mathematical analysis of communication signals
3	To understand statistical analysis of random process.
4	To understand and analyze passband digital transmission
5	To analyze error performance of a digital communication system in presence of noise and other interferences
6	To understand concept of spread spectrum communication system.

Course Outcomes
After successfully completing the course students will be able to

CO1	Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency
CO2	Perform the time and frequency domain analysis of the signals in a digital communication system
CO3	Select the blocks in a design of digital communication system
CO4	Analyze Performance of spread spectrum communication system

Course Contents	
Unit-I	Digital Transmission of Analog Signal
	Introduction to Digital Communication System: Why Digital? Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and

	Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.
	Practical : 1. Experimental Study of PCM and Commanded PCM. 2. Experimental Study of DM and ADM.
Unit-II	Baseband Digital Transmission
	Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization.
	Practical: 3. Experimental Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR AMI, MANCHESTER) & their spectral analysis.
Unit-III	Random Processes
	Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation &Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components
	Practical: **4.** Write a simulation program to study Random Processes.
Unit-IV	Baseband Receivers
	Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation : Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver
	Practical:
Unit- V	Passband Digital Transmission
	Pass band transmission model, Signal space diagram, Generation and detection, Error Probability derivation and Power spectra of coherent BPSK, BFSK and QPSK. Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DEPSK, Introduction to OFDM
	Practical: 5. Experimental Study of Generation &detection of BPSK and QPSK. **6.** Experimental Study of Generation &detection of BFSK **7.** Write a simulation program for calculation and plotting the error probability of BPSK, QPSK, QAM. Comparison of theoretical and practical BERs **8.** Write a simulation program for Constellation diagram of any passband modulated signal in presence of noise.
Unit-VI	Spread Spectrum Techniques
	Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication

	System.		
	Practical: 9. Experimental Study of Generation of PN Sequence and its spectrum. **10.** Experimental Study of Generation &detection of DS-SS coherent BPSK & its spectrum		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Simon Haykin	Digital Communication Systems	John Wiley&Sons, Fourth Edition
T2	A.B Carlson, P B Crully, J C Rutledge	Communication Systems	Fourth Edition, McGraw Hill Publication
Reference Books			
R1	Ha Nguyen, Ed Shwedyk	A First Course in Digital Communication	Cambridge University Press.
R2	B P Lathi, Zhi Ding	Modern Analog and Digital Communication System	Oxford University Press, Fourth Edition.
R3	Bernard Sklar,Prabitra Kumar Ray	Digital Communications Fundamentals and Applications	Second Edition,Pearson Education
R4	Taub, Schilling	Principles of Communication System	Fourth Edition, McGraw Hill
R5	P Ramkrishna Rao	Digital Communication	McGrawHill Publication
Self-Learning Facilities	Digital Communication by Simon Haykin		
Web Resources	Web-course by NPTEL on Digital communication by Prof. Saswat Chakrabarti Prof. R.V. Rajakumar ,IIT Kharagpur		
Research papers for reference	**Author**	**Title of Paper**	**Journal/Transaction**
Contents beyond Syllabus	Modulation used in GSM, CDMA techniques		
Additional Experiments	Verification of sampling theorem, Nyquist criteria, and aliasing effect		
Bridging Courses	NA		
Assignments			
1	Sampling theorem		
2	Comparison of DM .ADM,PCM		
3	Comparison of different line codes		
4	BPSK,BFSK and BASK		
5	Generation of PN sequence		
6	DSSS applications		
Tutorials	NA		
Presentations	Self prepared presentations on different units.		

Digital Signal Processing

Course Title: Digital Signal Processing		**Course Number:**304182	**Course Name:C302**
Year: TE	**Semester: I**		
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	On-line/In-sem Examination: 50/30 Marks	Theory/End Semester Examination: 50/70 Marks
		Term-work	Practical/Oral
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Signals and Systems, Engineering Mathematics		
Course Objectives			
1	Understanding the key DSP concepts like CT & DT signals and systems along with Fourier series and Fourier transform and how to relate to real world applications		
2	Properties of discrete-time signals and systems		
3	Methods of time domain and frequency domain implementation		
4	Understanding the filter theory		
5	Typical characteristics of real DSP Multirate systems		
6	Use of MATLAB to analyze and design DSP systems		
Course Outcomes			
CO1	Master the representation of discrete-time signals in the frequency domain, using z-transform, discrete Fourier transform (DFT)		
CO2	Understand the implementation of the DFT in terms of the FFT, as well as some of its applications (computation of convolution sums, spectral analysis)		
CO3	Learn the basic forms of FIR and IIR filters, and how to design filters with desired frequency responses. Use appropriate windows to diminish the effect of leakage		
CO4	Study and understand DSP applications as Digital cross-over audio systems, interference cancellation in ECG		
Course Contents			
Unit-I	**DSP Preliminaries**		
	Sampling, DT signals, sampling theorem in time domain, sampling of analog signals, recovery of analogue signals, and analytical treatment with examples, mapping between analog frequencies to digital frequency, representation of signals as vectors, concept of Basis function and orthogonality, Eigen value and eigen vector, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.		
	Practical		
	1. Plotting of DT signals using MATLAB		
	2. Verification of Sampling Theorem		
Unit-II	**Discrete Fourier Transform**		

	DTFT, Definition, Frequency domain sampling , DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, Linear filtering using overlap add and overlap save method, Amplitude spectrum and power spectrum, Introduction to Discrete Cosine Transform.
	Practical
	1. Verification of DFT properties
	2. Implementation of Discrete Cosine Transform to verify Energy Compaction Property
Unit-III	**Z transform**
	Need for transform, relation between Laplace transform and Z transform, relation between Fourier transform and Z transform, Properties of ROC, properties of Z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations using Z transform
	Practical
	1. Find the Z transform
	2. Plot pole-zero plot
	3. Verification of stability of given system
Unit-IV	**IIR Filter Design**
	Concept of analog filter design, IIR filter design by approximation of derivatives, IIR filter design by impulse invariance method, Bilinear transformation method, warping effect. Butterworth filter design, Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design.
	Practical
	Design of first order LP Butterworth filter
Unit- V	**FIR Filter Design**
	Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. Magnitude and Phase response of Digital filters, Frequency response of Linear phase FIR filters, FIR filters realization using direct form, cascade form, Finite word length effect in FIR filter design.
	Practical
	Design of FIR filer using Hamming and Hann window.
	Plotting comparative graphs of all windows
Unit-VI	**DSP Applications**
	Overview of DSP in real world applications such as Digital crossover audio systems, Interference cancellation in ECG, Speech coding and compression, Compact disc recording system, Vibration signature analysis

	for defective gear teeth, Speech noise reduction, Two band digital crossover.		
	Practical		
	Write a program for speech signal enhancement using pre-emphasis filter and speech filtering using band pass filter. Any biomedical signal e.g. ECG can also be used for signal enhancement		
Text Books	**Author**	**Title of Book**	**Publication**
T1	John G. Proakis, Dimitris G. Manolakis	Digital Signal Processing: Principles, algorithms and applications	Fourth edition, Pearson Prentice Hall.
T2	S. Salivahanan, C. Gnanpriya	Digital Signal processing	McGraw Hill
Reference Books			
R1	Ifaeachor E.C, Jervis B. W	Digital Signal processing : Practical approach	Pearson Publication
R2	Li Tan, Jean Jiang	Digital Signal Processing : Fundamentals and applications	Academic press,
R3	Dr. Shaila Apte	Digital Signal Processing	Wiley India Publication, Second edition
R4	K.A. Navas, R. Jayadevan	Lab Primer through MATLAB	PHI
R5	Sanjit Mitra	Digital Signal Processing	McGraw Hill
Self-Learning Facilities	NPTEL Lecture Series		
	MIT OCW Assignments		
Web Resources	Online DSP courses		
	DSP e-books		
Technical Notes for reference	**Author**	**Title of Paper**	**Journal/Transaction**
1	David Jacobs	Correlation & convolution	2005
2	Gilad Lerman	The Shannon Sampling Theorem and Its Implications	NA
3	Tim Wescott, Wescott Design Services	Sampling: What Nyquist Didn't Say, and What to Do About It	January 2015
4	Sanjit Mitra	DSP application (Technical Note)	--
Contents beyond Syllabus	DSP applications like Digital TV standards and filters for echo cancellation		
Additional	Plotting analog and digital signals using MATLAB		

Experiments	Implementation of correlation
	Verification of energy compaction property
Bridging Courses	Linear Algebra
Assignments	
1	Vector Analysis
2	Sampling Examples
3	FFT Algorithms
4	Fourier Transform Properties
5	DSP Processor Basics
Tutorials	1. Sampling Theory
	2. FFT algorithms
	3. DSP applications by Dr. Sanjit Mitra
Presentations	Finite wordlength effects : concept and examples
	FFT algorithm: DIT and DIF
	DSP architecture

Electromagnetic

Course Title:	Electromagnetics	Course Number: 304183	Course Name: C303
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		Tutorial : 1 Hr/Week	
Course Assessment Methods	Direct methods	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
	Indirect Methods	Assignments	Practice Sessions
Prerequisites	Engg. Mathematics: Coordinate systems, Vector calculus; Physics: Electrostatics & Electromagnetism		

Introduction of Course

The UG course has a broad spectrum of content that is more mathematical and starts from coordinate systems - vector calculus and covers the derivations and applications of basic principles in electromagnetics. It covers the fundamentals related to electrostatics, magnetic fields, motional emf, boundary conditions, Maxwell's equations, transmission line theory and electromagnetic wave propagation.

Course Objectives

1	To understand the mathematical tools and apply Coulomb's & Gauss law to solve electrostatic field problems.
2	To understand the nature of electric field and boundary conditions in different media.
3	To understand concepts of magnetostatics and boundary conditions in different media.
4	To understand the Maxwell's equations, Poynting vector and their applications.
5	To understand the transmission line parameters and application of Smith chart.
6	To understand the concept of electromagnetic wave propagation and polarization in different media.

Course Outcomes:

At the end of this course students will demonstrate the ability:

CO1	To derive electric field intensity due to point source, line, surface and volume charge distributions in free space & solve the related numerical.
CO2	To derive and solve boundary condition problems to free space, conductors & dielectric media for static electric fields
CO3	To derive magnetic field intensity due to current distributions and apply boundary conditions to different media for magnetic fields.

CO4	To derive Poynting vector, displacement current & retarded potential and apply Maxwell's equations to time varying field problems.
CO5	To derive and calculate transmission line parameters and impedances using Smith chart.
CO6	To derive Helmholtz wave equation, and intrinsic impedance to calculate reflection/ transmission coefficient at normal incidence.

Course Contents

Unit-I	**Electrostatics - I (8 Hrs)**
	Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields Gradient, Divergence, Curl – theorems and applications – Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications. Electric potential –Concept of Uniform and Non-Uniform field, Utilization factor.
Unit-II	**Electrostatics -I I (8 Hrs)**
	Electric field in free space, conductors, dielectrics – Dielectric polarization – Dielectric strength – Electric field in multiple dielectrics – Boundary conditions (dielectric-dielectric, conductor –dielectric), significance of Poisson's and Laplace's equations, Capacitance, Energy density, Applications.
	Tutorial
Unit-III	**Magnetostatics (9 Hrs)**
	Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials, Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.
Unit-IV	**Electrodynamic Fields** (8 Hrs)
	Faraday's law, Translational and motional emf, Displacement current, Time varying Maxwell's equations - point form,integral form, Power and Poynting theorem, concept of Retarded magnetic vector potential, Applications.
Unit- V	**Transmission Lines** (8 Hrs)
	Line parameters, skin effect, general solution, physical significance of the equations, wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z0, reflection coefficient, open and short circuited lines, reflection factor and reflection loss, standing waves; nodes; standing wave ratio, Input impedance of dissipation less line, Input impedance of open- and short-circuited lines, Power and impedance measurement on lines, Reflection losses on the unmatched Load, Problems solving using Smith chart.
Unit-VI	**Uniform Plane Waves** (8 Hrs)
	Maxwell's equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Relation between **E** and **H**, depth of penetration, concept of polarization, Reflection by perfect conductor-normal incidence, reflection by perfect dielectric- normal incidence, snell's law.

Text Books	**Author**	**Title of Book**	**Publication**
T1			Oxford University Press

	Mathew N. O. Sadiku	Principles of Electromagnetics	Inc, 2009, 4th ed. (current edition:6th)
T2	William H. Hayt and John A. Buck	Engineering Electromagnetics	Tata McGraw Hill, 8th Revised edition, 2011.
Reference Books			
R1	Kraus and Fleish	Electromagnetics with Applications	McGraw Hill International Editions, 5th edition, 2010
R2	Jordan and Balmain	Electromagnetic Waves and Radiating Systems	PHI, 1964.
Web Resources	NPTEL Lecture Series on Electromagnetics		
Research papers for reference	**Author**	**Title of Paper**	**Journal/Transaction**
Additional Experiments	Not applicable		
Assignments	Electrostatics I-Derivations		
	Magnetostatics-Derivations		
	Time varying fields Maxwell's equation-Derivations		
	Transmission line- Derivations		
	Uniform Plane waves-Derivations		
Tutorials	1. Vector Algebra and Coordinate System		
	2. Electric Field Intensity due to charge distributions		
	3. Applications of Gauss's law		
	4. Electric Potential		
	5. Capacitance		
	6. Electrostatic Boundary Conditions		
	7. Applications of Biot Savart's law		
	8. Applications of Ampere's law and magnetic flux density		
	9. Magnetic boundary conditions		
	10. Maxwell's equation and Poynting theorem		
	11. Transmission Lines		
	12. Application of Smith Chart		
Presentations	Based on each unit.		
Videos	Animation videos on electromagnetic field theory.		

Microcontroller

Course Title:	Microcontroller	**Course Number:** 304184	**Course Name:C304**
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work	Practical
	Indirect Methods	Assignments, Presentations Continuous assessment	Q&A session, Group Discussion
Prerequisites	Digital Electronics, Basics 'C' Programming		

Course Objectives	
1	To identify the applications of Microprocessors and Microcontrollers.
2	To summarize need of microcontrollers in embedded system.
3	To describe architecture and features of typical Microcontroller.
4	To illustrate various hardware and software tools for developing applications
5	To analyze interfacing of input output devices.
6	To analyze interfacing of various communication protocols
Course Outcomes After successfully completing the course, students will be able to	
CO1	Explain MCS-51 architecture and Instruction set.
CO2	Write simple Assembly Language Programs, programs for Timers and for data transmission and reception.
CO3	Demonstrate the interfacing of I/O devices and various external devices to MCS-51
CO4	Explain MCS-51 architecture and Instruction set.
CO5	Write Embedded C Program and demonstrate the interfacing of I/O devices and various on-chip peripherals to PIC18FXX
CO6	Explain various Serial Communication Protocols and implement them using PIC18FXX

Course Contents	
Unit-I	**Introduction to Microcontrollers Architecture** Overview of MCS-51 architecture, Block diagram and explanation of 8051, Port structure , memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port
Unit-II	**IO Port Interfacing-I** Interfacing of:LEDS,Keypad, 7-segment multiplexed display, LCD, ADC

	0809(All programs in assembly). Programming environment: Study of software development tool chain (IDE), hardware debugging tools (timing analysis using logic analyser)
	Practical
	Parallel port interacting of LEDS—Different programs(flashing, Counter, BCD, HEX, Display of Characteristic)
	Interfacing of Multiplexed 7-segment display (counting application)
	Interfacing of LCD to 8051 (4 and 8 bit modes)
Unit-III	**Parallel Port Interfacing-II** Interfacing of: DAC,Temperature sensors,Stepper motor, Motion detectors, Relay, Buzzer, Optoisolaters, Design of DAS and Frequency counter:All programs in assembly
	Practical
	Waveform Generation using DAC
	Interfacing of Stepper motor to 8051- software delay using Timer
Unit-IV	**PIC Microcontroller Architecture** Features, comparison & selection of PIC series as per application. PIC18FXX architecture- MCU, Program and Data memory organization, Pin out diagram, Reset operations, Oscillator options (CONFIG), BOD, power down modes & configuration bit settings, timer and its programming ,Brief summary of Peripheral support, Overview of instruction set.
Unit- V	**Real World Interfacing Part I** Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18FWith SFRS. Interfacing of LED, LCD (4&8 bits), and Key board, use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP: All programs in embedded C
	Practical
	Write a program for interfacing button, LED, relay & buzzer as follows A. On pressing button1 relay and buzzer is turned ON and LED's start chasing from left to right **B.** On pressing button2 relay and buzzer is turned OFF and LED start chasing from right to left .
	Generate square wave using timer with interrupt
	Generation of PWM signal for DC Motor control.
Unit-VI	**Real World Interfacing Part II** Basics of Serial Communication Protocol: Study of RS232,RS 485, I2C,SPI, MSSP structure(SPI &I2C),UART, Sensor interfacing using ADC, RTC(DS1306) with I2C and EEPROM with SPI. Design of PIC test Board, Home protection System:All programs in embedded C.
	Practical
	Interfacing serial port with PC both side communication.
	Interface analog voltage 0-5V to internal ADC and display value on LCD.
	Interfacing EEPROM 24C128 using SPI to store and retrieve data

Text Books	Author	Title of Book	Publication
T1	Muhammad Ali Mazidi	8051 microcontroller	Pearson

		& embedded system 3rd Edition ,	
T2	Muhammad Ali Mazidi	PIC microcontroller & embedded system 3 rd Edition	Pearson
Reference Books	-		
Self-Learning Facilities	NPTEL Lecture Series		
	VLAB sessions		
Web Resources			
Research papers for reference	**Author**	**Title of Paper**	**Journal/Transaction**
Contents beyond Syllabus	Simulation for every practical using PROTEUS		
Additional Experiments			
Bridging Courses	Guest session on "Applications of Embedded System" by Industry Expert .		
Assignments	**Theory :**		
1	1. Explain following Assembly Instructions with suitable example MOV, DJNZ, SJMP, LJMP , ACALL, LCALL, RET 1. Explain with example Assembler Directives in MCS 8051 2. Explain the design w.r.t. to port pins for the flashing and counting applications of LEDs 3. Draw and Explain Port structure of MCS 8051		
2	1. Explain interfacing of 8051 to DAC 0808 2. Calculate values for smooth sinusoidal waveform.		
3	1. Explain working of 7 segment display with neat diagram. 2. Explain the interfacing diagram of Multiplexed 7 segment display 3. Modify the existing program to improve time and space complexity.		
4	1. Describe LCD operation in 8 bit mode with respect to its pin Configuration. 2. Explain with example instruction MOVC and Register DPTR 3. Write an assembly code for LCD in 4 bit mode 4. Write down LCD Command Codes in Tabular form.		
5	1. Explain the types of stepper motors and its working principle. 2. Explain the interfacing of 8051 to stepper motor in full step sequence .		
6	1. Explain with neat diagram how 4X4 Keyboard is interfaced to MCS 8051 and a key pressed is detected		
7	1. Explain port structure of PIC 18F4550 along with its Pin Diagram. 2. Explain following registers "TRISx 2. PORTx 3. LATx		

8	1. Name and Explain with neat diagram Registers that are required to access inbuilt ADC of PIC18F4550 2. Draw the diagram to show PIC18F4550 ADC Channel and Reference Selection and explain in detail 3. Name and define features of in built ADC of PIC 18F4550 4. Define the terms : a. Resolution b. Conversion time c. Step size d. Data out e. Vref
9	1. Draw and Explain different registers used in implementing serial communication using PIC18F4550 2. Explain Baud rate calculation with example. Calculate values of registers SPBRG and SPBRGH for baud rate of 38400 and 9600.
10	1. Which are the pins used during SPI protocol access in PIC 18F4550. 2. Define and explain various registers used to access SPI in PIC18F4550 with neat diagram. 3. Explain EEPROM used during the experiment with its features. Write down the steps used to access EEPROM using SPI.
	Practicals : (Simulation On Proteus Software)
1	Parallel port interacting of LEDS—Different programs(flashing, Counter, BCD, HEX, Display of Characteristic) using MCS 8051
2	Waveform Generation using DAC using MCS 8051
3	Interfacing of Multiplexed 7-segment display (counting application) using MCS 8051
4	Interfacing of LCD to 8051 (4 and 8 bit modes)
5	Interfacing of Stepper motor to 8051- software delay using Timer
6	Write a program for interfacing button, LED, relay & buzzer as follows A. On pressing button1 relay and buzzer is turned ON and LED's start chasing from left to right B. On pressing button2 relay and buzzer is turned OFF and LED start chasing from right to left using PIC 18F4550 .
7	Interfacing 4X4 keypad and displaying key pressed on LCD using PIC 18F4550
8	Generation of PWM signal for DC Motor control using PIC 18F4550
9	Interface analog voltage 0-5V to internal ADC and display value on LCD using PIC 18F4550
Tutorials	**Not Applicable**
Presentations	• Timer in MCS 8051
	• ADC and DAC Interfacing to MCS 8051
	• Keypad Interfacing to MCS 8051
	• Timers of PIC18F
	• EEPROM with SPI

Mechatronics

Course Title: Mechatronics		**Course Number** :304185	**Course Code: C305**
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	On-line/In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work	Practical/Oral
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Basic electronics, Basic Mechanical, Applied Mechanics		

Introduction of Course	
Mechatronics is a multidisciplinary field of science that includes a combination of mechanical engineering, electronics, computer engineering, telecommunications engineering, systems engineering and control engineering. Mechatronics engineering is concerned with the design of automated machines. It is strongly based on a combination of mechanical, electronics and software engineering, but is a distinctly different discipline to all three.	
Course Objectives	
1	To understand principles of sensors their characteristics
2	To Understand of various data presentation and data logging systems
3	To Understand concept of actuator
4	To Understand various case studies of Mechatronics systems
Course Outcomes	
CO1	Identification of key elements of mechatronics system and its representation in terms of block diagram
CO2	Understanding basic principal of Sensors and Transducer
CO3	Able to prepare case study of the given system.
Course Contents	
Unit-I	**Introduction to Mechatronics**
	Basics of Mechatronics Systems : Definition of Mechatronics, Key elements of Mechatronics Systems, Levels of mechatronics systems, Measurement Characteristics, Examples of Mechatronics systems in daily life as ,Washing Machines, Digital Cameras, CD Players, camcorders, Mechatronics design process, phases of mechatronics design process, integrated design approach. Mechanical Components and Servo mechanism :Mechanical System and Motion, Mass Inertia and Dashpot, Gears, types of Gears, Servomechanism(Concepts and Theory, Problems).Case study Mechatronics Design of Coin Counter/Coin Separator
	Practical
	DC Servo Position control using photo electric pickup
Unit-II	**Overview of Sensors, Transducers and their Characteristics Specifications**
	Specifications related to selection criterion for force, pressure, temperature and motion (Rotary and Linear). Classification and selection of transducers: Force: Load Cell, Cantilever Beam (Design aspect example) Pressure: Strain Gauge, Piezoelectric Motion: Rotary and Linear motions, Proximity sensors Inductive,

	Capacitive and Magnetic, sources detectors in optical proximity sensors. Comparison of Various proximity sensors Temperature: Optical Fibre and its use in temperature measurement, Fibre Optic Temperature sensors, Ultrasonic Transducers for applications as position, level, flow measurement. Gas sensors, Wind sensors: Gyroscope, Accelerometer, Magnetometer (As used in smart phones) Smart Sensors: Concept, Radiation Sensors - Smart Sensors - Film sensor, IR- temperature sensors Introduction to MEMS& Nano Sensors . Rotary Optical Encoder.		
	Practical		
	Study of Liquid flow measurement		
	Weight measurement using load cell		
	Water(Liquid) level measurement, Position & Velocity measurement using encoders		
	Interfacing of any two sensors to Data Acquisition system.		
Unit-III	**Hydraulic Systems**		
	Introduction to Hydraulic Actuators Fluid Power systems: Concept of Actuators, Classification of Actuators: Pneumatic, Hydraulic and Electrical Actuators, Fluid Power systems Hydraulic Systems: Physical Components of a Hydraulic systems, Hydraulic Pumps (e.g. Gear Pumps, Vane Pumps, Piston Pumps and Axial Piston Pumps) , Filters and Pressure Regulation, Relief Valve, Accumulator.		
	Practical		
	Demonstration of Hydraulic components and circuits		
Unit-IV	**Pneumatic Systems**		
	Introduction to Pneumatic a Actuators Physical Components of a Pneumatic Systems, Pneumatic Cylinders, Pneumatic Actuators (e.g. Spring Actuator and Spring Actuator with positioner), Air compressor, Air Receiver, Air Dryer Air Service Treatment: Air Filter, air regulator and Gauge, Air Lubricator and Pressure regulation Intake and Air Filter. Case study of Robotic Pick and Place robot		
	Practical		
	Demonstration of Pneumatic components and circuits		
Unit- V	Electrical Actuators, Electron-Mechanical Actuators		
	Electrical-Actuation system: Selection criteria and specifications of stepper motors, solenoid valves, relay (Solid State relays and Electromechanical relays). Selection Criterion of control valve, Single acting and Double acting Cylinders. Electro-Pneumatic: Pneumatic Motors, Valves: Electro Hydraulic: 3/2 Valves, 4/2 Valves, 5/3 Valves Cables: Power cable and Signal cables		
	Practical		
Unit-VI	Mechatronics Systems in Automobile		
	(Treatment with Block Diagram Approach) Boat Autopilot, High Speed tilting trains, Automatic car parking systems, Engine Management systems, Antilock Brake systems (ABS) ,CNC Machines(Only Black Diagram and explanation)		
	Practical		
Text Books	**Author**	**Title of Book**	**Publication**
T1	W. Boltan	Mechatronics: Electronic Control Systems in Mechanical and Electrical	6th Edition, Pearson Education, 2016

		Engineering‖	
T2	K.P.Ramachandran, G.K.Vijayaraghavan and M.S. Balasundaram,	Mechatronics-Integrated Mechanical Electronic Systems	Willey Publication 2008
Reference Books			
R1	Nitaigour P. Mahalik	Mechatronics-Principles, Concepts and Applications‖,	Tata McGraw Hill, Eleventh reprint 2011
R2	DevdasShetty and Richard A.Kolk	Mechatronics System Design‖	Thomson India Edition 2007.
R3	HMT Limited	Mechatronics	Tata McGraw-Hill Publishing House
Self-Learning Facilities	NPTEL Lecture Series		
	Industry- Operational videos		
Web Resources	http://ieeexplore.ieee.org/		
	https://www.youtube.com/watch?v=BRAWjiP5OzM&t=7s		
	http://nptel.ac.in/courses/112101099/		
Research papers for reference	**Author**	**Title of Paper**	**Journal/Transaction**
1	Jeng-Nan Juang and R. Radharamanan	Design of a Solar Tracking System for Renewable Energy	©2014 IEEE. Proceedings of 2014 Zone 1 Conference of the American Society for Engineering Education (ASEE Zone 1)
2	Fernando Alfredo Auat Cheein	Agricultural Robotics: Unmanned Robotic Service Units in Agricultural Tasks	IEEE Industrial Electronics Magazine (Volume: 7, Issue: 3, Sept. 2013)
3	A. V. Isaev, A. I. Nefed'ev	Mechatronics conversion system: A conceptual energy model	Industrial Engineering, Applications and Manufacturing (ICIEAM), International Conference.
Contents beyond Syllabus	Video tutorials on advanced robotics.		
Additional Experiments	Virtual Laboratory		
Bridging Courses			
Assignments	Nil		
Tutorials	not applicable		
Presentations			

TE (E&TC)

Semester II

Power Electronics

<table>
<tr><td>Course Title</td><td colspan="2">Power Electronics</td><td>University Course Code:</td><td>304186</td></tr>
<tr><td colspan="2">Designation of Course</td><td>Professional Core</td><td>Course Number:</td><td>C309</td></tr>
<tr><td colspan="2">Teaching Scheme</td><td>Theory : 3 Hrs /Week</td><td colspan="2">Laboratories: 2 Hrs / Week</td></tr>
<tr><td rowspan="5">Course Outcome Assessment Tools</td><td rowspan="2">External Assessment (University Level)</td><td rowspan="4">Direct Tools</td><td>In-Semester Theory Examination: 30 Marks</td></tr>
<tr><td>End-Semester Theory Examination: 70 Marks</td></tr>
<tr><td rowspan="2">Internal Assessment (Department Level)</td><td>Term-work : 50 Mark</td></tr>
<tr><td>Oral : 50 Marks</td></tr>
<tr><td>Mid Sem. Test, Home Assignments, Laboratory Assignments, Presentations, Q&A session, Tutorials etc</td></tr>
<tr><td>Indirect Tools</td><td>Course Exit Survey</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Fundamentals in analog and digital communication, electromagnetic, network analysis etc</td></tr>
</table>

Introduction of the Course

Power electronics relates to the control and flow of electrical energy. Control is done using electronic switches, capacitors, magnetics and control system. There is a wide scope of power electronics from milli-watt to giga-watt. Power electronics is a growing field due to advancement in switching technologies and need for efficient power control systems. Power electronics is a multi-disciplinary and application specific course as shown in fig.1 that finds applications in every sector of life.

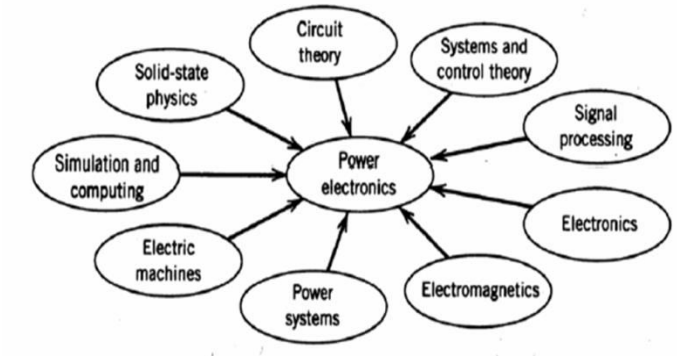

Fig. 1. Interdisciplinary nature of power electronics

Course Objectives	
1	To introduce fundamental theory of different power devices to study their construction, characteristics and turning on circuits
2	To understand principle of operation of different power converters and AC voltage controller and their performance analysis and protection circuits
3	To know different motor drives and their applications
4	To understand use and principle of operation of UPS and SMPS

Course Outcomes	
CO1	Explain construction, principle of operation and understand use and performance parameters of various power devices such as SCR, MOSFET, IGBT
CO2	Apply knowledge of power devices to build and evaluate the performance of various converters such as full converter, chopper, inverter, cyclo-converters and resonant converters
CO3	Apply knowledge of power devices to build and evaluate the performance of AC voltage controller using TRIAC and IGBT
CO4	Distinguish among various converters based on their performance and applications
CO5	Explain and understand the use of motor drives
CO6	Understand principle of operation of un-interruptible power supply and switch mode power supply and evaluate their performance
Course Contents as per the University Syllabus	
Unit-I	**Power Devices**
	Construction, Steady state characteristics & Switching characteristics of SCR, Construction, Steady state characteristics of Power MOSFET & IGBT. SCR ratings: I_L, I_H, V_{BO}, V_{BR}, dv/dt, di/dt, surge current & rated current. Gate characteristics, Gate drive requirements, Gate drive circuits for Power MOSFET & IGBT,opto isolator driving circuits for SCR. Series and parallel operations of SCR's. Applications of above power devices as a switch .
	Practical
	To plot SCR characteristics
	To plot n – channel E-MOSFET characteristics
Unit-II	**AC-DC Power Converters**
	Concept of line & forced commutation, Single phase Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, Three phase Semi & Full converters for R load, effect of source inductance, Power factor improvement techniques, Diode based boost converter. Single Phase dual converter with inductive load.
	Practical
	To measure performance of single phase full converter circuit with R and RL load
Unit-III	**DC-AC Converters**
	Single phase bridge inverter for R and R-L load using MOSFET / IGBT, performance Parameters, single phase PWM inverters. Three Phase voltage source inverter for balanced star R load with 120̊ and 180 mode of operation, Device utilization factor, Harmonics Elimination/Modulation Techniques**.**
	Practical
	To measure performance of single-phase PWM bridge inverter for R load
Unit-IV	**DC-DC converters & AC Voltage Controller**
	Working Principle of step down chopper for R-L load (highly inductive), control strategies. Performance parameters, Step up chopper, 2-quadrant & 4-quadrant choppers, SMPS: Fly back/ Half Bridge/ LM3524 based or equivalent Circuit. Single-Phase full wave AC voltage controller by using IGBT with R load**.**
	Practical
	To measure performance of single phase a.c. voltage controller using SCRs for R (lamp) load
	To simulate and evaluate the performance of IGBT based AC voltage controller using multisim
	To simulate and evaluate the performance of chopper circuit using multisim
Unit- V	**Resonant Converters & Protection of Power Devices & Circuits**

	Need for Resonant converters, Concept of Zero current switching (ZCS) and Zero voltage switching (ZVS) resonant converters. Cooling & heat sinks, over voltage conditions, over voltage protection circuits, metal oxide varistors**,** over current fault conditions, Over current protection. Electromagnetic interference, sources, minimizing techniques, shielding techniques for EMI.		
	Practical		
	To study over voltage / over current protection circuit		
Unit-VI	**Power Electronics Applications**		
	ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Electronic Ballast, LED Lamp with Driver Circuit, fan Regulator. Single phase separately excited DC motor drive, stepper motor drive, BLDC motor drive. Variable voltage & variable frequency three phase induction motor drive.		
	Practical		
	To plot line and load regulation characteristics of Switch Mode Power Supply		
	To measure performance of dc shunt motor using single phase full converter based dc drive		
Text Books	**Author**	**Title of Book**	**Publication**
T1	M. H. Rashid	Power Electronics circuits devices and applications	PHI 3rd edition
T2	M. S. Jamil Asghar	Power Electronics	PHI 3rd edition
Reference Books	**Author**	**Title of Book**	**Publication**
R1	Ned Mohan, T. Undeland & W. Robbins	Power Electronics Converters applications and design	2nd edition, John Willey & sons,
R2	P.C. Sen	Modern Power Electronics	S Chand & Co New Delhi.
R3	GE SCR MANUAL	6th edition,	General Electric, New York, USA
R4	Dr. P. S. Bimbhra	Power Electronics	Khanna Publishers,
R5	M. D. Singh, K. B. Khanchandani	Power Electronics	TMH
Self-Learning Facilities			
1.	NPTEL Lecture Series on Power Electronics		
Web Resources			
1	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/lecture-notes/		
2	https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_smps.htm		
3	http://www.electronics-tutorials.ws/		
4	http://www.cpes.vt.edu/areas/		
5	http://www.ni.com/white-paper/14677/en/		
6	https://www.coursera.org/course/powerelectronics		
7	http://energy.gov/eere/amo/next-generation-power-electronics-national-manufacturing-innovation-institute		
8	http://www.smps.us/		
9	http://educypedia.karadimov.info/electronics/electronicaopening.htm		
10	http://101science.com/Radio.htm		
11	http://www.kmitl.ac.th/emc/vuttipon/who's%20who%20in%20PE.htm		
12	http://ecetutorials.com/electrical/snubber-circuits-for-power-electronics/		
Research	**Author**	**Title of Paper**	**Journal/Transaction**

papers for reference			
1	B. K. Bose	Recent advances in power electronics	IEEE Transaction on Power Electronics Vol.7 No.1, Jan. 1991 http://power.eecs.utk.edu/pubs/bose_trans_pe_jan_1992.pdf
2	Bimal K. Bose	Power Electronics and Motion Control-Technology Status and Recent Trends	IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, VOL. 29, NO. 5, SEPTEMBEWOCTOBER 1993 http://www.cs.utah.edu/~shanth/stuff/misc/powerel.pdf
3	Fei (Fred) Wang and Zheyu Zhang	Overview of Silicon Carbide Technology: Device, Converter, System, and Application	CPSS TRANSACTIONS ON POWER ELECTRONICS AND APPLICATIONS, VOL. 1, NO. 1, DECEMBER 2016 http://vbn.aau.dk/files/250508960/Yongheng_Yang_CPSS_Transactions_on_Power_Electronics_and_Applications_CPSS_TPEA_vol.....pdf
4	Giovanna Oriti, Senior Member, IEEE, Alexander L. Julian	Power-Electronics-Based Energy Management System With Storage	IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 31, NO. 1, JANUARY 2016 http://www.kresttechnology.com/krest-academic-projects/krest-mtech-projects/EEE/M.Tech%20M.E%20EEE%20SIMULATION%20%202018-19/MTECH%20eee%20simulation%20basepaper/159%20Power%20Electronics-Based%20Energy%20Management%20System%20With%20Storage.pdf
Contents beyond Syllabus			
	Video lecture on recent advances in power electronics such as https://www.youtube.com/watch?v=SziSgsavt6Q https://www.youtube.com/watch?v=A9H3vef9IcY		
Additional Experiments	To simulate and evaluate the performance of IGBT based AC voltage controller using multisim		
Bridging Courses			
	No bridging course is required since all the prerequisite courses have been learnt by the students at SE and TE classes.		
Assignments			
	Six number of Assignments will be given to assess all the six course outcomes (COs)		
Tutorials			
	A. Solve Tutorial on Buck Converter using [1] B. Prepare a write up on Design of RC Snubber Circuits 1. http://www.ni.com/tutorial/14678/en/ 2. http://ecetutorials.com/electrical/snubber-circuits-for-power-electronics/		
Presentations			
	One lecture will be given for presenting the recent literature collected by the student on Applications of Power Electronics		

Information Theory and Coding Techniques

Course Title: Information Theory and Coding Techniques		**Course Number:**304187	**Course Name:C310**
Year: TE		**Semester: I**	
Designation of Course		Professional Core	
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In sem: 30 Marks	End Sem: 70 Marks
			Practical: 50 Marks
	Indirect Methods	Assignments, Presentations	Q&A session, Group Discussion
Prerequisites	Digital Communication System, bit error rate and need of source encoder and channel encoder. Probability and Bayes Theorem.		
Course Objectives			
1	To understand information theoretic behaviour of a communication system.		
2	To learn various source coding techniques for data compression and their applications.		
3	To design block codes and their sub-classes to improve error performance.		
4	To design convolutional codes and its derivatives.		
5	To analyze performance of communication system with coding and modulation		
6	To select source coding technique for image compression		
Course Outcomes: After successfully completing the course students will be able to			
CO1	Perform information theoretic analysis of communication system		
CO2	Design a data compression scheme using suitable source coding technique		
CO3	Compare, select and design channel coding scheme for a communication system		
CO4	Evaluate performance of a communication system		
CO5	Apply source coding techniques to compress images.		
Course Contents			
Unit-I	**Information Theory and Source Coding**		
	Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel, Mutual information, Examples of Source coding-Audio and Video Compression. Case Study: Huffmans coding in image compression/Detail overview of JPEG.		
	Practical : 1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as Noise free channel. b) Error free channel c) Binary symmetric channel d) Noisy channel Compare channel capacity of above channels 2. Write a program for generation and evaluation of variable length source coding using C/MATLAB (Any 2) a) Shannon –Fano coding and decoding b) Huffman Coding and decoding c) Lempel Ziv Coding and decoding		
Unit-II	**Information Capacity and Channel Coding**		

	Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code. Case Study: Shannon's Publications on information theory.
	Practical: Write a Program for coding & decoding of Linear block codes.
Unit-III	**Cyclic Codes**
	Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.
	Practical: Write a Program for coding & decoding of Cyclic codes.
Unit-IV	**BCH and RS Codes**
	Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code, CRC code, FEC and ARQ systems. Case Study: RS Coding in CD recording. Case Study: CRC used in Ethernet LAN.
	Practical: Write a program for coding and decoding of BCH and RS codes.
Unit- V	**Convolutional Codes**
	Introduction of convolution code, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding, Known good convolution code, Introduction to LDPC and Turbo codes.
	Practical: Write a program for coding and decoding of convolutional codes
Unit-VI	**Coding and Modulation**
	Goals of a communication System designer, Error Probability plane, Nyquist minimum bandwidth, Shannon Hartley theorem, Bandwidth efficiency plane, Modulation and coding tradeoffs, Defining, designing and evaluating digital communication system. Trellis Coded Modulation: Concept of TCM and Euclidean distance, Asymptotic coding gain, Mapping by set partitioning, Ungerboeck's TCM design rule. Case Study : TCM used in MODEMs
	Practical: Write a program to study performance of a coded and noncoded communication system (Calculate the error probability)

Text Books	Author	Title of Book	Publication
T1	Ranjan Bose	Information Theory Coding and Cryptography 2nd edition	McGraw Hill Publication
T2	J. C. Moreira, P.G.	Essentials of Error Control Coding	Wiley Student Edition

	Farrell		
Reference Books			
R1	Bernad Sklar	Digital Communication Fundamentals and Applications, 2nd Edition	Pearson Education
R2	Simon Haykin	Communication Systems, 4th Edition	John Wiley and Sons
R3	Shu Lin, Daniel j,Cistellojr	Error Control Coding, 2nd Edition	Pearson
R4	Todd Moon	Error Correction Coding: Mathematical Methods and algorithms	Wiley Publication
R5	Khalid Sayood	Introduction to Data Compression	Morgan Kaufmann Publishers
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Video Lecture Series by Dr. Ranjan Bose, IIT, Delhi		
	NPTEL Course Material on Digital Communication		
	MIT Open Courseware on Information Theory		
	Shannon C. E., "Mathematical Theory of Communication", Reprinted with corrections from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948.		
Contents beyond Syllabus	Arithmetic Coding Fundamentals of Digital Image Representation		
Additional Experiments	Calculation of information parameters for given text message.		
	Image compression using source coding technique (Huffman/DCT).		
Bridging Courses	Nil		
Assignments			
1	Information Theory		
2	Source-coding Techniques- Huffman and Shannon-Fano		
3	Linear Block Codes and their performance		
4	Cyclic Codes and their performance		
5	Convolutional Codes		
6	Case study		
Tutorials	Not applicable		
Presentations	Self prepared presentations on different units.		

Business Management

Course Title: Industrial Management		**Course Number:304188**	**Course Name:C311**
Year: TE		**Semester: II**	
Type of Course: Basic			
Teaching Scheme: 3Hrs/Week		**Laboratories:** 0Hrs/Week	
Course Assessment Method Examples	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
	Indirect Methods	Assignments, Presentations, MCQs	Seminars, Quiz, Q&A session, Group Discussion
Course Prerequisites	Basic knowledge of Industrial Processes and awareness of Management techniques.		
Course Objectives			
1	To get awareness about various domains of Industrial Management		
2	To understand concept of Quality Management ,Financial Management,Project Management		
3	To learn Resource Management		
4	To learn about basics of Entrepreneurship.		
5	To study Management Information Systems		
Course Outcomes			
CO1	To get overview of Management Science aspects useful in Industry		
CO2	To get Motivation for Entrepreneurship		
CO3	To Make Engineer competent for Industry		
CO4	To make student aware of Business Processes		
Course Contents			
Unit-I	**Basics of Management**		
	Introduction, Definition of management, characteristics of management, functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making, Principles of management – F.W.Taylor, Henry Fayol, Elton Mayo, Administration and management, Nature of management, levels of management, scientific management, managerial roles, Forms of Organization-Line , Line –staff,committee etc, Distinction between Traditional organization and Modern organization, concept of Globalization		
Unit-II	**Quality Management**		
	Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality – quality of design, conformance and performance, phases of quality management, Juran‟s and Demings view of quality, Quality Management Assistance Tools:Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mistake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management Standards (Introductory aspects only)- The ISO 9001:2008 Quality Management System Standard		
Unit-III	**Financial and Project Management**		

	Capital Structure, Fixed & working capital, Role of Securities and Exchange Board of India(SEBI), function of money market and capital Market, sources of finance. Introduction to capital budgeting, Techniques of capital budgeting. Break even analysis - assumptions, importance, Cost-Benefit analysis, CVP graph, Project Management, Planning and execution ofIT projects, Project network analysis, CPM, PERT and Project crashing and resource Leveling
Unit-IV	**Human Resource Development**
	Strategic importance HRM; objectives of HRM; challenges to HR professionals; role, Responsibilities and competencies of HR professionals; HR department operations; Human Resource Planning - objectives and process; human resource information system.. Talent acquisition; recruitment and selection strategies, career planning and management, training and development, investment in training programme; executive development, Case study on Recent trends in Human Resource Development
Unit- V	**Entrepreneurship Development**
	Concept of entrepreneurship, Identification of business opportunities, Generation of business idea, Business plan, Preparation of business proposal, Sources of finance – government and nongovernment agencies, Types of businesses / ownerships – Partnership, Proprietorship, Private limited company, Public limited company, Joint stock, Co-operative society, Govt. Sector etc, Policies and incentives for small business development, Government policies and incentives, Woman entrepreneurship, Industrial relations, Case study on Small scale industries in India.
Unit-VI	**Management Information Systems**
	Concept of data and information, characteristics of information, types of information, Definition of MIS, Need, Purpose and Objectives, Contemporary Approaches to MIS, Components of an information system, Need to study information systems, Information as a commodity, Types of information systems, Functional Business systems – sales & marketing, Human resources, accounting, manufacturing etc. Decision-making models, Types of decisions, Decision Support Systems, Introduction to e-commerce, types – B2B, B2C, C2B, C2C etc. Overview of ERP, Business Process Re-engineering.

Text Books	**Author**	**Title of Book**	**Publication & Edition**
T1	O.P.Khanna	Industrial Engineering and Management	Dhanpatrai publications Ltd, New Delhi.
T2	L.C.Jhamb	Industrial Management I	Everest Publishing House
Reference Books			
R1	Waman Jawadekar	Management Information Systems	Mc-Graw-Hill Education (India) Pvt. Ltd.
R2	G.S.Batra	Development of Entrepreneurship	eep and Deep Publications, New Delhi

R3	Kenneth C. Laudon and Jane P. Laudon	Management Information System	Eighth Edition, Pearson Education l
R4	Ashwathappa	Human Resource Management	Mc-Graw-Hill Education (India) Pvt. Ltd.
R5	M.Y. Khan and P. K. Jain,	Financial Management	Mc-Graw-Hill Education (India) Pvt. Ltd.
R6	Ravi M. Kishore	Project Management	Mc-Graw-Hill Education (India) Pvt. Ltd.
R7	Pravin Kumar	Fundamentals of Engineering Economics	Wiley India
Self-Learning Material (OCW, Handouts, Web Recourses, Research papers etc.)	Nil		
Contents beyond Syllabus	Various Case studies of Industries		
Additional Experiments (If any)	Nil		
Bridging Courses			
	Soft Skills		
Assignments	Nil		
Tutorials	Nil		
Presentations	Globalization		

Advanced Processors

Course Title:	**Advanced Processors**	**Course Number: 304189**	**Course Name:C312**
Designation of Course	Professional Core		
Teaching Scheme: 3 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	On-line/In-sem Examination: 50/30 Marks	Theory/End Semester Examination: 50/70 Marks
		Term-work	Practical/Oral
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Basics of Microcontroller and Embedded C		

Introduction of Course	
The course outlines 32 bit ARM microprocessor architecture and ARM7 based microcontroller and DSP processors. The course explores interfacing of different I/O devices to ARM based microcontroller.	
Course Objectives	
1	To understand architecture and features of typical ARM7 & ARM7 based microcontroller and CORTEX M4 based TIVA C- series microcontroller.
2	To learn on chip peripherals of ARM7 based microcontroller and demonstrate the interfacing of external I/O devices to microcontroller
3	To gain knowledge of architectures used for signal processing operations and applications and study the architecture and instruction set of TMS320C67X DSP processor
4	To learn to develop different signal processing operations on TMS320C67X processor.
Course Outcomes	
CO1	Explain architecture of ARM processor core, its operating modes and apply the instructions to construct assembly language programs
CO2	List the features and explain the architecture of ARM7 based microcontroller LPC2148
CO3	Demonstrate the interfacing of external I/O devices like LED, LCD, GLCD and keypad to ARM7 based controller.
CO4	Formulate and use the on chip peripherals of ARM7 based controller to demonstrate the interfacing of peripherals like Temperature sensor, SD Card, GSM, GPS to ARM7 based controller
CO5	List the computer architectures for signal processing and describe the architecture of TMS320C67X
CO6	List and explain different types of instructions of TMS320C67X processor and apply code composer tool to demonstrate implementation of signal processing operations like convolution, DFT on TMS320C67X

Course Contents	
Unit-I	**ARM7, ARM9, ARM11 Processors**
	Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers model, modes of operations. Introduction to Tiva TM4C123G Series Overview, Programming model, Tivaware Library
	Practical
	Introduction to Programming environment with CCS and Tiva
	GPIO configuration and control with simple LED example on TIVA TM4C123G Platform
	Programming of on chip ADC and displaying converted digital values on HyperTerminal on TIVA Platform
Unit-II	**ARM7 Based Microcontroller**
	ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), Memory Map, GPIO, Pin Connect Block, timer, Instruction set, programming in assembly language.
Unit-III	**Real World Interfacing with ARM7 Based Microcontroller -1**
	Interrupt structure of LPC2148, Interfacing with LED, LCD, GLCD, KEYPAD, simple LPC2148 GPIO Programming examples Using timers of LPC2148 to generate delay, serial communication programming for transmission and reception from computer, programming for UART.
	Practical
	Interfacing LED to LPC 2368
	Interfacing GLCD with LPC2368
	Using UART of LPC2368 for serial reception and transmission from/to computer
Unit-IV	**Real World Interfacing with ARM7 Based Microcontroller -2**
	GSM and GPS module interfacing, on-chip ADC using interrupt (VIC) and without using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC for waveform generation.
	Practical
	Using built-in ADC of LPC2368 for displaying its values (Programming built-in ADC without Interrupt)
	Interfacing EEPROM to LPC2368 using I2C protocol
Unit- V	**Digital signal Processors –I**
	Introduction, Computer Architectures for signal processing, General purpose Digital signal Processors, selecting digital signal processors, Special purpose DSP Hardware, Architecture of TMS320C67X, Features of C67X processors, CPU, General purpose register files, Functional units and operation, Data paths, Control register file.
Unit-VI	**Digital signal Processors-II**
	TMS320C67X Functional units,Internal memory, External memory, on chip peripherals, Interrupts, Instruction set and addressing modes, Fixed point instructions, Floating point instructions, Conditional operations,

	Parallel operations, Pipeline operations, Code Composer studio, Application programs in C67X.		
	Practical		
	To implement convolution (linear and circular convolution) on TMS320C6748 DSP Development kit (LCDK) with XDS100 V3 JTAG emulator		
	To implement Discrete Fourier Transform Using FFT Algorithm on TMS320C6748 DSP Development kit (LCDK) with XDS100 V3 JTAG emulator		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Andrew Sloss, Dominic Symes, Chris Wright	ARM System Developer's Guide – Designing and Optimizing System Software	ELSEVIER
T2	B. Venkatramani, M .Bhaskar	Digital Signal Processors: Architecture, Programming and Applications	McGraw Hill Second Edition
Reference Books			
R1	ARM architecture reference manual : - www.arm.com		
R2	Trevor Martin, An Engineer's Introduction to the LPC2100 series‖, Hitex (UK)		
R3	TMS320C67XX User manual: www.ti.com		
R4	Ifeachor, Barrie W. Jervis	Digital Signal Processing A Practical Approach by Emmanuel	Pearson Second edition
R5	Joseph Yiu	The Definitive Guide to the ARM Cortex-M‖, Newness,	ELSEVIER.
Self-Learning Facilities	NPTEL Lecture Series		
	Embedded Systems Dr Santanu Chaudhury Department of Electrical Engineering IIT Delhi Lecture 5 ARM Processor		
Web Resources	www.ti.com www.nxp.com		
	An Introduction to the Tiva™ C Series Platform of Microcontrollers, White paper, Miguel Morales, Texas Instruments		
Additional Experiments	Interfacing of LED to LPC 2368		
Assignments			
1.	Vector Interrupt controller of LPC 2148		
2.	Digital Signal Processors-I		

3.	Digital Signal Processors-I
Tutorials	
1.	System Architecture of LPC 2148
Presentations	LCD Interfacing with LPC 2148
	UART Interfacing with LPC 2148

System Programming & Operating Systems

Course Title: System Programming & Operating Systems		**Course Number:**304190	**Course Name:C313**
Year: TE		**Semester: I**	
Designation of Course		Professional Core	
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work : 25 marks	Practical/Oral: 25 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Basic knowledge of 'C ' language and data structures & files		
Course Objectives			
1	Learn the concepts and principles of system programming (like Language processor, assembler, loader, linker, compiler) and to enable them to understand the duties and scope of a system programmer.		
2	To provide the knowledge about both theoretical and practical aspects of system programming, teaching them the methods and techniques for designing and implementing system-level programs.		
3	Explain basic knowledge of Operating systems and facilities provided by it		
4	Learn concepts of processes management, memory management, scheduling , deadlocks, I/O management, File system		
Course Outcomes	**Upon completion of the subject, students will be able to:**		
CO1	Describe the role of system programming and the scope of duties and tasks of a system programmer		
CO2	Understand concepts and principles, and be familiar with the approaches and methods of developing system-level software (e.g., lexical analyzer, assembler , a Macro processor)		
CO3	apply the knowledge and techniques learnt to develop solutions to real-world problems		
CO4	Define basic concept and various facilities provided by operating system to develop the system level programs		
Course Contents			
Unit-I	**Basics of system programming**		
	Language processors: Language processing activities, Fundamentals of language processing, Fundamentals of language specification, Language processor development tools. Data structures for language processing: Search data structure, Allocation data structures. Scanning and parsing, Assembler: Assembly language programming, simple assembly scheme, pass structure of assembler, design of two pass assembler		
	Practical		
	Write C Program to implement Lexical Analyzer for simple arithmetic operation which creates output tables (Uniform Symbol Table or a. Identifier Table b. Literal Table c. Symbol Table)		

Unit-II	**Macro processor, Compliers and Interpreters**		
	Macro definition and call, macro expansion, Machine Independent macro processor features, Nested macro calls, advanced macro facilities, Design of macro preprocessor. Basic compliers function, Phases of compilation, memory allocation, compilation of expression, compilation of expressions, compilation of control structures, code of optimization, interpreter		
	Practical		
	Design of PASS I of two pass assembler for pseudo machine code.		
	Design of a MACRO PASS-I		
Unit-III	**Linkers and Loaders and Software tools**		
	Basic loaders functions, central loaders scheme Absolute loaders, Subroutine linkers, relocation. Loader, Direct linking loader, Dynamic linking loader, Design of absolute loaders direct linking loader, Implantation of MS DOS linker, Software tools for program development, editors, debug monitor, programming environment, user interfaces		
Unit-IV	**Introduction to Operating System, Process and threads and Deadlocks**		
	Evolution of O. S. Function, various OS, OS concepts, OS structure Processes, threads, inter process communication, IPC problems, scheduling Resources, introduction to deadlock, ostrich algorithm, deadlock detection and recovery, avoidance, prevention, other aspects		
	Practical		
	Implement Job scheduling algorithms: FCFS, SJF		
	Implement Bankers Algorithm for deadlock detection and avoidance		
Unit- V	**Memory management**		
	Basics of memory management, Swapping, Virtual memory, Page replacement algorithm, FIFO, second chance PR, clock PR, least recently used, working set PR, WS clock PR, Design issues for Paging systems, OS involvement with paging, page fault handling, Segmentation		
	Practical		
	Implementation of page replacement algorithm: FIFO / LRU		
Unit-VI	**Input and Output, File system**		
	Input and Output: Review of computer hardware, principles of I/O hardware, and principles of I/O software, I/O software layers, disks, disk scheduling Algorithms File System w.r.t. Linux: Files, directories, file system and implementation, File system layout, implementing files, implementing directories, shared files, disc space management		
	Practical		
	Write a program to list files, directories using System calls		
	Write a program to handle process using System calls		
	Study of basic Linux Commands		
	Write an shell scripting on LINUX		
Text Books	**Author**	**Title of Book**	**Publication**
T1	D. M. Dhamdhare	Systems Programming	McGraw Hill
T2	Siberschatz A; Galvin P.B; Gagne G	Operating System Concepts	John Wiley 8th Edition

Reference Books			
R1	J. J. Donovan	Systems Programming	McGraw Hill
R2	Andrew S. Tanenbaum	Modern Operating Systems	Second Edition PHI
R3	Alfred Aho, Ravi Sethi & Jeffrey D. Ullman	Compilers – Principles, techniques and tools	Pearson education
R4	G.Sudha Sadasivam	Compiler Design	Scitech Publication
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series :Dr. P.K.Biswas :Operating system: http://www.satishkashyap.com/2013/02/video-lectures-on-operating-systems-by.html		
	Virtual Laboratory: Computer Science & Engineering: Linux Lab: http://cse09-iiith.virtual-labs.ac.in/		
	Compiler Design: Prof. Sanjeev K Aggarwal: lecure notes http://nptel.ac.in/courses/106104072/ Compiler Design: Prof. Y.N. Srikanth: video lectures: http://nptel.ac.in/courses/106108052/ Operating Systems: Prof. P.C.P. Bhatt: http://nptel.ac.in/courses/106108101/		
Contents beyond Syllabus	File handling in C, Shell Script		
Additional Experiments	Study of File handling		
	Case Study Android Mobile OS		
Bridging Courses	Nil		
Assignments	**Theory assignments**		
1	Language processor		
2	Assembler		
3	Compiler		
4	Loader and linker		
5	Software tools		
6	Operating system		
Tutorials	Nil		
Presentations	On topic Language processor, Assembler, compiler , loader, linker, software tools		

Employability Skills and Mini Project

Course Title: Employability Skills and Mini Project		**Course Number:** 304196	**Course Name: C316**
Year: TE		**Semester: II**	
Type of Course		Professional Core	
Teaching Scheme: NA Hrs/Week		**Laboratories:** 4 Hrs/Week	
Course Assessment Method Examples	**Direct methods**	On-line/In-sem Examination: Nil	Theory/End Semester Examination: Nil
		Term-work: Nil	**Practical/Oral 50M**
	Indirect Methods	Assignments, Presentations, MCQs	Seminars, Quiz, Q&A session, Group Discussion
Course Prerequisites	Basic Knowledge of Electronics, Power supply design		
	Microcontrollers and coding/ Programming skills		
Course Objectives			
1	To illustrate various stages of product development cycle through Mini-Project.		
2	Ability to draft electrical , mechanical and Environmental specifications of Mini-Project		
3	lerstand the cost aspect of the mini-project derived from Bill Of material.		
4	Development of skills related to PCB design, use of EDA tools, soldering practices, aesthetic, ergonomic design and product engineering.		
5	To develop ability to correctly document an electronics product and write a technical report.		
Course Outcomes			
CO1	Understand and map various stages in product design to product design development cycle.		
CO2	Apply the system understanding in framing appropriate system specification document.		
CO3	Estimate the cost incurred in the product design (mini-project) correctly.		
CO4	Implement electronic hardware by learning PCB artwork design, soldering techniques, trouble shooting etc		
CO5	Prepare a technical report and seminar based on the Mini project.		
Course Contents			
	Project group shall consist of not more than 3 students per group.		

	Suggested Plan for various activities to be monitored by the teacher. Week 1 & 2: Formation of groups, Finalization of Mini project & Distribution of work. Week 3 & 4: PCB artwork design using an appropriate EDA tool, Simulation. Week 5 & 6: Hardware assembly, Testing Week 7 & 8: Enclosure Design, Fabrication etc Week 9 & 10: Preparation, Checking & Correcting of the Draft Copy of Report Week 11 & 12: Demo and Group presentations
	Mini Project Work should be carried out in the Projects Laboratory.
	Project designs ideas can be necessarily adapted from recent issues of electronic design magazines Application notes from well known component manufacturers may also be referred.
	Hardware component is mandatory
	Layout versus schematic verification is mandatory.
	Domains for projects may be from the following , but not limited to: Instrumentation and Control Systems Electronic Communication Systems Biomedical Electronics Power Electronics Audio , Video Systems Embedded Systems Mechatronic Systems
	Microcontroller based projects should preferably use Microchip PIC controllers.
	A project report with following contents shall be prepared Title Specifications Block diagram Circuit diagram Selection of components Simulation results PCB artwork Layout versus schematic verification report Testing procedures Enclosure design Test results Conclusion and Reference

Text Books	**Author**	**Title of Book**	**Publication & Edition**
T1	Nil		
T2			
Reference Books	Nil		
Self-Learning Material	Literature survey and identifying the problem statement using IEEE explorer For component selection various websites of IC Manufacturers		
	www.microchip.co, www.ti.com,www.adi.com **etc**		

(OCW, Handouts, Web Recourses, Research papers etc.)	Synopsis format / Template, Handouts of PCB design Guide-lines, Final Mini-Project Report Template.
	Reference/Handouts :
	Selecting the Right Microcontroller Unit handout by Freescale Semiconductors
	National Semiconductor Voltage Regulator Handbook
	Opamps for Everyone Third Edition By TI
	NXP Microcontrollers Selection Guide - NXP.com
	MCU Selector Guide2 - Silicon Labs
Contents beyond Syllabus	Industry expert sessions arranged every week for guiding students. Covering fundamentals related to LED interfacing , LCD interfacing , UART interfacing Motor Driver interfacing (mapping the basic concepts with industry standards)
Additional Experiments (If any)	Nil
Bridging Courses	PCB design Guidelines
Assignments	Generating Documents of each Phase of project like
1	Project Specification document,
2	component selection (comparative analysis),
3	Schematic Entry,
4	Simulation Results
5	PCB Layout Document
6	Results Document (Testing Results)
7	Enclosure design(Interconnection diagram, Mechanical assembly, drawing
	Final Mini-Project Report
Tutorials	Nil
Presentations	Layout Tool: Hand's-on on Proteus 7