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: 2017-18

FOR THE PROGRAMME

B. E. (ELECTRONICS & TELECOMMUNICATION ENGINEERING)

PUNE VIDYARTHI GRIHA'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

VISION

TO ACHIEVE EXCELLENCE IN ENGINEERING EDUCATION

MISSION

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

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING

VISION

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

MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES

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

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PO8. Ability to comprehend management and entrepreneurship skills.

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES

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

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

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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**
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(DCDSP)
	Indirect Methods	Assignments, Presentations	Q&A session, Group Discussion
Prerequisites	Analog Communication		
Course Objectives			
1	To understand the building blocks of digital communication system.		
2	To prepare mathematical background for communication signal analysis		
3	To understand and analyze the signal flow in a digital communication system		
4	To analyze error performance of a digital communication system in presence of noise and other interferences		
5	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 : Experimental Study of PCM and Commanded PCM. 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: 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: 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
Unit- V	**Pass band 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: Experimental Study of Generation &detection of BPSK and QPSK. Experimental Study of Generation &detection of BFSK Write a simulation program for calculation and plotting the error probability of BPSK, QPSK, QAM. Comparison of theoretical and practical BERs 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: Experimental Study of Generation of PN Sequence and its spectrum. 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, Web Resources, Research papers for reference	Digital Communication by Simon Haykin Web-course by NPTEL on Digital communication by Prof. Saswat Chakrabarti Prof. R.V. Rajakumar ,IIT Kharagpur		
Contents beyond Syllabus	Modulation used in GSM, CDMA techniques		
Additional Experiments	Verification of sampling theorem, Nyquist criteria, and aliasing effect		
Bridging Courses	Nil		
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	Not applicable		
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 Experiments	Plotting analog and digital signals using MATLAB
	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: Electromagnetic & Transmission Lines		**Course Number:**304184	**Course Name: C303**
Year: TE		**Semester: I**	
Designation of Course		Professional Core	
Teaching Scheme: 3 Hrs/Week		**Tutorial:** 1 Hr/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	End Semester Examination: 70 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session,Group Discussion
Prerequisites	Vector Algebra, Coordinate System, Divergence theorem Stoke's Theorem		
Course Objectives			
1	To study Basic Electrostatic and Magneto static Laws, Theorems.		
2	To understand Maxwell's Equation and apply to the basic electromagnetic problem.		
3	To interpret the given problem, and solve it using Maxwell's equations.		
4	To analyze boundary conditions, and understand the field at the interface of two different media.		
5	To analyze time varying electric and magnetic fields, wave propagation in different types of media**.**		
6	To understand transmission line fundamentals and apply them to the basic problem.		
7	To understand the fundamentals of electromagnetic theory and transmission lines.		
Course Outcomes			
CO1	Apply the Gauss law to some symmetric charge distributions and differential volume element.		
CO2	Demonstrate theoretically the use of Laplace ad Poisson equations and application of boundary conditions to understand the behavior of parallel plate, cylindrical and spherical.		
CO3	Apply Ampere's circuital law to a current carrying conductor of finite ad infinite length and also to circular loop.		
CO4	Interpret the electromagnetic problem and solve using Maxwell's equations and apply boundary conditions to different media, and formulate uniform plane wave equation, which is the basic of Antenna and wave propagation		
CO5	Analyze the transmission line problem, use the Smith chart for impedance calculations		
Course Contents			

Unit-I	**Fundamentals of Electrostatic Fields**
	Coulomb's Law & Electric Field Intensity, Electric Field due to point charge, line charge and surface charge distributions, Electric Flux Density, Gauss's Law and its Application to differential volume element, divergence, divergence theorem. Electric potential, Relationship between E & V, Potential Gradient. An electric dipole and flux lines.
	Tutorials
	1. Find the Electric field intensity and electric flux density at a given point due to following charge distributions. (In all coordinate systems)
	2. Find the Electric potential due to different charge distributions (Point charge, Line charge, Surface charge), in different coordinate systems.
	3. Application of Gauss's law.
	4. Given v (volume charge density), and the region with reference potential, find the potential in a given region, using Poisson's equation.
Unit-II	**Fields in Material Space and Boundary-Value Problem.**
	Energy density in electrostatic field, Current and current Density, continuity equation, Polarization in dielectrics, capacitance, capacitance of parallel plate; spherical; cylindrical capacitors with multiple di-electrics, Boundary conditions, Poisson's and Laplace's equation, General procedures for Solving Poisson's and Laplace's equations.
	Tutorials
	1. Using Laplace's equation, find capacitance between any two surfaces, if the boundary conditions are given
	2. Find the electrostatic fields (Tangential and Normal) at the boundary between, 1) Free space and dielectric medium 2) Free space and conductor 3) dielectric medium and conductor 4) Two dielectric media. 5) Two dielectric media when boundary is defined by a equation of plane
	3. Find the capacitance of, 1) Parallel plate capacitor with multiple dielectric layers. 2) Spherical capacitor with multiple dielectric layers 3) Cylindrical capacitor with multiple dielectric layers, Also find the total Energy stored within the region for all above mentioned capacitor
Unit-III	**Magneto statics**
	Biot-Savart's Law, Ampere's Circuital Law and its Applications, magnetic flux density, Magnetic Scalar and vectors potentials, Derivations of Biot-savarts law and Ampere's law based on Magnetic Potential, Forces due to magnetic field, magnetic dipole, Classification of Magnetic Materials, Magnetic boundary conditions.
	Tutorials
	1. Find H (Magnetic field intensity) and B (Magnetic flux density) at a given point due to,1) Infinitely long current carrying conductor

	2) Finite current carrying conductor 3) Infinite conducting surface 4) Finite conducting surface 5) Different current carrying configurations (i.e. thin conductor, surface all together)
	2. For the following current carrying configurations, find the H (Magnetic field intensity) in a given region (or point) using Ampere's circuital law.
	3. Find the static magnetic fields(Tangential and Normal) at the boundary between, 1) Two different magnetic media with nonzero surface current density(K) 2) Two different magnetic media with zero surface current density(K) 3) Two different magnetic media when boundary is defined by a equation of plane.
Unit-IV	**Time Varying Fields and Maxwell's equations**
	Faraday's law, Displacement current, Maxwell's equations in point form and integral form, Power and Poynting theorem, Boundary conditions for time varying field, Retarded magnetic vector potential, Time harmonic field, Introduction to the concept of Uniform Plane Wave and Helmholtz equation.
	Tutorial
	1. Given H (or E) and the region properties find B,D and E (or H) using Maxwell's equations. (In all coordinate systems)
	2. Given H (or E) and the region properties ,the average power density in W/m2 , Total power crossing the given surface in watts using Poynting Theorem (In all coordinate systems)
Unit- V	**Transmission Lines**
	Line parameters, inductance of a line of two parallel round conductors, coaxial line, skin effect, A line of cascaded T sections, general solution, physical significance of the equations; the infinite line, wavelength, velocity of propagation, the distortion less line, Inductance loading of telephone cables, Reflection on a line not terminated in Z0, reflection coefficient, open and short circuited lines, reflection factor and reflection loss, T and□□sections equivalent to lines.
	Tutorial
	1.Given the primary constants (R, L, G, C) along with the generator specifications and termination, find secondary constants (0 □□,□□,□□, Z) and other parameters like velocity, wavelength, received voltage, received power, reflection coefficient etc.
	2. Given secondary constants (0 □□, Z), find the primary constants (R, L, G, C) at the given frequency.
Unit-VI	**The Line at Radio Frequency**
	Voltages and currents on the dissipation less line, 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

	line, quarterwave line; impedance matching, Single-stub impedance matching on a line, The circle diagram for the dissipation less line, Application of the circle diagram, The Smith circle diagram, Application of the Smith chart for calculating impedance and admittance.		
	Tutorial		
	1. Problems on Transmission Line Analysis.		
	2. Problems on Impedance matching and design of stub matching using Smith Chart.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Matthew N.O. Sadiku	Principles of Electromagnetics	Oxford University Press
T2	J. D. Ryder	Networks, Lines and Fields	PHI.
Reference Books			
R1	Edminister J.A	Electromagnetics	Tata McGraw-Hill
R2	Hayt& Buck	Engineering Electromagnetics	Tata McGraw-Hill
R3	Kraus/Fleisch	Electromagnetics with applications	Tata McGraw-Hill
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series , MIT Lecture series		
Contents beyond Syllabus	Nil		
Bridging Courses	Nil		
Assignments			
1	Numerical on Electric field Intensity, Gauss's law, Electric potential		
2	Numerical on Capacitance		
3	Magnetic Scalar and Vector Potential		
4	Maxwell's Equation		
5	Transmission Line analysis using Smith Chart		
Tutorials	Vector Algebra, Coordinate System Numerical		
Presentations	1.Electric Field Intensity, Gauss's Law, Electric Potential, Relationship Between E and V		
	2. Ampere's law applied to different current carrying configurations		
	3. Derivation of Maxwell Equation		

Microcontroller

Course Title: Microcontroller and Applications		**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 understand the need and applications of microcontrollers in embedded system.
2	To study architecture and features of 8 bit Microcontrollers viz 8051 and PIC 18F
3	To learn interfacing input devices such as keyboard and output devices such as LED, LCD with PIC18F
4	To study on-chip units PWM, Timers and on chip ADC in PIC 18F.
5	To learn and interface different devices using different serial protocols as UART, SPI , I2C.

Course Outcomes After successfully completing the course students will be able to	
CO1	Explain architecture and features of 8 bit 8051 and PIC18F Microcontrollers
CO2	Implement interfacing of input and output devices with PIC18F
CO3	To make use of different on chip peripherals and inbuilt units as timers, PWM in PIC 18F .
CO4	Memorise different serial protocols in PIC18F
CO5	Interface different devices using serial protocols.

Course Contents	
Unit-I	**Introduction to Microcontrollers** 8 bit Microprocessor and Microcontroller architecture, comparison, advantages and applications of each Harward and Von Neumann architecture, RISC and CISC comparison. Survey of 8 bit controllers and its features Definition of embedded system and its characteristics. Role of microcontroller in embedded System. Limitation of 8 bit microcontrollers. Study of RS232, RS 485, I2C, SPI protocols. Software and hardware tools for development of microcontroller based system such as assembler, compiler, IDÉ, Emulators, debugger,

	programmer, development board, DSO, Logic Analyzer.
Unit-II	**8051 Architecture** MCS-51 architecture, family devices & its derivatives. Port architecture, memory organization, Interrupt structure, timers and its modes & serial communication and modes. Overview of Instruction set.
Unit-III	**PIC Microcontroller Architecture** PIC 10, PIC12, PIC16, PIC18 series architectures, comparison, features and selection as per application. PIC18f architecture, registers, memory Organization and types, stack, oscillator options, BOD, power down modes and configuration bit settings. Brief summary of Peripheral support Overview of instruction set, MPLAB IDE & C18 Compiler
	Practical
	Write a program for interfacing button, LED, relay & buzzer as follows : A. when button 1 is pressed relay and buzzer is turned ON and LED's start chasing from left to right B. when button 2 is pressed relay and buzzer is turned OFF and Led start chasing from right to left
Unit-IV	**Real World Interfacing Part I**
	Port structure, interrupt structure & timers of PIC18F. Interfacing of switches. LED, LCD, Keypad, use of timers With interrupts, PWM generation. All programs in embedded C.
	Practical
	To display message on LCD without using any standard library function
	Interfacing 4X4 keypad and displaying key pressed on LCD OR on HyperTerminal.
	Generation of PWM signal for DC Motor control.
Unit- V	**Real World Interfacing Part II** MSSP structure, UART, SPI,I2C, ADC, Comparators Interfacing serial port, ADC, RTC with I2C and EEPROM with SPI. All programs in embedded C.
	Practical
	Interfacing serial port with PC both side communication.
	Interfacing DS1307 RTC chip using I2C and display date and time on LCD
	Interfacing EEPROM 24C128 using SPI to store and retrieve data
	Interface analog voltage 0-5V to internal ADC and display value on LCD
Unit-VI	**Case studies with PIC Design of DAS system, Design of frequency counter** With display on LCD, Design of Digital Multimeter, Design of DC Motor control using PWM Should cover necessary signal conditioning of input stage ,hardware interfacing with PIC Microcontroller and

	algorithm or flowchart.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Mazidi	8051 microcontroller & embedded system 3rd Edition ,	Pearson 3 rd Edition
T2	Mazidi	PIC microcontroller & embedded system	Pearson
Reference Books			
R1	18F xxx reference manual www. MICROCHIP.COM		
Self-Learning Facilities, Web Resources, Research papers for reference	NPTEL Lecture Series		
	Virtual laboratory Sessions		
Contents beyond Syllabus	Simulation for every practical using PROTEUS		
Additional Experiments	Interfacing internal EEPROM .		
Bridging Courses	Guest session on Data Acquit ion System by Industry Expert .		
Assignments	**Theory :**		
1	Write down pin description of 16X2 LCD used in the Experiment Write down LCD Command Codes in Tabular form. Explain the steps required in Command and in Data mode with its significance. Describe LCD operation with respect to its pin Configuration		
2	Explain with neat diagram how 4X4 Keyboard is interfaced and a key pressed is detected		
3	Name and Explain with neat diagram Registers that are required to access inbuilt ADC of PIC18F4550 Draw the diagram to show PIC18F4550 ADC Channel and Reference Selection and explain in detail Name and define features of in built ADC of PIC 18F4550 Define the terms : Resolution,Conversion time,Step size,Data out,Vref		
4	With a neat diagram explain the architecture of PIC 18F4550 Explain following registers TRISx 2. PORTx 3. LATx		
5	Differentiate Timer0, 1 2 and 3 modules. Which are the registers required for using Timer0 module using interrupt? Explain above registers (bit wise) with neat diagram		
6	Draw and Explain different registers used in implementing serial communication using PIC18F4550		

	Explain Baud rate calculation with example. Calculate values of registers SPBRG and SPBRGH for baud rate of 38400 and 9600.
7	Highlight CCP feature in PIC18F4550. Which are the pins used for CCP. Explain different registers used to access CCP in PIC18F4550 with neat diagram. Which are the timer modules used for accessing CCP, explain respective Timer registers for the same. Calculate and write in detail values of register PR2, CCPR1L and CCPCON1 for : PWM frequency :3 KHz with 25%, 50% and 75% duty cycle PWM frequency :5 KHz with 25%, 50% and 75% duty cycle
8	Which are the pins used during SPI protocol access in PIC 18F4550. Define and explain various registers used to access SPI in PIC18F4550 with neat diagram. Explain EEPROM used during the experiment with its features. Write down the steps used to access EEPROM using SPI.
	Practical : (Simulation On Proteus Software)
1	Write a program for interfacing button, LED, relay & buzzer as follows : A. when button 1 is pressed relay and buzzer is turned ON and LED's start chasing from left to right B. when button 2 is pressed relay and buzzer is turned OFF and Led start chasing from right to left
2	To display message on LCD without using any standard library function
3	Interfacing 4X4 keypad and displaying key pressed on LCD OR on HyperTerminal.
4	Interface analog voltage 0-5V to internal ADC and display value on LCD
5	Generate square wave using timer with interrupt
6	Interfacing serial port with PC both side communication.
7	Generation of PWM signal for DC Motor control.
8	Interfacing EEPROM 24C128 using SPI to store and retrieve data
Tutorials	Not Applicable
Presentations	8 bit Microprocessor and Microcontroller architecture
	Memory organization
	PIC 10, PIC12, PIC16, PIC18 series architectures and comparison
	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

Course Title: Power Electronics		**Course Number:** 304193	**Course Name: C309**
Designation of Course		Professional Core	
Teaching Scheme: 3Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem. Examination: 30 Marks	End Semester Examination: 70 Marks
		Term-work: 25 Marks	Practical : 25 Marks
	Indirect Methods	Assignments, Presentations	Seminars, Quiz, Q&A session, Group Discussion
Prerequisites	Semiconductor devices, basic electrical engineering		

Course Objectives	
1	To explain different power devices and turning on circuits.
2	To discuss operation principle of single phage and three phage AC-DC converters with different loads.
3	To discuss operation principle of single phage and three phage DC-AC converters with different loads.
4	To classify DC-DC converters and explain working principal of AC voltage controllers.
5	To discuss different motor drives, various power electronics applications like UPS, SMPS and electronic ballast.
6	To explain protection circuits and resonant converters.
Course Outcomes	
CO1	Classify power devices and design a triggering / gate drive circuit for a power device
CO2	Analyze single phage and three phage AC-DC converters with different loads with the help of performance parameter.
CO3	Analyze single phage and three phage DC-AC converters with different loads with the help of performance parameter.
CO4	Compare different types of DC-DC converters and describe operation of AC voltage controllers
CO5	Justify the need of motor drives, electronics ballast, and Evaluate battery backup time, design a battery charger.
CO6	Illustrate need of protection circuits and resonant converters
Course Contents	
Unit-I	**Power Devices**
	Construction, Steady state characteristics & Switching characteristics of SCR, Construction, Steady state characteristics Power MOSFET & IGBT. SCR ratings: IL, IH, VBO, VBR, dv/dt, di/dt, surge current & rated current.Gate characteristics, Gate drive requirements, Synchronized UJT triggering for SCR, triggering of SCR using IC-785, gate drive circuits for Power MOSFET / IGBT.
	Experiments
	1) Characteristics of SCR i) Plot V-I characteristics ii) Observe the effect of gate current ii) Measure IH & IL

	2) V-I Characteristics of MOSFET / IGBT i) Plot output characteristics ii) Plot transfer characteristics
	3) Triggering circuit for SCR (Using UJT or IC-785) i) Verify the range of firing angle ii) Turn on the SCR, observe waveforms across load & SCR
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.
	Experiments
	1. Single phase Semi / Full Converter with R & R-L load i) Observe load voltage waveform, ii) Measurement of firing angle, average o/p voltage across loads, iii) Verification of theoretical values with practically measured values.
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.
	Experiments
	1.Single-Phase PWM bridge inverter for R load i) Observe output rms voltage waveforms,
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. Single-phase full wave AC voltage controller with R load.
	Experiments
	1. Step down dc chopper using power MOSFET / IGBT i) Measure duty cycle and observer effect on average load voltage for DC chopper
	2. Find load & line regulation of given SMPS
	3.Single phase AC voltage controller using SCRs for R load i) Observe output rms voltage waveforms, ii) Measurement of firing angle, o/p voltage across load, iii) Verification of theoretical values with practically measured values.
Unit- V	**Power Electronics Applications**
	ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Electronic ballast: Characteristics of fluorescent lamps and advantages over conventional ballast. Single phase separately excited DC motor drive, stepper motor drive, BLDC motors. Variable voltage & variable frequency three phase induction motor drive.
	Experiments
	1. Speed control of DC motor / stepper motor / ac motor i) Speed control of DC motor using armature voltage control / field control method. Measure RPM and plot graph of speed versus armature voltage and field

	current OR ii) Study drive circuit for stepper motor- phase sequencing and microstepping OR iii) Plot speed-torque characteristic of three phase induction motor.		
Unit-VI	**Resonant Converters & Protection of Power Devices & Circuits**		
	Need for resonant converters, SLR half bridge DC/DC converter in low frequency, Concept of zero current switching (ZCS) and zero voltage switching (ZVS) resonant converters. Cooling & heat sinks, over voltage conditions, over voltage protection circuits, over current fault conditions, over current protection. Electromagnetic interference: Sources, minimizing techniques.		
	Experiments		
	1.To study over voltage / over current protection circuit.		
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			
R1	Ned Mohan, T. Undeland & W. Robbins	Power Electronics Converters applications and design	2nd edition, John Willey & sons, Singapore
R2	U. R. Moorthi	Power Electronics, devices, circuits & industrial applications	Oxford University Press
R3	P.C. Sen	Modern Power Electronics	S Chand & Co New Delhi.
R4	Dr. P. S. Bimbhra	Power Electronics	Khanna Publishers, Delhi
R5	Nagrath Kothari	Electrical Machines	TMH
Self-Learning Facilities	NPTEL Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.		
Web Resources Research papers for reference	www.youtube.com (Lectures series by Experts)		
Contents beyond Syllabus	Nil		
Additional Experiments	Nil		
Bridging Courses	Nil		
Assignments	Simulation of Circuits using Multisim , Proteus and simulink		
Tutorials	Nil		
Presentations	Controlled converters, 3 phase power supply ,DC motor operation		

Information Theory Coding and Communication Networks

Course Title: Information Theory Coding and Communication Networks		**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.		
Course Objectives			
1	To understand information theoretic behaviour of a communication system.		
2	To understand various source coding techniques for data compression		
3	To understand various channel coding techniques and their capability.		
4	To Build and understanding of fundamental concepts of data communication and networking		
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	Design a channel coding scheme for a communication system.		
CO4	Understand and apply fundamental principles of data communication and networking.		
CO5	Apply flow and error control techniques in communication networks.		
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.		
	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.		
	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 Convolutional 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. Introduction of convolution code, State diagram, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding		
	Practical: 1. Write a program for coding and decoding of BCH and RS codes. 2. Write a program for coding and decoding of convolutional codes		
Unit- V	**Data Communication & Physical Layer**		
	Data Communications – Networks - Network models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media.		
	Practical:		
Unit-VI	**Data Link Layer**		
	Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – HDLC.		
Text Books	**Author**	**Title of Book**	**Publication**
T1	Bernad Sklar	Digital Communication Fundamentals & applications, Second Edition.	Pearson Education
T2	Behrouz A. Foruzan	Data communication and Networking	Tata McGraw-Hill
Reference Books			
R1	Simon Haykin	Communication Systems, 4th Edition	John Wiley and Sons
R2	Shu Lin, Daniel j,Cistellojr	Error Control Coding, 2nd Edition	Pearson
R3	Todd Moon	Error Correction Coding: Mathematical Methods and algorithms	Wiley Publication
R4	Khalid Sayood	Introduction to Data Compression	Morgan Kaufmann Publishers
R5	Ranjan Bose	Information Theory coding and Cryptography,2nd Edition	McGraw-Hill Publication
Self-Learning Facilities, Web	NPTEL Video Lecture Series by Dr. Ranjan Bose, IIT, Delhi		
	MIT Open Courseware on Information Theory		
	Shannon C. E., "Mathematical Theory of Communication", Reprinted with corrections		

Resources, Research papers for reference	from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948.
Contents beyond Syllabus	Information capacity Theorem applied to M-PSK
Additional Experiments	To study performance of a coded and uncoded communication system
Bridging Courses	Nil
Assignments	
1	Information Theory and Source-coding Techniques- Huffman and Shannon-Fano
2	Data Communication & Physical Layer and Data Link Layer
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	On completion of the course, student will be able to		
1	To get awareness about various domains of Business Management		
2	To understand concept of Quality Management ,Financial Management, Project Management		
3	To learn Human Resource Management, marketing management are the major tasks in Business		
4	To promote Entrepreneurship.		
Course Outcomes			
CO1	To get overview of Management Science aspects useful in Industry		
CO2	To get Motivation for Entrepreneurship		
CO3	Get Quality Aspects for Systematically Running the Business		
CO4	To Develop Project Management aspect and Entrepreneurship Skills		
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, Cash flow, Financial accounting concepts and application, Scope of business, Macro analysis, micro analysis, Demand and supply analysis. 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,. Introduction to Project Management process (Project Life cycle Management),Project selection criteria, project scope, Project planning, scheduling , Resources and constrains. Project estimates and costing .Project qualitative and quantitative Risk analysis and Mitigation, project quality planning and deliverables. Case study of a project Mnagement.
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	Marketing

	Introduction to marketing, marketing environment, segmentation. Consumer behavior and Marketing management. Marketing research, pricing, advertising, branding and packaging. Personal selling and sales force Management .Modern marketing system (digital Mastering□marketing) Email Marketing, Social Media Marketing, Web Marketing, Google (Google Analytics, Advertising and Applications), Facebook, LinkedIn, Twitter, Guides & Directories, Online Publications etc for sales, customer services, staff recruitment etc, Blogging and Micro Blogging Event Management, Online Payments, Disability Web Access, Surveys & Forms, Affiliate & Voucher Marketing, Crowd sourcing, Mobile Social Media (Geotagging etc) and Mobile Marketing, Mobile Applications (Apps and Mobile Web), Audio , Video podcasting. Introduction to supply chain management and customer relationship management

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
T3	Jenniffer Greene, Andrew Stellman,	Head First	PMP 3rd Edition OREILLY Publication
T4	Phillip Kotlar	Marketing Management	The Millennium Edition, PHI EEE Edition
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		

Advance Processor

Course Title: Embedded Processor		**Course Number: 304191**	**Course Name:C312**
Year: TE		**Semester: II**	
Designation of Course		Professional Core	
Teaching Scheme: 4 Hrs/Week		**Laboratories:** 2 Hrs/Week	
Course Assessment Methods	**Direct methods**	In-sem Examination: 30 Marks	Theory/End Semester Examination: 70 Marks
		Term-work	Practical
	Indirect Methods	Assignments, Presentations Continuous assessment	Q&A session, Group Discussion
Prerequisites	Basics of Microcontroller and Embedded C		
Course Objectives			
1	To understand need and application of 32 bit ARM Microprocessors in embedded system.		
2	To study architecture and features of typical ARM7 and to learn the difference between ARM 7, ARM 9 and ARM 11.		
3	To learn interfacing of different Input and Output devices with ARM 7.		
4	To learn different communication protocols to interface peripherals with ARM 7.		
5	To study features and the architecture of ARM CORTEX-M3.		
6	To understand the need of operating system in Embedded System Design		
7	To learn on chip communication protocol controllers in ARM CORTEX-M3and interfacing of real world peripheral devices.		
Course Outcomes	After successfully completing the course students will be able to		
CO1	Summarize the features and architecture of 8 bit, 16 bit microcontrollers.		
CO2	Compare RISC and CISC architecture and explain and features the architecture of 32 bit ARM Processor core.		
CO3	Explain the architecture of ARM7 based controller LPC 2148, LPC 2368 and ARM CORTEX M3 based controller LPC 1768.		
CO4	Make use of IDEs and tools like emIDE, Triton IDE and Flash Magic to experiment interfacing of on-chip and off-chip peripherals to ARM7 and CM3.		
CO5	Develop I2C and SPI Protocol to interface EEPROM and SD Card.		
CO6	Learn to implement CAN Bus protocol and Ethernet protocol to LPC 1768. Evaluate and compare the programming methods used in LPC 2148, LPC 2368 and LPC 1768.		
Course Contents			
Unit-I	**ARM7, ARM9, ARM11 Processors**		
	Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, ARM7 data flow model, programmer's model, modes of operations, Instruction set, programming in assembly language.		
	Practical		
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, interfacing with LED, LCD, GLCD, KEYPAD.		
	Practical		
	Interfacing LPC2148 to LCD/GLCD		
	GLCD interfacing with LPC2148		
Unit-III	**Real World Interfacing with ARM7 Based Microcontroller**		
	Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC for waveform generation.		
	Practical		
	UART Interfacing LPC2148 in embedded system (GSM/GPS)		
	Interfacing LPC2148 for internal ADC on interrupt basis		
	Interfacing SD card to LPC2148		
	Interfacing EEPROM to LPC2148 using I2C protocol		
Unit-IV	**ARM CORTEX Processors**		
	Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Need of operating system in developing complex applications in embedded system, desired features of operating system & hardware support from processor, Firmware development using CMSIS standard for ARM Cortex. Survey of CORTEX M3 based controllers, its features and comparison.		
Unit- V	**ARM CORTEX M3 based Microcontroller**		
	ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), System Control, Clock & Power Control, GPIO, Pin Connect Block, interfacing with RGB LED, Seven Segment, TFT Display, MOTOR control using PWM		
	Practical		
	Interfacing LPC1768 to Seven Segment / RGB LED		
	Generation of PWM signal for motor control using LPC1768		
	Interfacing TFT display to LPC1768		
Unit-VI	**Real World Interfacing with ARM-CM3 Based Microcontroller**		
	Concept of USB, CAN, and Ethernet based communication using microcontrollers. CAN, USB, ETHERNET applications in embedded c.		
	Practical		
	Implementing CAN protocol using LPC1768		
	Implementing ETHERNET protocol using LPC1768		
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	Joseph Yiu	"The Definitive Guide to the ARM Cortex-M", Newness,	ELSEVIER

Reference Books			
R1	LPC 214x User manual (UM10139) :- www.nxp.com		
R2	LPC 17xx User manual (UM10360) :- www.nxp.com		
R3	ARM architecture reference manual : - www.arm.com		
R4	Trevor Martin	,"An Engineer's Introduction to the LPC2100 series",	Hitex (UK) Ltd.
Self-Learning Facilities (OCW, Handouts, Web Recourses, Research papers etc.)	NPTEL Lecture Series VLAB sessions		
Contents beyond Syllabus	Learning KEIL compiler for Assembly language programming Learning additional device LPC 2368		
Additional Experiments	LED interfacing with LPC2148 Learning LPC 2368 and Implementing some practicals using LPC2368. Using KEIL execute simple assembly language programs.		
Bridging Courses	Arranging Guest lecture on ARM CORTEX-M3		
Assignments	**Theory :**		
1	Draw and explain the ARM core dataflow model. What is little-endian and big-endian? Explain the format of CPSR of ARM processor		
2	Write down pin description of 16X2 LCD used in the Experiment Explain PINSEL registers in LPC 2148. Explain PLL and VPB Divider of LPC 2148.		
3	Explain the ADCR in detail. What value to be loaded in ADCR for following specification a. ADC port pin: AD0.1 i.e. Channel 1 of ADC0 b. Desired ADC clock = 3 MHz c. Desired Precision = 11 bits d. Immediate start What is necessity of Vectored Interrupt Controller? Explain the working of VIC in LPC2148		
4	What is significance of repeated start condition in I2C protocol? How repeated start condition isgenerated in LPC2148. Explain the start condition and stop condition of I2C Protocol. How start and stop conditions aregenerated in LPC2148.		

	List the SFRs used in I2C Communication. Show the steps to generate 100 KHz I2C clock.
5	List the Features of UART0. What is special utility of UART0? What is difference betweenUART0 and UART1? Explain in brief the registers TCR, TC, CTCR, PC, and PR. Explain the steps to generate the delay of 500ms using timer when PCLK = 15Mhz. What is need of prescaler? Explain the working of timer prescaler in LPC2148?
6	State features of LPC1768 micro controller Explain in detail w.r.t. LPC1768 Different power control modes Different Oscillators NVIC
7	List the Features of on chip PWM in LPC 1768 Explain the PWM registers w.r.t. to their significance
	Practical :
1	Execution of Assembly language program for addition, subtraction , multiplication and division of two 32 bit numbers.
Tutorials	NIL
Presentations	Interfacing of LCD with LPC 2148 by students
	Interfacing of Keyboard with LPC 2148 by students
	SPI and I2C Protocol by Students

System Programming & Operating Systems

Course Title: System Programming & Operating Systems		**Course Number:**304185	**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		

Mini Project and Seminar

Course Title: Mini Project and Seminar		**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	To understand 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	Thomas C Hayes, Paul Horowitz	The Art of Electronics	Newens Publication
T2	Jim Williams (Editor)	Analog Circuit Design: Art, Science and Personalities,	EDN series for Design Engineers,
T3	M Ashraf Rizvi	Effective Technical Communication	Tata McGraw Hill Education Pvt. Ltd.
Reference Books			
R1	Robert Boylested	Essentials of Circuit Analysis	PHI Publications
R2	Meenakshi Raman, Sangeeta Sharma,	Technical Communication, Principles and Practice	Oxford University Press
R3	A.E. Ward, Angus	Electronic Product Design	Stanley thornes Publishers, UK
R4	C Muralikrishna, Sunita Mishra	Communication Skills for Engineers	Pearson
Self-Learning	Literature survey and identifying the problem statement using IEEE explorer For component selection various websites of IC Manufacturers		

Material (OCW, Handouts, Web Recourses, Research papers etc.)	www.microchip.co, www.ti.com,www.adi.com 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	Nil
Additional Experiments (If any)	Nil
Bridging Courses	PCB design Guidelines workshop
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)
Tutorials	Nil
Presentations	Layout Tool: Hand's-on on Proteus 7