FACULTY OF ENGINEERING

Savitribai Phule Pune University

Structure for the

T.E (Electronics Engineering)

(2015 Course)

(w.e.f . June 2017)

Savitribai Phule University of Pune, Pune

Third Year Electronics Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester I												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credits**	
		Theory	**Tutorial**	**Practical**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH+TUT**	**PR/OR/TW**
304201	Power Electronics and Applications	3		--	30	70	--	--	--	100	3	--
304202	Instrumentation Systems	3	--	--	30	70	--	--	--	100	3	--
304203	Electromagnetics and Wave propagation	3	1	--	30	70	--	--	--	100	4	--
304204	Microcontrollers and Applications	3	--	--	30	70	--	--	--	100	3	--
304205	Data Communication	3	--	--	30	70	--	--	--	100	3	--
304211	Instrumentation and Power Electronics Lab	--	--	4	--	--	50	50	--	100	--	2
304212	Microcontroller and Data Communication Lab	--	--	4	--	--	50	50	--	100	--	2
304213	Electronics System Design Practice	2	--	2	--	--	--	--	50	50	2	1
	Audit Course 3	--	--	--	--	--	--	--	--	--	----	
	Total	17	1	10	150	350	100	100	50	750	18	5
										Total Credits	**23**	

Third Year Electronics Engineering (2015 Course)

(With effect from Academic Year 2017-18)

Semester II												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credit**	
		Theory	**Tutorial**	**Practical**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH+TUT**	**PR /OR/TW**
304206	DSP and Applications	3	--	--	30	70	--	--	--	100	3	--
304207	Embedded Processors	4	--	--	30	70	--	--	--	100	4	--
304208	Business Management and Organization	3	--	--	30	70	--	--	--	100	3	--
304209	Fundamentals of HDL	3	--	--	30	70	--	--	--	100	3	--
304210	PLC and Applications	3	--	--	30	70	--	--	--	100	3	--
304214	Embedded and DSP Lab	--	--	4	--	--	50	50	--	100	--	2
304215	PLC and HDL Programming Lab	--	--	4	--	--	50	50	--	100	--	2
304216	Mini Project	2	--	2	--	--	--	--	50	100	2	1
	Audit Course 4	--	--	--	--	--	--	--	--	--		
	Total	18	---	10	150	350	100	100	50	750	18	5
										Total Credits	**23**	

Power Electronics & Applications (304201)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To understand construction, switching characteristics and protection of power devices
- To understand protection circuits and triggering circuits for power devices.
- To give an exposure to students of working & analysis of controlled rectifiers, inverters, choppers, AC voltage controllers for different loads.

Course Outcomes:

After successfully completing the course students will be able to

- Understand basic principle of power conversion.
- Design & implement a triggering / gate drive circuit for a power device
- Design & implement protection circuits for power devices.
- Understand, design & analyze different Power electronics converters.
- Utilize power converters in different industrial applications.

Perquisites:

Three phase supply: 3 phase 3 wire connection, 3 phase 4 wire connection ,single phase supply, DC supply and their measurement, Power factor and its significance. **1L**

Unit I: Overview of Power Electronics and Power Devices 8L

Power Electronic System: Power Electronics Versus linear electronics, scope and applications, Interdisciplinary nature of power electronics, classification of power converters

Power MOSFET: Construction, Operation, Static characteristics, switching characteristics, Breakdown voltages, Safe Operating Area, applications **IGBT:** Construction, Operation, Steady state characteristics, Switching characteristics, Safe operating area, applications, Base drive circuits, for Power MOSFET / IGBT. **SCR:** Construction, Operation & characteristics, two transistor analogy, different ratings, **TRIAC:** Construction, Operation & characteristics, applications.

Unit II: Gate drive circuits and Protection circuits for Power Devices 7L

Gate drive Circuits for SCR/TRIAC: Need, requirements, Isolation of Gate and base drives using pulse transformers and opto-coupler, Synchronized UJT triggering for SCR, triggering of SCR/TRIAC using dedicated triggering ICs, TRIAC triggering using DIAC. Typical Gate drive circuits for Power MOSFET / IGBT**.** Microprocessor based control circuits for power electronics applications.

Protection circuits for Power Devices: Cooling and heat sinks. Snubber circuits, reverse recovery transients, supply and load side transients. Voltage protection by selenium diodes and MOVs. Current protections – fusing, fault current with AC source, fault current with DC source.

Unit III: AC-DC power converters **7L**

Uncontrolled and controlled rectifiers need and applications Single phase Semi & Full converters for R, R-L loads, Concept of line & forced commutation, Effect of freewheeling diode, Performance parameters, Three phase Semi & Full converters for R and RL load. Design of Control circuit for single phase and three phase controlled rectifiers, Applications of controlled rectifiers.

Unit IV: DC-AC Converters & AC Voltage Controller **7L**

DC-AC Converters: Single phase full bridge inverter for R & R-L loads, performance parameters, three phase voltage source inverter for balanced star R load. Variable frequency control of three phase inverters, Need of PWM inverters. Voltage control of Inverters using PWM, three phase PWM inverters. Design of control circuit design for three phase inverters, PWM ICs. **AC Voltage Controller:** Single phase AC voltage controller with R load.

Unit V: DC-DC converters **7L**

DC-DC converters: Working principle of step down chopper for R-L load, control strategies. Performance parameters, Buck converter, Buck-Boost converter, 2-quadrant & 4-quadrant choppers, Applications of choppers, SMPS. Buck regulator e.g. TPS54160, Switching Regulator and characteristics of standard regulator ICs – TPS40200, Low Drop out (LDO) Regulators ICs-TPS 7A4901.

Unit VI: Power Electronics Applications **6L**

HVDC transmission system. UPS: ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Power Electronics in Battery Charging Applications, Power

Electronics in Induction heating, Electronic lamp ballast. Power Electronics for Electric drive applications: Overview of electric drive system, Classification of drives, Selection of power converters for different drive applications (introductory level only).

Text Books:

1. M H Rashid, "Power Electronics – circuits, devices and applications", 3rd edition, Pearson Education.
2. Power Electronics, M.D. Singh & K.B.Khanchandani, TMH
3. Ned Mohan, T. Undeland & W. Robbins, "Power Electronics Converters applications and design" 2nd edition, John Willey & sons, Singapore

Reference Books:

1. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi. 6. Nagrath Kothari, "Electrical Machines", TMH.
3. U. R. Moorthi, "POWER ELECTRONICS, DEVICES, CIRCUITS & INDUSTRIAL APPLICATIONS" , Oxford University Press, New Delhi, 2005

Instrumentation Systems (304202)
Credits: TH-03

Teaching Scheme:	**Examination Scheme**:
Lectures: 3 Hrs/ Week	In Semester Assessment: 30 Marks
	End Semester Examination: 70 Marks

Course Objectives:

- Explain the operation/working of different sensors
- To get fundamental knowledge of sensors and transducers and their operating principles, for measurement of mechanical parameters.
- To impart interdisciplinary knowledge regarding transducers, pneumatic actuators, hydraulic actuators.
- Describe advantages, disadvantages, and applications of limit switches, photoelectric sensors, inductive sensors, capacitive sensors, and ultrasonic sensors
- Transform a temperature reading among different scales.
- Explain the operation of pressure, flow, and level transducers in context with applications.
- Understand the concept of final control elements in various applications

Course Outcomes:

After successfully completing the course students will be able to:

- Applications and selection of sensors/transducers for particular application.
- Describe the various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors.
- Select appropriate transducers and instrumentation system components for a specific application.
- Design and development of temperature/pressure/flow etc measurement systems.
- Select appropriate Switches and final control elements for a specific application.

Unit I : Fundamentals of Sensors & Transducer **6L**

Definitions sensors & transducer, Classification of sensors & transducers, Sensor systems, Performance & Terminology: Range/Span, Errors & Accuracy, Non linearity, Dead band & saturation, output impedance, repeatability, reliability, Sensitivity, Resolution, Frequency response, Response time, Calibration. Advantages, disadvantages & applications of sensors & transducers, Block diagram & description of Instrumentation system,

Unit II: Temperature & Chemical sensors 6L

Temperature: Resistance temperature detectors, thermistors, thermocouples and pyrometers. Acoustics sensors, Semiconductor temperature sensing – LM75 block diagram, temperature compensated integrated phototransistor, Signal conditioning circuit for RTD & Thermocouple, Humidity Sensor. Interfacing technique of Temperature sensors with microcontroller.
Chemical sensors: classes of chemical sensors, Characteristics of chemical sensors, biochemical sensors, electronics noses.

Unit III: **Flow and Level Sensing 6L**

Flow: Bernoulli Equation, Differential head type flow meters (orifice, venture tube and flow nozzle), Pitot static tube, Variable area type flow meter – rotameter, vortex shedding, electromagnetic, ultrasonic flow meters. open channel flow measurement – anemometers.
Level: Float, DP Cell, chain balanced float type, Ultrasonic, Capacitance probe type, Hydrostatic pressure and Nuclear level detection techniques.

Unit IV: **Motion, Light & Radiation Detectors 6L**

Motion detectors: Ultrasonic, capacitive detectors, LVDT, optoelectronics motion sensors, Acceleration sensors – Accelerometer characteristics, capacitive accelerometers, Piezoelectric accelerometer, Piezoresistive accelerometer, thermal accelerometer. Tachometers – Optical tachometer, rotary detectors.
Light & Radiation detectors : Photo diodes, photo transistor, CCD, CMOS image sensors – advanced APD sensors, gas flame detectors, Radiation detectors – ionization detectors,

Unit V : **MEMS & Smart sensors 6L**
Magnetic field sensors – Hall effect and magneto-resistive elements (MRE), magneto-transistors, piezoelectric (PZT) sensors and actuators. Microelecromechanical systems (MEMS) - Bulk micromachining, micro-machined absolute pressure sensor, Surface
Micromachining-Hot wire anemometer micro-miniature temperature sensor, surface micro machined accelerometer and SMART sensors.

Unit VI : Actuators and Final Control Elements 6L
Pneumatic and hydraulic actuators- Directional control valves, Pressure control valves, Cylinders, Process control valves - Electrical actuators- Mechanical switches, Solid state switches, Solenoids, DC motors, AC motors and Stepper motors.

Text Books

1. W. Bolton; " Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering "; Pearson Education; 3rd Edition
2. William C. Dunn , "Introduction to Instrumentation, Sensors, and Process Control" , Artech House Sensors Library.

Reference Books

1. Curtis Johnson; " Process Control Instrumentation Technology "; Prentice Hall of India Pvt. Ltd.;7th Edition
2. Ernest O. Doebelin; "Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
3. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill
4. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition.

Electromagnetics and Wave Propagation (304203)

Credits: TH- 03+ TUT-01

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/ Week	In Semester Examination: 30 Marks
Tutorial: 1 Hr / Week	End Semester Examination: 70 Marks

Course Objectives:

- To study the basics of Electrostatics and Magnetostatics with their applications.
- To understand the Time Varying Fields and Maxwell's Equations.
- To interpret the given electromagnetic problem and solve it using Maxwell's Equations.
- To analyze the wave propagation in different media using wave equation**.**
- To study the effect of different parameters on wave propagation.

Course Outcomes:

After successfully completing this course, students will be able to

- Apply the basics of Electrostatics and Magnetostatics in different applications.
- Interpret the given electromagnetic problem and solve it using Maxwell's Equations.
- Formulate the wave equation and solve it for uniform plane wave in different media.
- Explain the effect of different parameters on wave propagation.

Unit I: Basic Electrostatics **8L**

Coulomb's Law & Electric Field Intensity, Electric Field due to Point Charge & Continuous Charge Distributions, Electric Flux Density, Gauss's Law and its Applications, Divergence & Divergence Theorem, Electric Potential, Relationship between E & V, Potential Gradient, Electric Dipole and Flux Lines.

Unit II: Applied Electrostatics **8L**

Energy Density in Electrostatic Field, Current and Current Density, Continuity Equation, Polarization in Dielectrics, Capacitance, Parallel Plate, Spherical and Cylindrical Capacitors with Multiple Dielectrics, Boundary Conditions, Poisson's and Laplace's Equations, General Procedures for Solving Poisson's and Laplace's Equations, Application Note – Lightning.

Unit III: Magnetostatics & Applications **8L**

Biot-Savart's Law, Ampere's Circuit Law and its Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Derivation of Biot-Savarts Law and Ampere's Law using Concept of Magnetic Vector Potential, Forces due to Magnetic Fields, Magnetic

Dipole, Classification of Magnetic Materials, Magnetic Boundary Conditions, Application Note – Magnetic Levitation.

Unit IV: Time Varying Fields and Maxwell's Equations 8L

Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations in Point Form and Integral Form, Time-Varying Potentials, Time Harmonic Fields, Maxwell Equations in Phasor Form, Boundary Conditions for Time varying Field.

Unit V: Plane Waves 8L

Wave Equation, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Free Space & Good Conductors, Electromagnetic Power and Poynting Theorem, Polarization of Wave: Linear, Circular & Elliptical, Reflection of a Plane Wave at Normal Incidence & Oblique Incidence.

Unit VI: Wave Propagation 8L

Fundamental Equation for Free-Space Propagation, Modes of Propagation: Ground, Sky & Space Wave Propagations, Structure of Atmosphere, Characteristics of Different Ionized Regions, Effect of Earth's Magnetic Field & Curvature on Wave Propagation, Virtual Height, MUF, Skip Distance, Multi-Hop Propagation, Duct Propagation, Characteristics of Wireless Channel: Fading, Multipath Delay Spread, Coherence Bandwidth and Coherence Time.

Text Books

1. Matthew N. O. Sadiku, "Principles of Electromagnetics", 4th Edition, Oxford University Press.
2. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi.

Reference Books

1. Edminister J. A, "Electromagnetics", Tata McGraw-Hill.
2. Hayt & Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill.
3. John D. Kraus, "Antenna & Wave Propagation", 4th Edition, McGraw Hill.
4. Vijay K. Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

Microcontrollers and Applications (304204)

Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To understand the applications of Microprocessors & Microcontrollers.
- To understand need of microcontrollers in embedded system.
- To understand architecture and features of typical Microcontroller.
- To learn interfacing of real world input and output devices
- To study various hardware & software tools for developing applications

Course Outcomes:

After successfully completing the course students will be able to

- Learn importance of microcontroller in designing embedded application
- Describe the 8051 & PIC18FXX microcontroller architectures and its feature.
- Develop interfacing to real world devices
- Learn use of hardware & software tools

UNIT I: Introduction to microcontroller Architecture 8L

Microprocessor and microcontroller comparison, advantages & applications. Harward & Von Neumann architecture, RISC & CISC processors. Role of microcontroller in embedded system. Selection criteria of microcontroller.

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: Interfacing-I 6L

Software and Hardware tools for development of microcontroller based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Logic Analyzer.

Interfacing LED with and without interrupt, Keypads, Seven Segment multiplexed Display, LCD, ADC Interfacing. All Programs in assembly language.

Unit III: Interfacing-II **6L**

Interfacing of DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Opto-isolators, Design of DAS and Frequency counter. All programs in assembly

Unit IV: PIC Microcontroller Architecture **6L**

PIC 10, PIC12, PIC16, PIC18 series comparison, features and selection as per application. PIC18FXX architecture, registers, memory Organization and types, stack, oscillator options, BOD, power down modes and configuration bit settings, timer and its programming. Brief summary of Peripheral support, Overview of instruction set, MPLAB IDE & C18 Compiler.

Unit V: Real World Interfacing Part I **6L**

Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18F with SFRS. Interfacing of switch, 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.

Unit VI: Real World Interfacing Part II **6L**

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.

Text Books

1. Mazidi, 8051 microcontroller & embedded system 3rd Edition ,Pearson
2. Mazidi, PIC microcontroller & embedded system 3rd Edition ,Pearson

Reference Books

1. 18F xxx reference manual www.microchip.com
2. I2C, EEPROM, RTC data sheets from www.ti.com

Data Communication (304205)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To provide an in-depth introduction to all aspects of data communication system.
- To define different data formats for better data transmission.
- To introduce various digital baseband and bandpass modulation schemes.
- To identify the need of data coding and error detection/correction mechanism.
- To provide knowledge of various multiplexing schemes.

Course Outcomes:

After successfully completing the course, students will be able to

- Define and explain terminology of data communications
- Understand the impact and limitations of various modulation techniques.
- Get exposure to entropy and other coding techniques.
- Identify and explain error detection and correction using appropriate techniques.
- Design of data communication system.
- To acknowledge the need of spread spectrum schemes.

Unit I: Data Transmission Fundamentals 8L

Data transmission concepts and terminology, analog and digital data transmission, Transmission modes (simplex, half duplex, full duplex), Transmission Impairments and Channel Capacity, transmission media : Guided (UTP, STP, Optical, coaxial) & wireless(Radio wave, Microwave, Infrared), Data Transmission(parallel and serial-synchronous and asynchronous transmission), analog and digital signal properties, Bandwidth, bit rate, baud rate data rate limits, Connecting devices: Hubs/Repeaters, Switches, Bridges, Routers, Layered Architecture (OSI Model), ISDN

Unit II: Error Control Coding 8L

Linear block codes, Hamming code, Hamming distance, CRC, syndrome detection, convolution code, trellis diagram, coding gain, Veterbi algorithm for detection

Error control systems: FEC, ARQ Stop and Wait, Hybrid ARQ, go back N, selective repeat.

Unit III: Information Theory 6L

The concept of Information, Information rate, entropy, mutual information, channel capacity, Bandwidth-SNR tradeoffs, use of orthogonal signals to achieve Shannon's limit.

Entropy coding: overview of BSC, Huffman coding, Shannon-Fano coding, code efficiency, channel through put.

Unit IV: Baseband Signal Encoding 8L

Block Diagram of Digital Communication System, Digital Versus Analog Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, DM, ADM, DPCM and applications,

Basic line codes: RZ, NRZ, Unipolar, Polar, Bipolar, AMI, Manchester: properties and comparison; Multilevel line codes: MLT3, 2B1Q.

Unit V: Bandpass Digital Signalling 8L

Generation, detection, signal space diagram ASK, FSK, PSK, QPSK, OQPSK, QAM schemes, comparison.

M-ary signalling: MPSK, MFSK signalling, OFDM.

Unit VI: Multiple Access Techniques 6L

Introduction to Multiple Access Techniques – TDMA, FDMA, CDMA Spread spectrum techniques DSSS and FHSS, introduction to orthogonal codes and their properties; suitable example of orthogonal code and its autocorrelation, random access, Pure and slotted ALOHA, Media access control protocol (CSMA)

Text Books

1. Bernard Sklar, Digital Communication,2/E, Pearson Education India, 2009
2. Willam Stallings, Data and Computer Communications,8/E, Pearson, 2007

Reference Books

1. Behrouz A. Forouzan, Data Communications and Networking, 4/E, McGraw-Hill, 2006
2. Leon W. Couch II, Digital and Analog Communication Systems, 6/E, Pearson Education Asia, 2002
3. Taub Schilling, Principals of Communication Systems, 2/E, Tata McGraw Hill, 2004
4. John J Proakis, Digital Communications, 3/E, McGraw-Hill Higher Education, 2001
5. Simon Haykin, Digital Communication, 4/E, Wiley,1988

Instrumentation and Power Electronics Lab (304211)
Credits: PR-02

Teaching Scheme:	**Examination Scheme:**
Practical: 4hrs/week	Practical: 50 Marks
	Term work: 50 Marks

Instrumentation Systems

List of Experiments: (Any 8 experiments)

1. Weight measurement using load cell and strain gauges.
2. Measurement of vibration.
3. Liquid level measurement(Capacitance probe/ Ultrasonic/Hydrostatic-any one technique)
4. Measurement of speed of rotation of shaft using optical incremental encoder.
5. Temperature measurement. (RTD signal conditioning with bridge circuit, instrumentation amplifier, ADC and microcontroller)
6. Simulation of temperature measurement experiment with any software's (RTD signal conditioning with bridge circuit, instrumentation amplifier, ADC and microcontroller).
7. Design of signal converters using Electronics/electro-mechanical components (any one out of V/I, I/V, I/P, P/I)
8. Pneumatic cylinder sequencing with simple logic.
9. Data acquisition and analysis using PC.
10. Study of various switches
11. Study of different valves and their characteristics.
12. Study of characteristics of valves

Power Electronics & Applications:

List of Experiments:

1. V-I Characteristics of MOSFET / IGBT
2. V-I Characteristics of SCR & measurement of holding & latching current
3. Triggering circuit for MOSFET / IGBT.
4. Triggering circuit for thyristor (Using UJT or specialised IC)
5. Single phase Semi / Full Converter with R & R-L load
6. Three phase Semi / Full Converter with R load
7. Single-Phase PWM bridge inverter for R load

OR

8. Three-Phase inverter for R load
9. Four quadrant chopper operation

OR

10. Load and Line Regulation of SMPS
11. Simulation of Three phase Semi/Full converter for R and RL load.

OR

12. Simulation of Three phase PWM inverters for R and RL load.

13. Study of DC-DC Buck converter
    a. Analyze the influence of voltage loop feedback compensation on load-transient response of current-mode control TPS54160 buck regulator.
    b. Analyze the way the operating conditions influence the current ripple and voltage ripple of a TPS54160 buck regulator, depending on the type of core material of the inductor and on core saturation

OR

14. With TPS7A4901 study-
    a. Impact of line and load conditions on drop out voltage
    b. Impact of line and load conditions on efficiency
    c. Impact of capacitor on PSRR
    d. Impact of output capacitor on load-transient response

15. Case study of any one of the following: HVDC transmission system, Photovoltaic System, Wind generator system

Microcontroller and Data Communication Lab (304212)
Credits: PR-02

Teaching Scheme:	**Examination Scheme:**
Practical: 4hrs/week	Practical: 50 Marks
	Term work: 50 Marks

Microcontrollers and Applications

List of Experiments:

Experiments 1 and 2 are compulsory. Perform any 8 experiments from 3 to 12.

1) Interfacing LED bank to 8051 microcontroller using timer with interrupt.
2) Interfacing Seven Segment Display to 8051 microcontroller
3) Write a program for interfacing button, LED, relay & buzzer to PIC18FXX 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
4) Display message on LCD without using any standard library function for PIC18Fxx.
5) Interfacing 4X4 keypad and displaying key pressed on LCD OR on HyperTerminal for PIC18Fxx.
6) Generate square wave using timer with interrupt for PIC18Fxx.
7) Serially transfer the data on PC using serial port of PIC18Fxx.
8) Generation of PWM signal from PIC18Fxx for DC Motor control.
9) Interface analog voltage 0-5V to internal ADC and display value on LCD.
10) Using DAC generate various waveforms.
11) Interfacing DS1307 RTC chip using I2C and display date and time on LCD.
12) Interfacing EEPROM 24C128 using SPI to store and retrieve data.

Data Communication

List of Experiments: (Any seven from 1 to 9):

1. Experimental Study of PCM and Companded PCM.
2. Experimental study of Differential Pulse Code Modulation or delta modulation and signal reconstruction
3. Experimental study of basic line codes and Multi level line codes
4. Experimental study of ASK modulation and demodulation
5. Experimental study of PSK modulation and demodulation
6. Experimental study of FSK modulation and demodulation
7. Experimental study of QPSK and OQPSK modulation and demodulation
8. Design of PN sequence generator.
9. Experimental study of generation and detection of Spread Spectrum System (DSSS)

Software Assignments: (Any two from 10 to 12):

10. Implementation of linear block code
11. Implementation of Convolution code and Viterbi algorithm
12. Implementation of Shannon Fano and Huffman codes

Electronics System Design Practice (304213)
Credits: TH- 02+OR-01

Teaching Scheme:
Lectures: 2Hrs/ Week
Practical: 2Hrs/Week

Examination Scheme:
Oral: 50 Marks

Course Objectives:

- To teach the student, the art of applying basic concepts for designing electronic systems
- To imbibe good design practices for robust design of electronic systems
- To highlight the importance and significance of customer specifications/requirements
- To teach electronic circuit function verification with an EDA tool
- To create an interest in the field of electronic design as a prospective career option

Course Outcomes:

After successfully completing the course students will be able to

- Shall be able to understand and interpret the specifications
- Shall be able to select optimal design topologies
- Shall be able to interpret datasheets and thus select appropriate components and devices
- Shall be able to use an EDA tool for circuit schematic and simulation
- Shall be able to design an electronic system/sub-system and validate its performance by simulating the same

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Unit I: Design of Linear Power Supply & SMPS **6L**

Typical specifications, Concept of ideal power supply & Voltage regulation, Rectifier and filter design, Heat-sink selection, Three terminal IC regulator & Variable Regulator.

SMPS: Advantages of SMPS, Basic concept of switching regulator, Basic topologies, Step down converter, Step up converter, Polarity inverter, Filter capacitor and inductor.

Unit II: Design of Data Acquisition Systems (DAS) **6L**

Need of DAQ, Block diagram of DAQ, Application Areas of DAQ, Performance parameters of DAQ, Selection of Sensor, Transducers, and Actuator, Interfacing of sensor, Need of signal conditioners, Design of signal conditioning circuits, Selection criteria for ADC and DAC, Selection Criteria of Microcontrollers, RS-232 PC Interfacing using serial communication, Overview of storage interface (like SD-Card, Serial EEPROM), LCD Display interfaces

Unit III: Design of Electronics System 5L

Design of Solar Power System: Load Power Calculations & Component Selection & design, Solar Panel Selection, Battery Types & Selection Criteria, Charge Control unit Design, Buck/Boost Convertor Design.

Unit IV: Design using Internet of Things 6L

IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee, Bluetooth , Bluetooth Low Energy , Adding Wi-Fi capability to the Microcontroller , Wi-Fi MCUs (e.g., CC3200).

Unit V : PCB Design 4L

Types of PCB, PCB artwork components (pads, vias, tracks, footprints) and their metrics, Netlists, Power planes, High frequency considerations, Power considerations, Design Artwork (double sided PTH), Carry out signal integrity analysis.

List of Assignments:

Note:

• Students are expected to complete FOUR assignments during the semester.

• Paper design should be functionally verified with an appropriate EDA tool (NI Multisim / Orcad / Pspice / open source)

• Specifications should be different for different group of students

• Documentation shall consist of:

- Problem statement
- Specifications
- Block Diagram
- Detailed circuit diagram (separate sheet Imperial /Half Imperial size)
- Calculations
- Component selection
- Calculations using the selected component values
- Simulation results (partial simulations , in the case where models are not available)
- Component List
- Conclusion
- Datasheets]

Assignment 1:

A) Design of Linear Power Supply:

– Single Polarity (Fixed, Display)

- Dual Polarity (Fixed, Display)
- Variable Polarity (display)

B) Design of Switched Mode Power Supply

– Single polarity, multiple outputs (Buck/Boost/Flyback)

Note:

- Heat-sink design is mandatory wherever necessary
- Transformer design steps are expected

Assignment 2: Design of Data Acquisition System

- Multi-channel data acquisition systems
- Serial communication
- RTC interface, LCD display,
- DC motor driver, relay driver

Note:

• Sub-circuit designs are also expected except for power supply sub-system

• Micro-controller programming is expected (cross-compiler/assembly language)

Assignment 3: Design IoT applications using Raspberry Pi / equivalent.

Assignment 4: Design of Solar Power System for any particular application: e.g. Home applications, Water pumping applications.

Reference Books

1. Practical design of power supplies" , Ron Lenk, John Wiley & Sons, 2005, ISBN: 978-0-08-097138-4
2. "Intuitive Analog Circuit Design A Problem-Solving Approach using Design Case Studies", Marc T. Thompson, Elsevier Inc, 2006,ISBN-10: 0-7506-7786-4
3. "Linear Circuit Design Handbook", Hank Zumbahlen, Elsevier Inc, 2008 , ISBN 978-0-7506-8703-4
4. "The Circuit Designer's Companion", Peter Wilson, Elsevier Ltd, 2012
5. "Switching Power Supply Design," 3E, Abraham I. Pressman et. al, McGraw-Hill, 2009
6. "Measurement, Instrumentation, and Sensors Handbook", John G. Webster, CRC Press, 1999
7. "Electronic Filter Design Handbook", 4E, Arthur Williams, Fred Taylor, McGraw-Hill, 2006

Semester II

DSP and Applications (304206)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To understand the digital signal processing, sampling and aliasing.
- To introduce students with transforms for analysis of discrete time signals and systems.
- To use and understand implementation of digital filters.
- To understand concept of sampling rate conversion and DSP processor architecture

Course Outcomes:

After successfully completing the course students will be able to,

- The student will be capable of calibrating and resolving different frequencies existing in any signal.
- The student will be in position to understand use of different transforms and analyze the discrete time signals and systems.
- The student will realize the use of LTI filters for filtering different real world signals.
- The student will be in a position to design and implement multistage sampling rate converter.

Unit I: DSP Preliminaries **6L**

Sampling, DT signals, sampling theorem in time domain, sampling of analog signals, recovery of analog signals, and analytical treatment with examples, Concept of Multirate DSP, Sampling rate conversion by a non-integer factor, Design of two stage sampling rate converter, mapping between analog frequencies to digital frequency, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

Unit II: Discrete Fourier Transform **8L**

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.

Unit III: Z transforms 6L

Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and 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.

Unit IV: IIR filter design 8L

Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by approximation of derivatives, , IIR filter design by impulse invariance method, Bilinear transformation method, warping effect. Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design.

Unit V: FIR filter design 6L

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. FIR filters realization using direct form, cascade form and lattice form, Finite word length effect in FIR filter design.

Unit VI: DSP Applications 6L

General Architecture of DSP, Issues involved in DSP processor design– speed, cost, accuracy, pipelining, parallelism, quantization error, etc Overview of DSP in real world applications such as Digital crossover audio systems, Interference cancellation in ECG, Compact disc recording system, Vibration signature analysis for defective gear teeth, Implementation of Triggering for Converter, D.C.Motor Control, AC Phase Control, Proportional Control.

Text Books

1. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing: Principles, Algorithms and applications” Fourth edition, Pearson Prentice Hall.
2. S. Salivahanan, C. Gnanpriya, “Digital Signal processing”, McGraw Hill

Reference Books:

1. Ifaeachor E.C, Jervis B. W., “ Digital Signal processing : Practical approach”, Pearson publication
2. Dr. Shaila Apte, “Digital Signal Processing” Wiley India Publication, second edition

3. K.A. Navas, R. Jayadevan, “Lab Primer through MATLAB”, PHI
4. Li Tan, Jean Jiang, “Digital Signal Processing: Fundamentals and applications“ Academic press

Embedded Processors (304207)

Credits: TH-04

Teaching Scheme:
Lectures: 4 Hrs/ Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To understand need and application of ARM Microprocessors in embedded system.
- To study the architecture of ARM series microprocessor
- To understand architecture and features of typical ARM7& ARM CORTEX-M3 Microcontroller.
- To learn interfacing of real world input and output devices
- To learn MSP430 Microcontroller and low power features.

Course Outcomes:

After successfully completing the course students will be able to

- Describe the ARM microprocessor architectures and its feature.
- Interface the advanced peripherals to ARM based microcontroller
- Design embedded system with available resources.
- Design simple applications using MSP430

Unit I: MSP430 Microcontroller Architecture and Low Power Features 8L

Low Power 16-bit MSP430x5xx microcontroller architecture, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power; reliability.

Unit II: Real World Interfacing 6L

GPIO programming and I/O multiplexing; Interrupts and interrupt programming. Watchdog timer. Timers & Real Time Clock (RTC), PWM control. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA. Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and

I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

Unit III: ARM7 **7L**

Introduction to ARM processors and its versions. ARM7, ARM9 & ARM11 comparison, advantages & suitability in embedded application. ARM7 data flow model, programmer's model, modes of operations, Instruction set.

Unit IV: ARM7 Based Microcontroller **7L**

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, KEYPAD.

Unit V: Real World Interfacing with ARM7 Based Microcontroller **7L**

Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SD card interface using SPI, on-chip DAC for waveform generation.

Unit VI: ARM CORTEX Processors **7L**

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.

Text Books:

1. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN- 13: 978-0750682763
2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER
3. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER

Reference Books:

1. LPC 214x User manual (UM10139) :- www.nxp.com
2. LPC 17xx User manual (UM10360) :- www.nxp.com
3. ARM architecture reference manual : - www.arm.com
4. Trevor Martin, "An Engineer's Introduction to the LPC2100 series", Hitex (UK) Ltd.
5. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880

6. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
7. http://processors.wiki.ti.com/index.php/MSP430_16Bit_UltraLow_Power_MCU_Training

Business Management and Organization (304208)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination: 70 Marks

Course Objectives:

- To provide a basis of understanding to the students with reference to working of business organization through the process of management.
- Understanding of business concepts with a view to prepare them to face emerging challenge of managing business.

Course Outcomes:

After successfully completing the course students will be able to

- Understand Basic principles of management - will acquaint himself with management process, functions and principles
- Get the idea about new developments in management.
- Understand the basic concepts in commerce, trade and industry. He will be exposed to modern business world.
- Understand modern business practices, forms, procedures and functioning of various business organizations.

Unit I: Introduction 6L

Meaning, scope and evolution of commerce & industry, -Industrial Revolution- its effects. Emergence of Indian MNCs & transnational corporations -Recent trends in business world. Globalization & challenges for Indian Business in new millennium

Unit II: Business sectors & forms of business organizations 6L

private sector, Cooperative sectors, public sector, joint sector, Services sector, Various forms of business organizations – Sole Proprietorship, Partnership firms, Joint stock companies – their features, relative merits, demerits & suitability.

Unit III: Merges, acquisitions & Setting up new enterprises 6L

Mergers in India. Networking, Franchising, BPOs & KPOs, E-commerce, On-line trading, patents, trademarks & copyright, Decisions in setting up an Enterprise – opportunity and idea generation, Role of creativity and innovation, Feasibility study and Business Plan, Business

size and location decisions, various factors to be considered for starting a new unit, Relevant Government Policies - SEZ (Special Economic Zone) policy etc.

Unit IV: Business and Society 6L

Changing Concepts and Objectives of Business, Professionalization, Business ethics, Business and culture, Technological Development and Social Change, Social Responsibility of Business, Social Audit.

Unit V: Principles of Management 6L

Nature of Management: Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management-Administration-Organization, Evolution of Management Thought: Contribution of F.W.Taylor, Henri Fayol ,Elton Mayo, Functions of Management, Strategic Management.

Unit VI: Strategic Management & Recent Trends in Management 6L

Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits, Social Responsibility of Management – environment friendly management Management of Change Management of Crisis Total Quality Management Stress Management International Management.

Text Books:

1. Industrial Engineering & Management by O.P.Khanna
2. Modern Business Organization by S. A. Sherlekar
3. Industrial Organization Management: Sherlekar, Patil, Paranjpe, Chitale

Reference Books:

1. Business organization and Management by Talloo, Tata McGraw Hill
2. Business Environment and Policy – A book on Strategic Management/Corporate Planning by Francis Cherunilam Himalaya Publishing House 2001 Edition
3. Principles of Management, by Tripathi, Reddy, Tata McGraw Hill

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Fundamentals of HDL (304209)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment: Phase I : 30
End Semester Examination: Phase II: 70

Course Objectives:

- To study basic programming in VHDL
- To learn Concepts of Verilog HDL

Course Outcomes:

After successfully completing the course students will be able to

1. Learn the role of HDL in digital system design using latest tools like VHDL and Verilog.
2. Describe and test digital logic circuits in data flow description, structural description, behavioral description and advanced constructs (procedures, tasks, functions) using both VHDL and Verilog.
3. Develop VHDL code to model and simulate basic combinational networks and sequential machines

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Unit I: Introduction to HDL **7L**

Introduction: Why HDL? A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

Unit II: Modelling styles in VHDL **7L**

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements. Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, state Machines

Unit III: Programmable Logic Devices **7L**

Complex Programmable Logic Devices – Architecture of CPLD, Organization of FPGAs, FPGA

Programming Technologies (SRAM, Antifuse), Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs

Unit IV: Procedures and Functions **7L**

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions.

Unit V: Introduction to Verilog HDL **7L**

Program structure, Logic System, Nets, Variables, and Constants, Vectors and Operators, Arays, Logical Operators and Expressions.

Unit VI: Design Elements in Verilog **7L**

Compiler directives, structural design elements, Dataflow design elements, Behavioral design elements (Procedural Code)

Text Books:

1. HDL Programming (VHDL and Verilog)- Nazeih M.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition
2. John F Wakerly, Digital Design- Principles and Practices, Pearson education, 4th Edition

Reference Books:

1. VHDL –Douglas Perry, TMH
2. Stephen Brown & ZvonkoVranesic, Fundamentals of Digital Logic Design with VHDL,Tata McGrw-Hill, New Delhi, 2nd Ed., 2007
3. Verilog HDL –Samir Palnitkar, Pearson Education
4. Fundamentals of Digital Logic with Verilog Design-Stephen Brown, TMH

PLC & Applications (304210)
Credits: TH-03

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment: 30 Marks
End Semester Examination:70 Marks

Course Objectives:

- Ability to recognize industrial control problems suitable for PLC control.
- Overview of Ladder Logic Programming to Program PLC.
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.

Course Outcomes:

After successfully completing the course students will be able to

- Understand concepts of PLC, its uses & applications.
- Develop PLC ladder programs for simple industrial applications.
- Use knowledge of Installation, troubleshooting & maintenance of PLC to provide solution for industrial automation problems.

Unit I : PLC Overview **6L**

Definition & History of PLC, Basic structure & Components of PLC, Principle of Operation, Selection of PLC, Why Use PLC, PLC I/O Modules, Memory & How it is used, PLC advantages & Disadvantages, PLC vs Computers, , Overview of Micro PLCs.
Conventional ladders vs PLC Ladder logic, What is Logic? Overview of Logic functions, Number systems & Codes, Hardwired Logic vs Programmed logic, Programming word level logic instructions, Relation of digital gate logic to contact/coil logic, Relay logic, Relay Sequencers.

Unit II : Basics of PLC Programming -I **6L**

Processor memory organization, PLC Programming languages, Ladder diagrams, Relays, contactors, switches, sensors, output control devices, latching relays, ladder diagram elements. Instructions: Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming. Write ladder logic for a) two switches labelled as A & B are wired in parallel controlling a lamp, where two switches are separate inputs. b) That will cause output, pilot light PL, to be on when selector switch SS is closed, push button PB is closed and limit switch LS is open.

Unit III : Basics of PLC Programming -II 6L

Basic Functions : PLC Timer & Counter functions, Timer & Counter Industrial applications, Arithmetic functions, Comparison functions, Jump functions, Data handling functions, Digital Bit functions, PLC matrix Functions, Advanced PLC Functions: Analog PLC operation, PID control of Continuous processes. Write a PLC program for a) controlling lubricating oil being dispensed from a tank, b) Automatic water sprinkler system of a garden.

Unit IV : PLC Installation, Troubleshooting & Maintenance 6L

Installation : Consideration of operating environment, Receiving test, check & assembly, Electrical Noise, Leaky inputs & outputs, Grounding, voltage variations & surges, Circuit protections & wiring, Program Editing & Commissioning. Troubleshooting: Processor module, Input & Output malfunctions, Ladder logic program. PLC Maintenance.

Unit V : Process control, HMI & SCADA 6L

Types of processes, structure of control systems, on/off control, PID Control, Motion control, SCADA (Supervisory control and data acquisition): Block diagram, RTU (Remote terminal unit), Functions of RTU, MTU (Main terminal unit), functions of MTU, operating interfaces & applications, HMI (Human Machine Interface, Interfacing technique of PLC with HMI.

Unit VI : PLC Networking & Applications 6L

Types of communication interface, Types of networking channels, Advantages of standard industrial network, Serial communication, Industrial network : CAN (Controller area network), Devicenet, Controlnet, Ethernet/IP, Modbus, Fieldbus, Profibus-PA/DP, SCADA (Supervisory control & data acquisition), HMI (Human Machine Interface), Two-axis, three axis robot control with PLC, Examples of some simple automated systems.

Text Books

1. “Programmable Logic Controllers” Frank D. Petruzella, Fourth Edition, McGraw-Hill Education,
2. “Programmable logic controllers & Industrial Automation” Madhuchandra Mitra, Samarjeet Sen Gupta, Fourth reprint 2012. Penram International Pvt.Ltd.

Reference Books

1. "Programmable Logic Controllers, Principles & Applications" John W. Wobb, Ronald A. Rais, Fifth Edition, PHI publishing.
2. "Introduction to Programmable Logic Controllers "Garry Dunning, 3rd Edition, Thomson, Delmar Learning.
3. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education.

Embedded and DSP Lab (304214)
Credits: PR-02

Teaching Scheme:
Practical: 4 Hrs/ Week

Examination Scheme:
Practical: 50 Marks
Term work: 50 Marks

Embedded Processors

List of Experiments:

(5 from each group)

Group A: Experiments using MSP430:

1. Learn and understand how to configure MSP-EXP430G2 digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface). **Exercises:**
    a. Modify the code to make the green and red LEDs blink.
    b. Modify the delay with which the LED blinks.
    c. Modify the code to make the green LED blink.
    d. Alter the code to turn the LED ON when the button is pressed and OFF when it is released.
    e. Alter the code to make the green LED stay ON for around 1 second every time the button is pressed.
    f. Alter the code to turn the red LED ON when the button is pressed and the green LED ON when the button is released.

2. **Usage of Low Power Modes:**

    Configure the MSP-EXP430G2 for Low Power Mode (LPM3) and measure current consumption both in active and low power modes. Use MSPEXP430FR5969 as hardware platform and measure active mode and standby mode current.

    Exercises:

    a) How many Low power modes are supported by the MSP430G2553 platform?
    b) Measure the Active and Standby Current consumption in LPM3 mode for the same application using MSP430F5529

3. **Learn and understand GPIO based Interrupt programming**. Write a C program and associated GPIO ISR using interrupt programming technique.

   Exercises:

   a) Write the code to enable a Timer interrupt for the pin P1.1.
   b) Write the code to turn on interrupts globally.

4. **Implement Pulse Width Modulation** to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.

   Exercises:

   a) Observe the PWM waveform on a particular pin using CRO.
   b) What is the maximum resolution of PWM circuitry in MSP430G2553?
   c) Change the above code to create a PWM signal of 75% duty cycle on particular PWM pin.

5. The main objective of this experiment is to control the on-board, red LED by the analog input from a potentiometer. This experiment will help you to learn and understand how to configure an ADC to interface with a potentiometer.

   Exercises:

   a) Alter the threshold to 75% of Vcc for the LED to turn on.
   b) Modify the code to change the Reference Voltage from Vcc to 2.5V.

6. Learn and understand how to **configure the PWM and ADC modules** of the MSP-EXP430G2 to control the DC motor using external analog input.

   Exercises:

   a) What is the maximum resolution of PWM circuitry in MSP430G2553 and how it can be achieved using program?
   b) Create a PWM signal of 75% duty cycle on particular PWM pin.
   c) Create Switch case code from the example code to run the DC Motor in 3 set of speeds.

7. Configure of Universal Serial Communication Interface (USCI) module of MSP430G2553 for UART based serial communication. The main objective of this experiment is to use UART of the MSP430G2553 to communicate with the computer.

Exercise:

Modify the above code to transmit the set of strings to the serial terminal via UART as shown below:

char str1[]=”MSP430G2553 MCU”
char str2[]= “ Ultra low power mixed signal processing applications”

8. Understand and Configure 2 MSP430F5529 in **master-slave communication mode for SPI protocol.**

Exercises:
a) Which port pins of MSP430 can be configured for SPI communication?
b) What is the data transfer rate supported by MSP430 for SPI communication?

Group B: LPC2148 Based Experiments

9. Interfacing LPC2148 to LCD
10. UART Interfacing LPC2148 in embedded system (GSM/GPS)
11. Interfacing LPC2148 for internal ADC on interrupt basis
12. Interfacing SD card to LPC2148
13. Interfacing EEPROM to LPC2148 using I2C protocol
14. Interfacing LPC2148 to Seven Segment / RGB LED
15. Generation of PWM signal for motor control using LPC2148
16. Interfacing TFT display to LPC2148
17. Implementing CAN protocol using LPC2148

DSP and Applications

List of Experiments:

Instructions:

Note: Experiments 1 to 10 can be performed in any appropriate software like C / MATLAB / Scilab etc. Minimum eight experiments to be performed. Experiment no. 11 is mandatory.

1. Implement the sampling theorem and aliasing effects by sampling an analog signal with various sampling frequencies.
2. Design and implement two stage sampling rate converter.
3. To study the properties of DFT. Write programs to confirm all DFT properties.

4. To study the circular convolution for calculation of linear convolution and aliasing effect. Take two sequences of length
5. Write a program to find 4 point circular convolution and compare the result with 8 point circular convolution to study aliasing in time domain.
6. a) To find Z and inverse Z transform and pole zero plot of Z-transfer function.
   b) To solve the difference equation and find the system response using Z transform.
7. To plot the poles and zeros of a transfer function when the coefficients of the transfer function are given, study stability of different transfer functions.
8. To study the effect of different windows on FIR filter response. Pass the filter coefficients designed in experiment 6 via different windows and see the effect on the filter response.
9. Design Butterworth filter using Bilinear transformation method for LPF and write a program to draw the frequency response of the filter.
10. To plot the mapping function used in bilinear transformation method of IIR filter design.(assignment may be given)
11. Effect of coefficient quantization on the impulse response of the filter using direct form I and II realization and cascade realization.(theory assignment)
12. To implement at least one of the following operations using DSP Processor
    i. Linear and Circular convolution.
    ii. Low pass filter an audio signal input to DSK with FIR filter.
    iii. Low pass filter an audio signal input to DSK with IIR filter.
    iv. To generate sine wave using lookup table with table values generated within the programme.

PLC and HDL Programming Lab (304215)
Credits: PR-02

Teaching Scheme:
Practical: 4 Hrs/ Week

Examination Scheme:
Practical: 50 Marks
Term work: 50 Marks

PLC and Applications

List of Experiments: (Any 8)

Design & Simulate using any PLC simulation software.

1. Simple Start/Stop Ladder Logic Relay
2. Single Push Button On/Off Ladder Logic
3. PLC Program Example with On Delay Timer
4. PLC Program Example with Off Delay Timer
5. PLC Program Example with Retentive Timer
6. Star Delta PLC Ladder Diagram
7. Ladder Diagram for DOL Motor Starter
8. Traffic Light Ladder Logic Diagram
9. Ladder Diagram for Bottle Filling Plant
10. PLC Ladder Diagram for Elevator Control

11, 12, 13. Implement experiments 8, 9, and 10 using PLC hardware.

Fundamentals of HDL

List of Experiments:

1. Simulate Half adder and Full Adder using VHDL
2. Simulate 4:1 Mux using VHDL
3. Simulate all types of FlipFlops using VHDL
4. Simulate Shift Register(Left and Right shift) using VHDL
5. Simulate Half adder and Full Adder using Verilog
6. Simulate 3:8 Decoder using Verilog
7. Simulate Counter using Verilog
8. Simulate ALU using Verilog

Mini Project (304216)

Credits: TH- 02+OR-01

Teaching Scheme:
Theory: 02 hr/week
Practical: 02 hr/week

Examination Scheme:
Oral : 50 Marks

Course Objectives

- To undertake & execute a Mini Project through a group of students, To understand the 'Product Development Cycle' through Mini Project.
- To plan for various activities of the project and distribute the work amongst team members.
- To learn budget planning for the project.
- To inculcate electronic hardware implementation skills by –
    a. Learning PCB artwork design using an appropriate EDA tool.
    b. Imbibing good soldering and effective trouble-shooting practices.
    c. Following correct grounding and shielding practices.
    d. Knowing the significance of aesthetics & ergonomics while designing electronic product.
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
- To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes (COs)
The student will be able to

- Planning and implementation of hardware/ software project
- Prepare the budget for hardware requirement
- Demonstrate the project
- Work as a team member.

Maximum Group Size: Minimum 2 and maximum 3 students can form a group for the mini project.

Project Type: The selected mini project must be based on development of a prototype electronic system/product mandatorily having a hardware component with supporting software.

The Assessment Scheme will be:

a. **Continuous Assessment 50 marks** *(based on regular interaction, circuit development)*
b. **End Semester 50 marks** *(based on implementation, testing, results, poster presentation, and demonstration)*

Execution steps for Mini Projects:

1. Complete Paper work Design using datasheets specifying:
   · Selection criteria of the components to be used.
   · Specifications of system i/p and desired o/p.
   · Module based hardware design.
   · Test points at various stages in various modules
2. The circuit should be simulated using any of the standard simulation software available (either complete circuit to be simulated, if possible or an appropriate part of the circuit can be simulated)
3. Algorithm and the flow chart of the software part must be defined.
4. Result verification for hardware and testing the algorithms.
5. Comparison with the paper design to identify the discrepancies, if any. Justification of the same must be given.
6. Verified circuit should be assembled and tested on breadboard or general purpose board.
7. Simulation results and/or the snapshots indicating the current and voltage readings or detailing the test point results at various stages must be preserved and included in the project report.
8. Art work / layout of the circuit using standard layout tools.
9. Assembling and testing of circuit on final PCB.
10. Design and fabrication of suitable enclosure and outside fittings such as switches, Buttons, knobs, meters, indicators, displays etc.
11. Final testing of the circuit using the earlier defined test points.
12. Preparing Bill of components and materials.
13. Drawing entire circuit diagram (component level), outlining various blocks indicating test points, inputs and outputs at various stages on A3 graph sheet.

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

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

References

Text Books:

1. Thomas C Hayes, Paul Horowitz, "The Art of Electronics", Newens Publication
2. Analog Circuit Design: Art, Science and Personalities, by Jim Williams (Editor) , EDN series for Design Engineers,
3. M Ashraf Rizvi, " Effective Technical Communication", Tata McGraw Hill Pvt. Ltd.

Reference Books:

1. Robert Boylested, " Essentials of Circuit Analysis", PHI Puublications
2. Meenakshi Raman, Sangeeta Sharma," Technical Communication, Principles and Practice", Oxford University Press
3. A.E. Ward, Angus, " Electronic Product Design", Stanley thornes Publishers, UK.

C Muralikrishna, Sunita Mishra," Communication Skills for Engineers", Pearson

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Faculty of Science and Technology

Syllabus
B.E. (Electronics) 2015 Course

(With effect from Academic Year 2018 - 19)

SAVITRIBAI PHULE PUNE UNIVERSITY

THE SYLLABUS IS PREPARED BY:
B.O.S. in Electronics & Telecommunication,
Savitribai Phule Pune University

Savitribai Phule Pune University
Final Year Electronics Engineering (2015 Course)

(With effect from Academic Year 2018-19)

Semester I												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credits**	
		TH	**TUT**	**PR**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH/TW**	**PR+OR**
404201	VLSI Design	3	--	--	30	70	--	--	--	100	3	--
404202	Advanced Power Electronics	4	--	--	30	70	--	--	--	100	4	--
404203	Electronics System Design	3	--	--	30	70	--	--	--	100	3	--
404204	Elective I	3	--	--	30	70	--	--	--	100	3	--
404205	Elective II	3			30	70	--	--	--	100	3	--
404206	Lab practice -I (APE+ ESD)	--	--	4	--	--	50	50	--	100	--	2
404207	Lab practice -II (VLSI + Ele I)	--	--	4	--	--	50	50	--	100	--	2
404208	Project Stage I	-	2	--	--	--	-	--	50	50	--	2
	Audit Course 5	--	--	--	--	--	--	--	--	--	----	
Total		16	2	8	150	350	100	100	50	750	16	6
Total Credits											**22**	

Elective I	**Elective II**
Digital Image and Video Processing	Mobile communication
Audio and Speech Processing	Bio-Medical Electronics
Embedded Systems & RTOS	Optimization techniques
Internet of Things	Computer modelling and simulation
Software Defined Radio	Digital Signal Processor TMS320C67X

Audit Course 5	Foreign Language (Japanese Module 3)
	Critical Thinking

Final Year Electronics Engineering (2015 Course)

(With effect from Academic Year 2018-19)

Semester II												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credit**	
		TH	**TUT**	**PR**	**In-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH/TW**	**PR+OR**
404209	Computer Networks & Security	3	--	--	30	70	--	--	--	100	3	--
404210	Process Instrumentation	4	--	--	30	70	--	--	--	100	4	--
404211	Elective III	3	--	--	30	70	--	--	--	100	3	--
404212	Elective IV	3	--	--	30	70	--	--	--	100	3	--
404213	Lab practice -III (CNS+PI)	--	--	4	--	--	50	50	--	100	--	2
404214	Lab practice -IV (Elective- III)	--	--	2	--	--	--	50	--	50	--	1
404215	Project Stage II	--	6	--	--	--	150	--	50	200	--	6
	Audit Course 6	--	--	--	--	--	--	--	--	--		
Total		13	6	6	120	280	200	100	50	750	13	9
Total Credits											**22**	

Elective III	**Elective-IV**
Automotive Electronics	Robotics
Artificial Intelligence and Machine Learning	Wireless Sensor Networks
Optical and Microwave Communication	Renewable Energy Systems & DSM
Audio Video Engineering	TM4C123GH6PM Microcontroller
Testing and verification for SoC Design	Open Elective*

*Any one subject from the list of Elective IV of computer/IT/Electrical/Instrumentation or Institute can offer elective IV based on any industry need with prior approval from BoS (Electronics). Repetition of subjects or topics is to be avoided.

Audit Course 6	Foreign Language (Japanese Module 4)
	Technologies, Disruptions and Entrepreneurial Opportunities

SEMESTER - I

404201 VLSI DESIGN

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination Phase I: 30
End Semester Examination Phase II: 70

Course Objectives:

- To understand CMOS technology and its application in VLSI Circuits.
- To design digital circuits using HDL.
- To implement digital circuits using FPGA.
- To design using CAD tools.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand VLSI Design Flow.
2. Design advance digital circuit using HDL.
3. Understand the importance of CAD tools.

Unit I: Introduction to VLSI Circuits 6L

MOS Inverter: MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Transistor Sizing, Voltage Transfer Characteristics, Power Dissipation, Noise Margin, Power Delay Product, Energy dissipation. Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates; Designing with transmission gates.

Unit II: Digital Circuit Design and testing using HDL 6L

Module, Entity, Architecture, Modelling styles, Design of sequential circuits, asynchronous and synchronous design issues, state machine modelling (Moore and Mealy machines), attributes, Generics, Basic test benches, Test bench structure, constrained random stimulus generation.

Unit III: CMOS Subsystem Design 6L

Semiconductor memories, memory chip organization, Random Access Memories (RAM), Static RAM (SRAM), standard architecture, 6T cell, sense amplifier, address decoders, timings. Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings.

Unit IV: Floor Planning and Placement 6L

Clock skew, Clock distribution techniques, clock jitter. Supply and ground bounce, power distribution techniques. Power optimization. Interconnect routing techniques; wire parasitic, Signal integrity issues. I/O architecture, pad design.

Unit V: Design and Verification with PLD's 6L

Implementing Functions in FPGAs, Implementing Functions Using Shannon's Decomposition, Carry Chains in FPGAs, Cascade Chains in FPGAs, Examples of Logic Blocks in Commercial FPGAs, Dedicated Memory in FPGAs, Dedicated Multipliers in FPGAs, JTAG, Boundary scan, TAP Controller.

Unit VI: CAD Tools **6L**

MOS Layers Stick/Layout Diagrams: Layout Design Rules, Issues of Scaling, Scaling factor for device parameters. Layout editors, Design rule checkers, circuit extractors – Hierarchical circuit extractors – Automatic layout tools, silicon compilers, modelling and extraction of circuit parameters from physical layout.

Text Books

1. Neil H. Weste and Kamran, Principles of CMOS VLSI Design, Pearson Publication.
2. John F. Wakerly, Digital Design, Principles and Practices, Prentice Hall Publication.

Reference Books

1. Douglas Perry, VHDL, McGraw Hill Publication.
2. Samir Palnitkar, Verilog HDL 2/e, Pearson Education.
3. Charles Roth, Digital System Design using VHDL, McGraw Hill Publication.
4. Preas, M. Lorenzatti, "Physical Design and Automation of VLSI Systems", The Benjamin Cummins Publishers, 1998.
5. R. Jacob Baker; Harry W.Li., David E. Boyce, CMOS Circuit Design, Layout and Simulation, IEEE Press, Prentice Hall of India.
6. M.Ciletti, Advanced Digital Design with Verilog HDL,Second Edition Pearson Education.
7. Sung-Mo (Steve) Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata McGraw Hill Publication.
8. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, Wiley, 1993.

404202 ADVANCED POWER ELECTRONICS

Teaching Scheme:
Lectures: 4 Hrs/Week

Examination Scheme:
In Semester Examination Phase I: 30
End Semester Examination Phase II: 70

Course Objectives:

- Study operation and implementation of dual converters, Multilevel Inverters and cycloconverters.
- Study and understand the operation of electric motor drives controlled from a power electronic converter and to introduce the design concepts of controllers for closed loop operation.
- Specify appropriate power circuit configuration amongst the phase controlled rectifiers and Choppers for DC drive system, Induction motor drive and Special purpose motor drive.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand operation and implementation of dual converters, Multilevel inverters, cycloconverters and power factor improvement techniques for controlled rectifiers.
2. Select and Design a suitable power converter to meet the demand of DC drive system.
3. Select and Design a suitable power converter to meet the demand of 3 phase inductor motor drive.
4. Understand working of BLDC, Stepper, Servo drive system.
5. Understand implementation of Solar and Wind Power System.

Unit I: Dual Converters and Power factor improvement of converters 8L

Single-phase and three-phase dual converters: Ideal and practical dual converter, control schemes for non-circulating current type dual converter, analysis of circulating current type dual converter.

Power factor improvement of converters: Phase angle control: EAC, SAC, PWM, sequence control of series converters, comparative evaluation of schemes. Power factor conditioning of diode rectifiers, Double sided PWM converter systems.

Unit II Multilevel Inverters and Cycloconverters 7L

Cycloconverters: Single phase to single phase cycloconverters, three phase to Single phase cycloconverters, three phase to three phase cycloconverters.

Multilevel Inverters: Concept of multilevel inverter, Types of multilevel inverter: Diode clamped, Flying Capacitor and Cascade Multilevel inverters.

Unit III: DC Motor Drives 8L

Basic characteristics of DC motors, Operating modes, Motor performance parameters, 1ϕ & 3ϕ converter drives for separately excited & series DC motors for continuous & discontinuous operations, Chopper fed DC drives, Comparison of converter fed drive & chopper fed drive, Open loop & closed loop control of dc drives, Microprocessor based

control of dc drives, Dynamic and regenerative breaking of DC motors.

Unit IV: Induction Motor Drives 8L

Induction motor characteristics ,Control strategies like stator voltage control, v/f control, rotor resistance control ,Variable frequency Square wave VSI Drives ,Variable frequency SPWM VSI Drives ,Variable frequency CSI Drives , Open loop & closed loop control of 3 phase induction motor drive, Vector Control (Field oriented Control): Basic principle of vector control, Direct & Indirect vector control, Breaking of induction motor, soft acceleration and deceleration, various protections.

Unit V: Special Purpose Motor Drive 6L

Brushless DC drives, Stepper motor drive, Servo motor drive, Switched reluctance motor drive, Synchronous reluctance motor drive.

Unit VI: Solar and Wind power System 6L

Solar Power System: PV characteristics, working of solar power system, Types of PV system: Stand-alone PV systems, Grid connected PV systems. Case study to implement solar power system: Selection of Solar panel, inverter, battery, charge controller, Metering of solar based system.

Wind Power System: Working of wind power system, Types: Standalone wind energy systems, Grid connected wind energy systems, types of wind generator Control of wind turbines.

Text Books:

1. M H Rashid, “Power Electronics – circuits, devices and applications”, 3rd edition, Pearson Education.
2. Power Electronics, M.D. Singh & K.B.Khanchandani, TMH

Reference Books:

1. Ned Mohan, T. Undeland & W. Robbins, “Power Electronics Converters applications and design” 2nd edition, John Willey & sons, Singapore
2. P.C. Sen, “Modern Power Electronics”, S Chand & Co New Delhi
3. Dr. P. S. Bimbhra, “Power Electronics”, Khanna Publishers, Delhi.
4. Nagrath Kothari, “Electrical Machines”, TMH.
5. M. H. Rashid, " Handbook of Power Electronics”

404203 ELECTRONIC SYSTEM DESIGN

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Course Objectives:

- To understand the stages of system (hardware/ software) design and development.
- To learn the different considerations of analog, digital and mixed circuit design.
- To be acquainted with methods of PCB design and different tools used for PCB Design.
- To understand the importance of testing in product design cycle.
- To understand the processes and importance of documentation.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand various stages of hardware, software and PCB design.
2. Analyze reliability of product design.
3. Design and test various electronic products/modules.
4. Suggest special design considerations and understand need of documentation.

Course contents:

Unit I: Introduction 6L

Stages in product design- Market survey, Product Specifications (Electrical, Mechanical, Environmental), R&D and Engineering Prototypes, Pilot Production Batch, Environmental testing, Documentation, Manufacturing. Electronic Products Classification: Consumer, Industrial and Military, their peculiarities in terms of Cost/performance ratio and Reliability. Case study of a typical Industrial Product. Reliability: Bath tub curve, Measures taken (at Component and Product level and various soldering techniques including Surface Mount Technology) to improve reliability.

Unit II: Hardware Design- Analog Circuits 6L

Analog signal conditioning: Factors affecting choice of Op-Amps in signal conditioning, applications, Need for Instrumentation Amplifiers- Case study of an Instrumentation amplifier circuit designed using discrete components and special purpose IC. Error budget analysis with case study. Interpretation of ADC and DAC specifications from design view point, considerations in selecting references (Vref for ADC).

Unit III: Hardware Design- Digital Circuits 6L

Interfacing of LED, HB LED, LCD, Keyboard, Relays (Electromagnetic and Solid State) with Microcontrollers. Comparative study of different Microcontroller architectures, Factors affecting choice of Microcontroller for particular application with case study of one application. Comparison of buses and protocols used in electronic products- I2C, SPI, CAN, LIN, Flexray.

Unit IV: Software Design and Testing for Electronic Product 6L

Different approaches for development of application software for Electronic Product. Assemblers, Factors affecting choice between Assembly language and High level languages like C and C++. Documentation practices and templates for above software. Debugging tools and techniques for software- Features of Simulators, ICE, IDE.

Unit V: PCB Design and EMI/EMC 6L

PCB Design practices for Analog and Mixed signal circuits: Ground Loops, Precision circuits, shielding and guarding. PCB Design Practices for High speed digital circuits, Signal integrity and EMC, EMI/EMC testing standards and compliance for PCB design.

Unit VI: Fault Finding and Testing 6L

Analyses- DC/ Operating Point Analysis, AC (Frequency Response), Transient, Sensitivity, Monte Carlo. Debugging/ Fault finding- Features and limitations of Analog CRO, DSO, Spectrum analyzer, Logic Analyzer and Mixed Signal Oscilloscopes in finding hardware/software faults. Environmental Testing: Need for Environmental Testing. Temperature, Humidity, Vibration and Shock tests. Introduction to EMI/EMC testing standards and compliance.

Text Books

1. Bernhard E. Bürdek, History, Theory and Practice of Product Design, Springer Science, 2005.
2. Paul Horowitz, Art of Electronics, Cambridge University Press.

Reference Books

1. Howard Johnson, Martin Graham, High-speed Digital design- A Handbook of Black Magic, Prentice Hall Publication.
2. G. Pahl and W. Beitz J. Feldhusen and K.-H. Grote, Engineering Design – A Systematic Approach_, Springer, 2007.
3. Tim Williams, EMC for Product Designers, Elsevier, Fourth edition 2007
4. Jerry C Whitaker, The Electronics Handbook, CRC Press, IEEE Press, ISBN 0- 8493-8345-5.
5. David Bailey, Practical Radio Engineering and Telemetry for Industry, Elsevier, ISBN 07506 58037.
6. Pressman, Software Engineering - A Practitioner's Approach.
7. David Bailey, Practical Radio Engineering & Telemetry for Industry, Elsevier, ISBN 07506 58037.
8. Domine Lenders, Johan van der Tang, Cicero S. Vaucher , Circuit Design for RF Transceivers, Kluwer Academic Publishers, 2003.

404204 ELECTIVE I

Teaching Scheme:
Lectures: 3Hrs/Week
Credits: 3

Examination Scheme:
In Semester Examination: 30 Marks
End Semester Examination: 70 Marks

DIGITAL IMAGE AND VIDEO PROCESSING

Course Objectives:

- To learn the fundamental concepts of Digital Image and video Processing.
- To study basic image and video processing operations.
- To understand image and video analysis algorithms.
- To expose students to current applications in the field of digital image and video processing.

Course Outcomes:

After successfully completing the course students will be able to

1. Develop and implement various mathematical operations on image.
2. Develop and implement algorithms for image enhancement and restoration.
3. Apply compression techniques for image and video processing.
4. Use segmentation and morphological operations for image processing applications.
5. Apply video processing algorithms for motion detection applications.

Unit I: Digital Image Fundamentals 6L

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement and Restoration 6L

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.
Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering.

Unit III: Image Compression 6L

Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

Unit IV: Image Segmentation and Morphological Operations **6L**

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit V: Basics of Video Processing **6L**

Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two dimensional motion models.

Three Dimensional Rigid Motion, Approximation of projective mapping.

Unit VI: Motion estimation Techniques **6L**

Optical flow, motion representation, motion estimation criteria, optimization methods, pixel based motion estimation, Block matching algorithm, gradient based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion.

Motion analysis applications: Video Summarization, video surveillance.

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.

Reference Books

1. S Sridhar, "Digital Image Processing", Oxford University Press.
2. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication.
4. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication.
5. "Handbook of Image and Video processing", Al Bovik, Academic press, second Edition.

List of Experiments:

1. Conversion of 24 bit color image to 8 bit , 4 bit, 1 bit image.
2. Apply image negation and power-law correction operations on image.
3. Enhance image using histogram equalization and stretching.
4. Perform image smoothing and sharpening operations.
5. Detect image edges using Sobel, Prewitt and Roberts's operator.
6. Perform Morphological operations on binary images.
7. Compress image using DCT / Wavelet transform.
8. Apply Global and adaptive thresholding to an image.
9. Using frequency domain technique estimates the motion in video.
10. Implement algorithm for video boundary detection.

Note: Experiments are to be performed preferably using open source software.

404204 ELECTIVE I

Teaching Scheme:
Lectures: 3Hrs/Week
Credits: 3

Examination Scheme:
In Semester Examination: 30 Marks
End Semester Examination: 70 Marks

AUDIO AND SPEECH PROCESSING

Course Objectives:

- To introduce the models of speech production and acoustic phonetics.
- To understand time and frequency domain techniques for estimating speech parameters.
- To understand predictive techniques for speech coding.
- To introduce speech recognition applications.

Course Outcomes:

After successfully completing the course students will be able to

1. State and describe the concepts of speech production mechanism, phoneme classification, digital models for speech production, homomorphic speech processing and LPC analysis.
2. Identify, classify and explain types of speech production mechanism, phoneme classification, digital models for speech production, homomorphic speech processing and LPC analysis.
3. Apply signal processing theory for estimation of speech parameters in time and Frequency domain.
4. Analyze applications of speech processing in speech compression and speech recognition

UNIT I: Speech Production, Acoustic Phonetics and Auditory Perception **6L**

Anatomy and physiology of speech organs, articulatory phonetics, acoustic phonetics, acoustic theory of speech production, discrete time model for Speech Production. Ear physiology and psychoacoustics.

UNIT II: Speech Analysis in Time Domain **6L**

Time, energy, average magnitude, and zero-crossing rate, speech vs silence discrimination, short-time autocorrelation, pitch period estimation using short-time autocorrelation, median smoothing.

UNIT III: Speech Analysis in Frequency Domain **6L**

Time dependent Fourier representation for voiced and unvoiced speech signals, Linear filtering interpretation, spectrographic displays Pitch period estimation based on FFT and harmonic peak detection method, estimation of formants using log spectrum.

UNIT IV: Speech Coding **6L**

Time domain waveform coding: linear PCM, companded PCM, DPCM, DM, ADM. Spectral coders: Filter bank analysis, sub-band coders, Adaptive Transform Coders (ATC),

Introduction, Vocoders, Cepstral vocoders, Sub-band coding, Vector Quantization coder, Perceptual audio coding, MPEG audio standards.

UNIT V: Linear Predictive Coding (LPC) of Speech 6L

Introduction, Estimation of LPC coefficients, Lattice formulation & Solution, Choice of LPC order & window length, Frequency domain Interpretation of LPC.

UNIT VI: Speech Processing Applications 6L

Automatic speech recognition (isolated word recognition, automatic telephone number dialing system etc. using statistical signal modeling e.g. GMM, GMM-HMM), Linear and dynamic time warping, text to speech synthesis, speaker recognition and verification, speech enhancement, Introduction to Musical instrument classification, Musical Information retrieval.

Text books:

1. Rabiner and Schafer, "Digital Processing of Speech Signals", Pearson Education, Delhi, 2004.
2. Shaila D. Apte, "Speech and Audio Processing", Wiley India, New Delhi, 2012.

Reference Books:

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", Wiley India (P) Ltd, New Delhi, 2006.
2. A.R.Jayan, "Speech and Audio Signal Processing", PHI learning pvt ltd, Delhi-110092, 2016.
3. Douglas O'Shaughnessy, "Speech Communications: Human and Machine: 2nd Edition Universities Press.
4. L. R. Rabiner , B. H. Juang and B. Yegnanarayana "Fundamentals of speech recognition". Pearson Publication.

List of Experiments:

NOTE: To perform the experiments software like MATLAB, SCILAB or any appropriate open source software can be used. For analysis of speech signals tools like PRAAT, Audacity can be used. Use of open source software is encouraged.

1. Record speech signal (isolated words, continuous speech) and analyze the speech signal using speech analysis tool (e.g. PRAAT). Observe spectrogram, pitch, formants, intensity etc.
2. Write a program to compute short time energy and ZCR for different frame.
3. Write a program to compute narrow band and wide band spectrogram.
4. Write a program for extracting pitch period for a voiced part of the speech signal using autocorrelation method and average magnitude difference function (AMDF).
5. Write a program to design a Mel filter bank and using this filter bank write a program to extract MFCC features.
6. Write a program to perform the cepstral analysis of speech signal and detect the pitch from the voiced part using cepstrum analysis.
7. Write a program to find LPC coefficients using Levinson Durbin algorithm.
8. Write a program to enhance the noisy speech signal using spectral subtraction method.
9. Write a program to extract frequency domain audio features like SC, SF and Spectral roll off.

404204 ELECTIVE I

Teaching Scheme:
Lectures: 3 Hrs/ Week
Credits: 3

Examination Scheme:
In Semester Examination Phase I: 30
End Semester Examination Phase II: 70

EMBEDDED SYSTEMS & RTOS

Course Objectives:

- To understand the embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment
- To learn embedded software development and testing process.

Course Outcomes:

After successfully completing the course students will be able to

1. Get insight of design metrics of embedded systems to design real time applications to match recent trends in technology.
2. Understand Real time system concepts.
3. Understand Linux operating system and device drivers.
4. Get to know the hardware – software co-design issues and testing methodology for embedded system.

Unit I: Introduction to Embedded Systems 6L

Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. ARM9 architecture.
ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), System Control, Clock & Power Control, GPIO, Pin Connect Block.

Unit II: Real Time Systems Concepts 6L

Foreground/ Background systems, Critical section of code, Resource, Shared resource, multitasking, Task, Context switch, Kernel, Scheduler, Non-Preemptive Kernel, Preemptive Kernel, Reentrancy, Round robin scheduling, Task Priorities, Static & Dynamic Priority, Priority Inversion, Assigning task priorities, Mutual Exclusion, Deadlock, Clock Tick, Memory requirements, Advantages & disadvantages of real time kernels.

Unit III: µCOS II 6L

Features of µCOS II. Kernel structure. µCOS II RTOS services: Task management, Time management, Intertask Communication and Synchronization.

Unit IV: Embedded Linux Development Environment 6L

Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS Versus Boot loader, Anatomy of an Embedded System, Storage Considerations, Embedded Linux Distributions. Embedded Development Environment, Cross-Development Environment, Host System Requirements, Hosting Target Boards. Development Tools, GNU Debugger, Tracing and Profiling Tools, Binary Utilities.

Unit V: Linux Kernel Construction 6L

Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration. Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das UBoot. Porting U-Boot. Device Driver Concepts, Module Utilities, Driver Methods. Linux File System & Concepts.

Unit VI: Embedded Software Development, Testing Process and Tools 6L

Embedded Software development process and tools, Host and Target Machines, linking and Locating Software, Getting Embedded Software into the Target System, Issues in Harware-Software Design and Co-design. Testing on Host Machine, Simulators, Laboratory Tools. Case study of Embedded system like Automatic Chocolate Vending Machine, Mobile Phone, digital camera.

Text Books

1. Jean J.Labrosse, "MicroC OS II, The Real-Time Kernel", 2nd edition, CMP Books.
2. Christopher Hallinan, "Embedded Linux Primer -A Practical, Real-World Approach "2nd edition, Prentice Hall.

Reference Books

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design" 2nd edition, McGraw Hill.
2. Frank Vahid and Tony Givargis, " Embedded System Design – A Unified hardware/ Software introduction " 3rd edition, Wiley.

List of Experiments:

Group A: ARM7/ ARM Cortex- M3 & μCOS - II Based Experiments (any four)

1. Multitasking in μCOS II RTOS using minimum 3 tasks on ARM7/ ARM Cortex- M3.
2. Semaphore as signalling & Synchronizing on ARM7/ ARM Cortex- M3.
3. Mailbox implementation for message passing on ARM7/ ARM Cortex- M3.
4. Queue implementation for message passing on ARM7/ ARM Cortex- M3.
5. Implementation of MUTEX using minimum 3 tasks on ARM7/ ARM Cortex- M3.

Group B: ARM9 & LINUX Based Experiments (any four)

6. Download pre-configured Kernel Image, File System, boot loader to target device- ARM9.
7. Writing simple application using embedded Linux on ARM9.
8. Writing "Hello World" device Driver. Loading into & removing from Kernel on ARM9 board.
9. Write a program for I2C based RTC using embedded Linux on ARM9.
10. Using Device driver for GPIO, write a program to blink LED onARM9.
11. Write a program for external interrupt on ARM9.

404204 ELECTIVE I

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In Semester Examination Phase I: 30
End Semester Examination: Phase II: 70

INTERNET OF THINGS

Course Objectives:

- Introduction to different aspects of the IoT, including end devices, networks, programming, and security and privacy implications.
- Understand what constitutes an IoT design solution.
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes:

After successfully completing the course students will be able to

1. Discover key IoT concepts including identification, sensors, localization, wireless protocols, data storage and security.
2. Explore IoT technologies, architectures, standards, and regulation.
3. Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.
4. Examine technological developments that will likely shape the industrial landscape in the future.
5. Develop and implement IoT solutions and applications.

Unit I: Fundamentals of IOT 6L

Introduction to Internet of Things, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Logical design of IoT, Sensors and actuators, Introduction to IOT networking: Gateways and routing, IoT Protocols, IoT enabling technologies, IoT Issues and Challenges, IoT Security and privacy, Applications.

Unit II: IoT Protocols and Security 6L

SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, HART, Zigbee, MQTT, IoT Security: Security Requirements, Challenges for Secure IoT, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Security model for IoT.

Unit III: WSN & Cloud Computing 6L

WSN: introduction to WSN technology, Basic components of WSN, Characteristic features of WSNs, challenges, Application of WSN in: smart homes, healthcare, intelligent transportation, agriculture, etc.

Cloud Computing: Cloud architecture standards and interoperability, Business concerns in the cloud, characteristics, Cloud types; IaaS, PaaS, SaaS, Public cloud, Private cloud,

Benefits and challenges of cloud computing, Development environments for service development: Amazon, Azure, Thingspeak, Google App-cloud platform in industry.

Unit IV: Implementation of IoT **6L**

Implementation of IoT with Arduino: Introduction to arduino, arduino board overview, Programming environment, Simple assignments using arduino, Sending data to Cloud, analysis using any IoT platform

Introduction to Raspberry Pi, Raspberry Pi board overview, Programming environment, introduction to python programming, Simple assignments using Raspberry Pi, Sending data to cloud, analysis of data using any IoT platform.

Unit V: Big Data - Data Storage and Analytics **6L**

What is Big Data (BD), Modern Corporate need of BD Strategy, Main components of Big Data Solution, Basic Architecture of BD Solution, Introduction to Hadoop, Prototyping with any development board

Data Analytics: Types of data analytics, Using Cloud Services to Visualize live Data Streams. Data analytics using any platform like Amazon, Azure, Thingspeak or any other open source platform

Unit VI: Technological Aggregation & Case Studies **6L**

Modern trends in IOT: Wearable, industrial standards, Open Data Management & API. Case studies, connected use cases in Real-life/Thematic areas – Smart Homes/Buildings, Smart Cities, Smart Industry, Smart Medical care, Smart Automation etc.

Text Book:

1. Arshdeep Bahga, Vijay Madisetti,, Internet of Things, A hands-on approach, Universities Press
2. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012

Reference Book:

1. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010
2. Lyla B. Das, Embedded Systems: An Integrated Approach, Pearson
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer, 2011
4. Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, 2012
5. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things – Key applications and Protocols, Wiley, 2012
6. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.
7. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley, 2014

List of Experiments

Perform any 4 experiments from group A and
Any 4 from Group B,
Any 1 from Group C

Group A

1. Study of Connectivity and configuration of Arduino board circuit with basic peripherals, LEDs. Understanding GPIO and its use in program.
2. Interfacing touch sensor, LDR, Gas sensor, Sound Sensor with Arduino board
3. Interfacing of DC motor and servo motor with Arduino Board.
4. Interfacing temperature and humidity sensor using I2C protocol with Arduino board.
5. Wireless communication between Arduino and PC using Bluetooth protocol.
6. Interfacing Wifi module with Arduino.
7. Interfacing Xbee module with Arduino.

Group B

8. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board.
9. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.
10. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDs.
11. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
12. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image.
13. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee.
14. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.
15. Create a simple web interface for Raspberry-pi/Beagle board to control the connected LEDs remotely through the interface.

Group C

16. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.
17. Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user‘s approval.

404204 ELECTIVE I

Teaching Scheme
Lecture: 3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

SOFTWARE DEFINED RADIO

Course Objectives:

- The course gives students knowledge of fundamental and state-of the-art concepts in software-defined radio.
- Learn the design of the wireless networks based on the cognitive radio.
- Understand the concepts of wireless networks and next generation network

Course Outcomes:

After successfully completing the course students will be able to

1. Describe the basics of the software defined radio.
2. Implement modern wireless system.
3. Design the wireless networks based on the cognitive radio.
4. Explain the concepts behind the wireless networks and next generation networks

Unit I Software Defined Radio fundamentals 6L

Introduction to SDR, Need of SDR, Principles of SDR , Basic Principle and difference in Analog radio and SDR , SDR characteristics, required hardware specifications, Software/Hardware platform, GNU radio -What is GNU radio, GNU Radio Architecture, Hardware Block of GNU, GNU software , MATLAB in SDR , Radio Frequency Implementation issues, Purpose of RF front End, Dynamic Range ,RF receiver Front End topologies, Flexibility of RF chain with software radio, Duplexer ,Diplexer ,RF filter ,LNA ,Image reject filters , IF filters , RF Mixers Local Oscillator , AGC, Transmitter Architecture and their issues, Sampling theorem in ADC, Noise and distortion in RF chain, Pre-distortion

Unit II: SDR Architecture 6L

Architecture of SDR-Open Architecture, Software Communication Architecture, Transmitter Receiver Homodyne/heterodyne architecture, RF front End, Power amplifier, ADC, DAC, DAC/ADC Noise Budget, ADC and DAC Distortion, Role of FPGA/CPU/GPU in SDR, Applications of FPGA in SDR, Design Principles using FPGA, Trade –offs in using DSP, FPGA and ASIC, Power Management Issues in DSP,ASIC,FPGA

Unit III: Multi Rate Signal Processing 6L

Sample timing algorithms, Frequency offset estimation and correction, Channel Estimation, Basics of Multi Rate, Multi Rate DSP, Multi Rate Algorithm, DSP techniques in SDR, OFDM in SDR

Unit IV: Introduction to Cognitive Radio **6L**

Defining CR: History, Applications and Related Concepts , A Brief History of Elastic Spectrum Management ,A View of Wireless Network Futurists ,Ambiguity in CR Definitions ,Definition of Cognitive Radio Network ,Spectrum Management , Computational Platforms . CR Terminology Standardization - IEEE 1900.1 ,IEEE 1900.2 ,IEEE 1900.3 , IEEE 1900.4 , IEEE 1900.5 ,IEEE 1900.6, Related Standardization Efforts

Unit V : Cognitive Radio Architecture **6L**

Cognitive Radio network architecture– Resource manager frame work, architecture for spectrum sensing, network optimization through utilities , Value of Perfect Information ,Policy Support as a Part of the Architecture ,Spectrum Brokering Services Information Modelling, Topology Aware CRN Architectures - Statistical Characterization of Node Locations ,Spatial Statistics of Spectrum Usage, Publish-Subscribe CRN Architecture.

Unit VI: Public safety and cognitive radio **6L**

Introduction - Requirements, Commercial Wireless Communication Networks , Economic Value of the Spectrum , Benefits of Cognitive Radio. Standards for Public Safety Communication - TETRA ,C2000 Applications of Cognitive Radio – Disaster management, Bandwidth Requirements ,Spectrum Organization , Propagation Conditions , White Space Assessment , System Spectral Efficiency, Antijamming .

Text Books:

1.Jeffrey.H.Reed ,“Software Radio : A Modern Approach to Radio Engineering “, Pearson , LPE

2.Alexander M. Wyglinski, Worcester Maziar Nekovee., Thomas Hou, “Cognitive Radio Communications and Networks Principles and Practice”, 2010 ELSEVIER

Reference Books:

1. Markus Dillinger , KambizMadani ,Nancy Alonistioti, “Software Defined Radio : Architectures , Systems and Functions” ,Wiley
3. Tony .J. Rouphael , “RF and DSP for SDR”, Elsevier Newness Press ,2008
4. SDR –Handbook , 8th Edition , PENTEK
5. Bruce a. Fette , “Cognitive Radio Technology, Newness”, Elsevier

List of Experiments:

Part A: (Perform any seven)

Use GNU and SDR kit

1. To observe SNR clipping.
2. To generate multi tone.
3. To implement AM transmitter and receiver.
4. To implement FM transmitter and receiver.
5. To generate and measure bit error rate.
6. To implement FFT filter.
7. To generate BPSK signal.
8. To generate QAM signal.
9. To generate OFDM signal.

Part B: MATLAB Code

10. Spectrum sensing of Cognitive radio.
11. Optimization in cooperative spectrum sensing in Cognitive radio network.
12. Energy Detection Simulation: Cognitive Radio.

404205 ELECTIVE II

Teaching Scheme
Lecture: 3hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

MOBILE COMMUNICATION

Course Objectives:

- To introduce the concepts and techniques associated with wireless cellular communication systems.
- To give an exposure to students of various techniques used for modulation, equalization, diversity, coding & multiple access in cellular communication system.
- To familiarize with state of art systems & standards used in wireless cellular systems.

Course Outcomes:

After successfully completing the course students will be able to
1. Understand the fundamentals of cellular system & radio propagation.
2. Design mobile communication system by appropriately selecting necessary techniques.
3. Analyse different wireless networking & communication systems & standards.

Unit I: Fundamentals of Wireless Communication 6L

Evolution of mobile radio communication, Examples of mobile radio system, Overview of 2G, 2.5G, 3G ,4G ,5Gwireless networks, Cellular fundamentals: frequency reuse, channel assignment strategies, handoff strategies, Interference & system capacity, Trunking & grade of service, Techniques of improving coverage & capacity of cellular system.

Unit II: Mobile Radio Propagation 6L

Radio wave propagation, Free space propagation model, Propagation mechanisms: reflection, ground reflection model, diffraction, scattering. Small scale multipath propagation, Impulse response model of multipath channel, Small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading.

Unit III: Modulation, Equalization & Diversity Techniques 6L

Linear modulation techniques, Constant envelope modulation techniques, Combined linear & constant envelope modulation techniques, Spread spectrum modulation techniques. Equalization: fundamentals, training & survey of equalization techniques, Linear & Non-linear Equalization, Algorithms for Adaptive Equalization, Fractionally spaced equalizers, Diversity Techniques, RAKE receiver, Interleaving.

Unit IV: First and Second Generation Mobile Systems 6L

First Generation Cellular Systems, AMPS, GSM Cellular Telephony: Introduction, Basic GSM Architecture, Basic radio transmission parameters in GSM system, Logical Channels,

GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover, Modifications and derivatives of GSM.

Unit V: Third and fourth Generation Mobile Systems **6L**

3G Wireless Standards: CDMA2000: Overview, Radio & Network Components, Network Structure, Packet - Data Transport Process Flow, Radio Network, EVDO, BCMCS, EVDV, CDMA Channel Allocation.TD-CDMA: Overview, Generic Architecture, Core Network, Radio Network, Interference – Mitigation Techniques, RAN Traffic Planning, Handover, Implementation

TD-SCDMA: Overview, Generic Architecture, Core Network, Radio Network, Interference – Mitigation Techniques, RAN Traffic Planning, Handover, Implementation.

4G Wireless Standards- LTE: Network Architecture and Interfaces, FDD Air Interface and Radio Network, TD-LTE Air Interface, Scheduling , Mobility Management and Power Optimization, LTE Security Architecture Overview of WiMAX.

Unit VI: Wireless Networking **6L**

Wireless Networks: Introduction, Development, Fixed network transmission hierarchy, Traffic routing in wireless networks, Wireless data services, Common channel signalling , ISDN, SS7, PCS/PCN, Protocols for network access, Network databases, UMTS.

Text Books

1. T. S. Rappaport, “Wireless Communications: Principles & Practice” Second Edition, Pearson Education.
2. A. Goldsmith, “Wireless Communications”, First Edition, Cambridge University Press.

Reference Books

1. A. F. Molisch, “Wireless Communications”, Second Edition, Wiley India.
2. W. C. Y. Lee, “Wireless and Cellular Telecommunications”, Third Edition, Tata McGraw-Hill Education.
3.Clint Smith, P. E. Daniel Collins ,”3G Wireless Networks” ,Second Edition, Tata Mc-Graw Hill
4. Martin Sauter From ,”GSM To LTE: An Introduction To Mobile Networks And Mobile Broadband”, First Edition, Wiley

404205 ELECTIVE II

Teaching Scheme
Lecture:3hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

BIOMEDICAL ELECTRONICS

Course Objectives:

- To familiarize students with various medical equipments and their technical aspects.
- Analyze how noise from the environment, instruments and other physiologic systems can create artefacts in instrumentation.
- To introduce students to the measurements involved in some medical equipments like ECG, EEG, EMG etc.
- To learn and understand principles of different clinical lab instrumentation and Radiology Instrumentation.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand operation of the cardiac, respiratory and neural physiological systems.
2. Understand the principle, operation, design of biomedical instruments and specific applications of biomedical engineering.
3. Understand working principle of Clinical Lab Instruments.
4. Understand working principle and applications of Radiology Instrumentation.

UNIT I: Biomedical sensors and transducers 6L

Overview of Biomedical Instrumentation system, Sources of bioelectric potential, Types Bio-Signals, Biomedical Instrumentation System and its components.
Sensors and Transducers for bio-signal measurement, Biomedical Electrodes, Model of biomedical electrode, Silver-Silver chloride reference electrode, Types of electrodes for measurement of EEG, ECG, EMG, PCG, Respiration, Temperature. Chemical Sensors to measure pH, pO2, Glucose, O_2, Skin contact impedance, Artefacts and noise in medical instrumentation.

Unit II: Cardiovascular System 6L

Heart Structure, Functioning of Heart System, Cardiac cycle, ECG Electrodes, Electrocardiograph, Lead Configurations to measure ECG, Einthoven Triangle, Vectocardiography, Normal and abnormal ECG, ECG Signal Processing, ECG Amplifiers and Filters , ECG Machine, Heart sounds.

Unit III: Nervous System and Electromyography 6L

Introduction to Nervous System-Anatomy: The anatomy of the nervous system, The Autonomic nervous System, 10-20 electrode placement system for EEG measurement, Evoked Potentials, Types and significance of EEG Signal, EEG machine, EEG amplifiers and filters, Analysis of Diseases using EEG.

Electromyography (EMG), Muscle contraction mechanism, Myoelectric voltages, EMG Machine.

Unit IV: Medical Instruments and Measurements **6L**

Life Saving Devices: Pacemakers, Defibrillators, Ventilators, Introduction to Blood Pressure Measurement (Direct and Indirect Methods). Blood Flow Measurement, Finger Plethysmography, Echocardiography, Stress Testing System, Bedside Monitors, Central Monitoring System.

Unit V: Clinical Lab Instruments **6L**

Blood Cell Counter, Electron Microscope, Colorimeter, Autoanalyser, Flame photometer, PH measurement/Blood Gas Analyzer for measurement of pH, pO2 & pCO2, Pulse Oximeter, Introduction to Dialysis System. Electrical Safety of Instruments: Grounding and Shielding, Issues of Noise Pollution around Hospitals.

Unit VI: Radiology Instrumentation & Biotelemetry **6L**

Introduction to Radiology Instrumentation such as X-Ray Machine, Computer Tomography, PET, MRI Machine, Ultrasonic Doppler Machine, 2D echo, Fitness band.

Laser applications in Biomedical. Electronics in dental field: Digital OPG Machine, Orthodontic Welder.

Biotelemetry: Introduction to Biotelemetry, Physiological Parameters adaptable to biotelemetry, components of Biotelemetry system, Implantable Units, Application of Telemetry in Patient Care.

Text Books

1. Carr and Brown, Biomedical Instrumentation.
2. Cromwell, Biomedical Instrumentation and Measurement, PHI.

Reference Books

1. Webster, Application and Design of Medical Instruments.
2. R. S. Khandpur, Biomedical Instrumentation.

404205 ELECTIVE II

Teaching Scheme
Lecture:3hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination Phase II: 70

OPTIMIZATION TECHNIQUES

Course Objectives:

- To study basic concept of optimization technique and problems.
- To understand classical optimization techniques.
- To solve problems on linear programming and non-linear programming.
- To study various algorithms for solving optimization techniques problems.

Course Outcomes:

After successful completion of the course students will be able to

1. Understand basic concept of optimization technique and problems.
2. Understand classical optimization techniques.
3. Solve problems on linear programming and non-linear programming.
4. Analyze various algorithms for solving optimization techniques problems.

UNIT I: Introduction to Optimization **6L**

Motivation, mathematical review, Basic Concepts of Optimization-Convex and Concave Functions, Necessary and sufficient conditions for Stationary Points, Formulation of Various Optimization Problems, Classification of optimization problems.

UNIT II: Classical optimization Techniques **6L**

Optimization of one-dimensional Functions, Multivariable Optimization with no constraints: semi defined case, saddle point, Multivariable Optimization with equality constraints: Solution by direct substitution, solution by method of constrained variation. Multivariable Optimization with inequality constraints: Kuhn-Tucker conditions.

UNIT III: Linear Programming **6L**

Standard form of Linear Programming problem, Definitions and theorems, Solution of a linear simultaneous equation, Pivotal reduction of general system of equation, Simplex algorithm: Identifying an optimal point, improving a non optimal basic feasible solution.

UNIT IV: Nonlinear Programming I **6L**

One dimensional minimization methods: Elimination Methods, Unrestricted search, Exhaustive search, Dichotomous search, interval halving method. Interpolation methods: Quadratic interpolation, Cubic interpolation. Direct root method: Newton's method, Quasi-Newton's method, Secant Method.

UNIT V: Nonlinear Programming II **6L**

Unconstrained optimization Techniques: Direct Search Methods, Random Search, Grid Search, Univariate search, Powell's method. Indirect Search: Gradient of a function, steepest descent method, Conjugate gradient Method

UNIT VI: Nonlinear Programming III **6L**

Constrained optimization Techniques: Necessary and Sufficient Conditions for Constrained Optimum, Quadratic Programming, Generalized Reduced Gradient Method.

Text Books:

1 Singiresu S. Rao, "Engineering Optimization- Theory and Practice" Fourth Edition, 2009 by John Wiley & Sons, Inc.
2 G.V.Rekllaitis, A.Ravindran, Schechter and K.M.Ragsdell, "Engineering Optimization-Methods and Applications", John Wiley, New York (1983)

Reference Books:

1 Edgar, Himmelblau and Lasdon, "Optimization of chemical processes", McGraw Hill, International edition, 2001.
2 R. Fletcher, "Practical Optimization (2nd Edition)", John Wiley & Sons, New York, 1987.
3 M.S.Bazaraa ,H.D.Sherali and C.Shetty , "Nonlinear Programming, Theory and Algorithms", John Wiley and Sons, New York, 1993.

404205 ELECTIVE II

Teaching Scheme
Lecture: 3hr/week

Examination scheme
In Semester Examination Phase I: 30
End Semester Examination Phase II: 70

COMPUTER MODELING AND SIMULATION

Course Objectives:

- To study different methods of computer modeling.
- To study different methods of computer simulation.
- To study real time applications of computer modeling and simulation.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand methods for modeling of systems using discrete event simulation.
2. Understand the importance of simulation in IT sector, manufacturing, telecommunication, and service industries etc.
3. Formulate simulation model for a given problem and perform simulation analysis of the system.

Course contents:

UNIT I: Simulation Techniques 6L

Introduction to Simulation -Simulation Examples: Simulation of queuing systems, inventory systems and other examples - General Principles: Concepts in discrete event system simulation - List Processing.

UNIT II: Queueing Systems 6L

Simulation of Queueing Systems: Queueing System Characteristics - Queueing Notation - Transient and Steady-State Behaviour of Queues - Long-Run Measures of Performance of Queueing Systems - Steady- State Behaviour of Infinite-Population Markovian Models - Network of Queues.

UNIT III: Inverse Transformation Techniques 6L

Random-Number Generation: Properties of Random Numbers - Generation of Pseudo-Random Numbers - Techniques for Generating Random Numbers - Tests for Random Numbers. Random Variate Generation: Inverse Transformation Technique:- Uniform Distribution - Exponential Distribution - Weibull Distribution - Triangular Distribution - Empirical Continuous Distribution - Discrete Distribution - Direct Transformation for the Normal Distribution - Convolution Method for Erlang Distribution - Acceptance-Rejection Technique: Poisson Distribution - Gamma Distribution.

UNIT IV: Simulation Model **6L**

Input Data Analysis: Data Collection - Identifying the Distribution with Data - Parameter Estimation - Goodness-of- Fit Tests: Chi-Square Test - Kolmogorov-Smirnov Test; Selecting Input Models without Data - Multivariate and Time-Series Input Models. Verification and Validation of Simulation Models: Model Building, Verification and Validation - Verification of Simulation Models - Calibration and Validation of Models:- Face Validity - Validation of Model Assumptions - Validating Input-Output Transformations - Input-Output Validation using Historical Input Data - Input-Output . Validation using a Turing Test.

UNIT V: Output data analysis **6L**

Output Data Analysis: Stochastic Nature of Output Data - Types of Simulation with respect to Output Analysis - Measures of Performance and their Estimation - Output Analysis for Terminating Simulations - Output Analysis for Steady-State Simulation

UNIT VI: Case studies **6L**

Case Studies: Simulation of manufacturing systems, Simulation of Material Handling system, Simulation of computer systems, Simulation of super market, Cobweb model, and any service sectors.

Text Books:

1. J. Banks, J. S.Carson II and B. L. Nelson, 1995, Discrete-Event System Simulation, 2nd Edition, Prentice Hall of India, New Delhi.
2. Averill M.Law and W.David Kelton, 1991, Simulation Modeling & Analysis, 2nd Edn., Tata McGraw Hill.

Reference Books:

1. Geoffrey Gardon, 1992, System Simulation, 2nd Edn., Printice Hall of India.
2. Narsingh Deo, 1979, System Simulation with Digital Computers, Prentice Hall of India.
3. C.Dennis Pegden, Robert E.Shannon and Randall P.Sadowski, 1995, Introduction to Simulation using SIMAN, 2nd Edn., Tata McGraw-Hill.

404205 ELECTIVE II

Teaching Scheme
Lecture: 3hr/week

Examination scheme
In Semester Examination Phase I: 30
End Semester Examination Phase II: 70

DIGITAL SIGNAL PROCESSOR TMS320C67X

Course Objectives:

- To study DSP processor
- To study detail architecture of TMS320C67X
- To study applications of TMS320C67X

Course Outcomes:

After successfully completing the course students will be able to

1. Understand concept of DSP processors.
2. Understand architecture of TMS320C67X
3. Use TMS320C67X Microcontroller for general and industrial applications

Course contents:

Unit I: Architecture 6L

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 II: Memory 6L

TMS320C67X Functional units, Internal memory, External memory, on chip peripherals, peripheral register descriptions, signal groups description, device configurations, cache configuration (CCFG) register description

Unit III: Interrupts 6L

Interrupts, Instruction set and addressing modes, Fixed point instructions, Floating point instructions, Conditional operations, Parallel operations, Pipeline operations, Code Composer studio

Unit IV: Communication 6L

PLL and PLL controller, power-down mode logic, multichannel audio serial port (McASP) peripherals, I2C.

Unit V: General applications of TMS320C67X 6L

Adaptive filtering, Convolution, Correlation, Digital filtering, Fast Fourier transforms, Hilbert transforms, Waveform generation, Windowing.

Unit VI: Industrial applications of TMS320C67X **6L**

Numeric control, Power-line monitoring, Robotics, Security access.

Reference: TMS320C67X datasheet : www.ti.com

404206 LAB PRACTICE –I

Teaching Scheme
Practical: 4 Hours/Week

Examination scheme
Term Work: 50 Marks
Practical: 50 Marks

ADVANCED POWER ELECTRONICS

List of Experiments:

Perform any 10 experiments

1. Dual converter (Single phase/ Three phase)
2. Power Factor improvement techniques for single phase converters (SAC, EAC, PWM)
3. Study of 1 phase to 1 phase/ 3 phase to 1 phase Cycloconverter
4. Feedback Controlled DC Motor Drive.
5. Chopper fed 4-Quadrant reversible DC drive.
6. Microcontroller based DC drive.
7. V/F controlled three phase induction motor drive.
8. Stepper motor drive.
9. Servo motor drive.
10. BLDC motor drive.
11. Simulation of closed loop controlled DC drive using PSIM/MATLAB.
12. Simulation of three phase induction motor drive using PSIM / MATLAB/ MathCad.
13. Wind Power System
14. Solar Power System.

ELECTRONIC SYSTEM DESIGN

List of Experiments:

1. Design and implement low dropout regulated power supply (Estimation of current requirement)
2. Design of SPAN ZERO circuit.
3. Design and implement Transducer interface using Wheatstone bridge.
4. Study of Error budget analysis of instrumentation amplifier or any other complicated circuit using ADC/ DAC.
5. Design Data Acquisition System (DAS) using appropriate Microcontroller.
6. PCB Design for Mixed Signal Circuit (Involving ADC and Signal Conditioning). Test the circuit using MSO.
7. DC and AC analysis of given circuit.
8. Sensitivity analysis for given circuit.
9. Reliability calculations from given data.
10. Visit to product based industry to study various processes.

404207 LAB PRACTICE -II

Teaching Scheme:
Practical: 4 Hrs/week

Examination Scheme:
PR: 50Marks
TW:50Marks

VLSI DESIGN

PART-A (Perform any four)

Modelling and Functional Simulation, synthesis and implementation on PLDs of the following digital circuits (with Xilinx/ ModelSim tools/Pyxis) using VHDL/Verilog Hardware Description Languages.
(Two experiments are to be performed using VHDL and two using Verilog.)

1. Parity generator
2. Cyclic Encoder / Decoder
3. Read Only Memory (ROM)/ Random Access Memory (RAM) implementation
4. Mealy State Machine/Moore State Machine-examples
5. Arithmetic Multipliers using FSMs
6. Digital calculator

PART-B (Perform any four)

Experiments shall be carried out using Mentor Graphics/Cadence Tools/Microwind

Schematic Entry/ Simulation / Layout/ DRC/PEX/Post Layout Simulation of:

1. CMOS Inverter
2. NAND Gate/ OR Gate
3. Flip Flops(T & D)
4. Register Cell
5. Adder Circuits

PART- C (Optional)

VLSI system design using IP generator-Vivado software.

ELECTIVE I

Experiments to be chosen based on Elective I.

404208 PROJECT PHASE-I

Teaching Scheme:
Tutorial: 2Hrs/week

Examination Scheme:
OR: 50 Marks

1. Group Size
The student will carry the project work individually or by a group of students. Optimum group size is in 3 students. However, if project complexity demands a maximum group size of 4 students, the committee should be convinced about such complexity and scope of the work.

2. Selection and approval of topic
Topic should be related to real life application in the field of Electronics OR
Investigation of the latest development in a specific field of Electronics or Communication or Signal Processing
OR
The investigation of practical problem in manufacture and / or testing of electronics or communication equipment
OR
The Microprocessor / Microcontroller based applications project is preferable.
OR
Software development project related to VHDL, Communication, Instrumentation, Signal Processing and Agriculture Engineering with the justification for techniques used / implemented is accepted.
OR
Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

3. Note:
The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by internal and external guides.
Project report must be submitted in the prescribed format only. No variation in the format will be accepted. One guide will be assigned at the most 3 project groups.

4. Oral is based on presentation of the project work carried throughout the semester.
Assessment is based on the project topic. It consists of Literature Survey and basic project work. The abstract of the project should be submitted before Term work assessment.
The report consists of the Literature Survey, basic project work and the size of the report should be maximum of 40 pages. The examination is conducted by two examiners (internal and external) appointed by the university. The examiners appointed must have minimum 5 years of experience with UG qualification or 2 years with PG qualification.
5. The assessment is based on Innovative Idea, Depth of understanding, Applications, Individual contributions, presentation, and the grade given by the internal guide based on the work carried out in a semester.

6. A certified copy of report is required to be presented to external examiner at the time of final examination.

AUDIT COURSE 5

FOREIGN LANGUAGE (JAPANESE MODULE 3)

About Course: With changing times, the competitiveness has gotten into the nerves and ‗Being the Best' at all times is only the proof of it. Nonetheless, ‗being the best' differs significantly from Communicating the best'. The best can merely be communicated whilst using the best suited Language!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the ‗resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it. The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcome:

On completion of the course, learner will be able to–

- Have ability of basic communication.
- Have the knowledge of Japanese script.
- Get introduced to reading, writing and listening skills for language Japanese.
- Develop interest to pursue professional Japanese Language course

Course Contents:

1. Introduction to Kanji Script, Describing one's daily routine. To ask what someone does. Expressions of Giving & Receiving.

2. Adjectives (Types of adjectives), Asking impression or an opinion about a thing / person / place that the listener, has experienced, visited, or met, Describing things / person / places with the help of the adjectives.

3. Expressions of Like & Dislikes. Expressing one's ability, hobby, Comparison between objects, persons & cities, which resulted from a certain action in the past.

References:

1. Minna No Nihongo, Japanese for Everyone‖, Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.
2.http://www.tcs.com(http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx

AUDIT COURSE 5
CRITICAL THINKING

Course Objective:

- To make students a better thinker, sharpen their mind, clarify thoughts, and help them to make smarter decisions (especially about career).
- To overcome shortcomings of fresh graduates that they are incapable of "independent decision making". We intend to overcome this shortcoming

Course Outcome:

- Students can expect to be smarter, stronger and more confident thinkers.
- Students can embark on a life-long journey of "self-directed learning".

Course Content:

Unit No.	Topics and their descriptions

1	An introduction to Critical Thinking
	• What is Critical Thinking
	  ○ It's role in problem solving
	  ○ The difference between a critical thinker and one who is not
	• Barriers that prevent us from thinking critically

2	The importance of being logical • Key concepts of "Thinking fast and slow" - Logical fallacies & Mistakes we make when do not think "statistically"
3	Patterns in deductive logic • Hypothetical syllogism - Categorical syllogism(Set theory concepts) • Argument by elimination, based on maths, based on definition • Evaluating deductive arguments – validity & soundness
4	Argumentation – the foundation of critical thinking • Recognizing arguments and their structural components & indicator words Analysis of arguments • Categorical logic - VENN Diagrams to test logical "validity" • Propositional logic - Complex statements & arguments • Truth Tables – to test validity of complex statements
5	Inductive reasoning • The importance of inductive reasoning in hypothesis testing, analytics, belief systems, . • Evaluating the strength of an inductive argument
6	Basic probability concepts • Probability & frequency distributions • Important parameters & measures • Bayesian probability

References:

1. "Thinking Fast and Slow"- Daniel Kahneman – Penguin Books
2. "Critical Thinking – Students Introduction" - Bassham, Irwin, Nardone, Wallace – McGraw Hill

SEMESTER - II

404209 COMPUTER NETWORKS AND SECURITY

Teaching Scheme
Lecture:3hr/week

Examination scheme
In Semester Examination: Phase I : 30
End Semester Examination: Phase II: 70

Course Objectives:

- To make students able to describe how computer networks are organized with the concept of layered approach.
- To make students able to pursue advanced courses in computer networking.
- To develop skills to design simple computer networks.

Course Outcomes:

After successfully completing the course students will be able to

1. Design, implement, and analyze simple computer networks.
2. Identify, formulate, and solve network engineering problems.
3. Use techniques, skills, and modern networking tools necessary for engineering practice.
4. Have a basic knowledge of cryptography and network security

Unit I: Introduction to Computer Networks 6L

Definition & Uses of computer Network, Network Hardware-LAN, WAN, MAN & Internet, Network Software-design Issues for layers, Service primitives and relationship of services to Protocols, Reference models-OSI &TCP/IP, network architectures introduction, Addressing types-Physical, Logical & port address, Protocols and Standards.

Unit II: Physical Layer 6L

Physical layer-Data rate limits, Transmission media-guided and Unguided, Switching systems- Circuit switching, Datagram Switching & Virtual circuit switching, Example of networks- X.25, Frame Relay & ATM, Structure of circuit and packet switch networks, cable modem and DSL technologies, Communication satellites (LEO/MEO/GEO), Introduction to physical layer in 802.11 LAN & 802.15 WPAN.

Unit III: Data link layer 6L

Data link layer: Framing, Flow & Error control Protocols, noiseless channels, Noisy channels, HDLC, PPP, Multiple access techniques-random access, controlled access & Channelization, Ethernet types-bridged, Switched, Full duplex, Fast & gigabit Ethernet. Introduction to Data link layer in 802.11 LAN, Connecting devices like passive hubs, repeaters, Active hubs, Bridges, Two-layer Switches, Routers, three layer switches, Gateway etc., Backbone networks, Virtual LANs.

Unit IV: Network Layer and Transport Layer 6L

Network Layer: IPv4 address, IPv6 address, Address mapping-ARP, RARP & DHCP, IPv4 datagram detail format, IPv6 datagram detail format, ICMP, IGMP, Network layer issues like

Delivery, forwarding, intradomain and Interdomain routing, Routing algorithms like Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Path vector routing etc., Simple Router architecture. Transport layer-Process to process delivery, Connection oriented & Connectionless Transport, UDP, TCP, congestion control and Quality of Service.

Unit V: Application Layer **6L**

Application layer protocols and applications like Ping, FTP, telnet, http (www), SMTP, SNMP, Trace route, TFTP, BOOTP, DNS, NFS, RPC, X-server, E-mail, Introduction to streaming Audio/Video,P2P file sharing, Introduction to socket & Socket Interface, Introduction to HTML programming.

Unit VI: Basics of Network Security and Network administration **6L**

Network security: Introduction to Cryptography, Secret key algorithm, public key algorithm, Hash Functions, Basics of Security Requirements/Services/Dimensions, Basics of Security attacks, Basics of Security mechanisms / solutions. Network Administration: UTP Cabling for PC to PC communication, Network tester, network monitoring, Protocol Analyzer, Network Simulation, internet access through Dialup/DSL/Leased Line/Mobile handset.

Text Books

1.Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, TATA McGraw Hill
2. Andrew Tenenbaum, Computer Networks, 4th Edition, Pearson Education.

Reference Books

1. William Stallings, Computer Networks and Cryptography, 3rd edition, Pearson Education
2. Behrouz A. Forouzan, TCP/IP protocol Suit, 3rd edition, TATA McGraw Hill
3. Stevens, TCP/IP illustrated Volume - I & II, Pearson education.
4. Feibel Werner, Encyclopaedia of networking, Pearson education.
5. Frank J. Derfler, Practical Networking, 2nd edition, QUE international Publishing.
6. Atul Kahate, Cryptography and Network Security, 2nd edition, TATA McGraw Hill
7. Kenneth Mansfield, Computer Networking from LANs to WANs: Hardware, Software & Security, CENGAGE learning.
8. Nurul Sarkar, Computer Networking & Hardware concepts, Information Science Publisher, USA.
9. Kurose & Ross, Computer Networking: A top Down Approach featuring the Internet. 3rd edition, Pearson Education

404210 PROCESS INSTRUMENTATION

Teaching Scheme
Lecture: 4 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

Course Objectives:

- To make the students familiar with different process dynamics in Process industries and different control schemes generally used to get best output.
- To introduce process control action which are helpful for process design
- To aware various analysis and design methods for multivariable systems.
- To introduce about state process control and Batch process

Course Outcomes:

After successfully completing the course students will be able to

1. Handle any kind of process by framing it in block diagram, mathematical model and different process variables.
2. Handle different types of controller like electronic, pneumatic and hydraulic.
3. Implement different control schemes to various processes.
4. Design relay logic for various processes.
5. Understand batch process with an example
6. Design process control scheme

Unit I: Process Characteristics 8L

Types of processes (dead time single & multi capacity, self & non-self-regulating, interacting & non-interacting, Linear & non-linear), Process gain, process reaction curve, process time constant & constant step analysis method for finding time constant, dead time, dynamic elements in control loops

Unit II: Process Control Action 8L

Elements of process control, Controller Principle, Process Characteristics, Control system parameters, discontinuous, continuous and composite controller modes/actions (P,I,D,PI,PD and PID).

Unit III: Process Controllers and Tuning 8L

General features, construction and working of Pneumatic, Hydraulic and Electronic controller. Process reaction curve method, Zigler-Nichols method, Cohencoon correction for quarter amplitude, Frequency response method, Relay based tuning.

Unit IV: Control Schemes 8L

Feedback, feed forward, cascade, ratio, split range, selective control, adaptive control, and model based control.

Unit V: Multivariable and Discrete-State Control **8L**

Block diagram analysis of multivariable systems, Interaction, Tuning of Multivariable controllers, relative gain analysis, Discrete state process control characteristics of the system, Introduction to Batch Process with example

Unit VI: Process control Design **8L**

Defining the problem, measurements, final elements, Process Operability, Control Structure, Control Algorithm, Control for safety, performance Monitoring. Managing the Design Process: Sequence of design steps, hierarchy of control structure, process Decomposition, Integrating the control design methods, key guidelines.

Text Books:

1. Curtis D. Johnson, *Process Control Instrumentation Technology*, PHI /Pearson Education 2002.
2. F.G. Shinsky, *Process Control System*, TMH.

Reference Books:

1. M.Chidambaram, *Computer Control of Processes*, Narosa, 2002.
2. Deshpande P.B and Ash R.H, *Elements of Process Control Applications*, ISA Press, New York,1995.
3. George Stephenopolos, *Chemical process control*, PHI-1999.
4. D. Patranabis, *Principles of Process Control*, Second edition, TMH.
5. N.E. Battikha,Condensed Handbook of Measurement and Control,3rd Ed., ISA Publication.
6. Donald P. Eckman, Automatic Process Control, Wiley Eastern Ltd.

List of Experiments:

1. Design and test of ON-OFF Controller. (Simulation+Hardware).
2. Testing of controller modes (pure and composite) on a PID controller (Simulation).
3. Tuning of a PID controller (Simulation).
4. Study of various pneumatic and hydraulic system components
5. Development, implementation and testing of pneumatic circuits. (simulation+Hardaware)
6. Development, implementation and testing of hydraulic circuits(simulation+Hardaware)
7. Analysis of temperature control loop Using PID controller (Hardware)
8. Analysis of pressure control loop Using PID controller (Hardware)
9. Analysis of flow control loop Using PID controller (Hardware)
10. Design and implementation of cascade controller for a given application.
11. Design & implementation of feed-forward controller for a given application.

404211 ELECTIVE III

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

AUTOMOTIVE ELECTRONICS

Course Objectives

1. To understand the concepts of Automotive Electronics and it's evolution and trends
2. Automotive systems & subsystems overview.
3. To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
4. To understand, design and model various automotive control systems using Model based development technique.
5. To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software.
6. To describe various communication systems, wired and wireless protocols used in vehicle networking.
7. To understand Safety standards, advances in towards autonomous vehicles.
8. To understand vehicle on board and off board diagnostics.

Course Outcomes

After successfully completing the course students will be able to:

1. Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry
2. Interface automotive sensors and actuators with microcontrollers
3. Develop, simulate and integrate control algorithms for ECUs with hardware

Course contents:

UNIT I: Automotive Systems, Design Cycle and Automotive Industry Overview 6L

Overview of Automotive Industry: Leading players, Automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes.

Introduction to Modern Automotive Systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles. Spark and Compression Ignition Engines: Ignition systems, Fuel delivery systems, Engine control functions, Fuel control, Electronic systems in engines.

Automotive transmissions: Transmission fundamentals, Types MT, AT, CVT and DCT. Vehicle Braking Fundamentals: Vehicle dynamics during braking, Hydraulic brake system components, Introduction to antilock braking systems.

Steering Control: Steering system basics, Fundamentals of electronically controlled power steering, Electronically controlled hydraulic systems and electric power steering systems, Passenger safety and convenience, Occupant protection systems, Tyre pressure monitoring systems.

ECU Design Cycle: V-Model development cycle, Components of ECU, Examples of ECU on chassis, and in body electronics, infotainment and clusters. Overview of hybrid vehicles.

UNIT II: Automotive Sensors and Actuators 6L

Systems Approach to Control and Instrumentation: Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor modeling, Smart Nodes.

Examples of Sensors: Accelerometers, Wheel speed, Brake pressure, Seat occupancy, Engine speed, Steering wheel angle, Vehicle speed, Throttle position, Turbine speed, Temperature, Mass air flow (MAF) rate, Exhaust gas oxygen concentration, Throttle plate angular position, Crankshaft angular position/RPM, Manifold Absolute Pressure (MAP), Differential exhaust gas pressure and Air bag sensors.

Actuators used: Solenoids, Various types of electric motors and piezoelectric force generators.

Examples of Actuators: Relays, Solenoids and motors. Chassis control systems and Automatic transmission control systems.

UNIT III: Microcontrollers/Microprocessors in Automotive domain 6L

Critical review and overview of development within the automotive context of microprocessors, microcontrollers and digital signal processors (architecture of 8/16 bit microcontrollers with emphasis on Ports, Timer/Counters, Interrupts, Watchdog timers and PWM). Criteria to choose the right microcontroller/processor for various automotive applications. Understanding various architectural attributes relevant to automotive applications. Automotive grade processors viz. Renesas, Quorivva, Infineon. Understanding and working on tool chains for different processors. Development of control algorithms for different automotive subsystems, Look-up tables and maps, Need of maps, Procedure to generate maps, Fuel maps/tables, Ignition maps/tables, Engine calibration, Torque table, Dynamometer testing.

UNIT IV: Communication protocols, Infotainment systems 6L

Communication protocols: Overview of automotive communication protocols, CAN, LIN , Flex Ray, MOST , Ethernet, D2B and DSI, Communication interface with ECUs, Interfacing techniques and Interfacing with infotainment gadgets, Relevance of Protocols such as TCP/IP for automotive applications, Wireless LAN standards such as Bluetooth, IEEE 802.11x communication protocols for automotive applications. Infotainment Systems: Application of telematics in automotive domain, Global positioning systems (GPS) and General packet radio service (GPRS).

UNIT V: Automotive Control Systems and Model Based Development 6L

Automotive Control System & Model Based Development: Control system approach in Automotive Electronics, Analog and digital control methods, Modelling of linear systems, System responses, Modelling of Automotive Systems with simple examples. Model based Development: Introduction to MATLAB, Simulink and SIMSCAPE tool boxes, Model-Based Design for a small system, Motor Model, Generator Model, Controller Model, SimDriveline, Introduction to Simulink simulations, Exploring the system response using different control methods, Tuning the system, Exploring system limitations, Understanding and refining motor models, Real time simulations on a simple target (Arduino / Rasberry Pi etc), Study of modeling and simulation of any one Automotive System.

UNIT VI: Safety Systems in Automobiles and Diagnostic Systems 6L

Active Safety Systems: ABS, TCS, ESP, Brake assist, etc. Passive Safety Systems: Airbag systems, Advanced Driver Assistance Systems (ADAS): Combining computer vision techniques as pattern recognition, feature extraction, learning, tracking, 3D vision, etc. to develop real-time algorithms able to assist the driving activity. Examples of Assistance Applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.

Functional Safety: Need for safety systems, Safety concept, Safety process for product life cycle, Safety by design, Validation

Diagnostics: Fundamentals of Diagnostics, Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system, Fault finding and corrective measures, Electronic transmission checks and Diagnosis, Diagnostic procedures and sequences, On-board and off-board diagnostics in Automobiles, OBDII, Concept of DTCs, DLC, MIL, Freeze Frames, History Memory, Diagnostic tools, Diagnostic protocols KWP2000 and UDS.

Text Books:

1. Williams. B. Ribbens: “Understanding Automotive Electronics”, 6th Edition, Elsevier Science, Newnes Publication, 2003.
2. Robert Bosch: “Automotive Electronics Handbook”, John Wiley and Sons, 2004.

Reference books:

1. Ronald K Jurgen: “Automotive Electronics Handbook”, 2nd Edition, McGraw-Hill, 1999.
2. ames D. Halderman: “Automotive Electricity and Electronics", PHI Publication.
3. Terence Rybak & Mark Stefika: “Automotive Electromagnetic Compatibility (EMC)”, Springer, 2004.
4. Allan Bonnick: “Automotive Computer Controlled Systems, Diagnostic Tools and Techniques”, Elsevier Science, 2001.
5. Uwe Kieneke and Lars Nielsen: “Automotive Control Systems: Engine, Driveline and Vehicle”, 2nd Edition, Springer Verlag, 2005.
6. David Alciatore & Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE)”, TMH, 2007.

7. Iqbal Husain: "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
8. Tom Denton: "Advanced Automotive Diagnosis", 2nd Edition, Elsevier, 2006.
9. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications", Springer, 2009.
10. Tracy Martin: "How to Diagnose and Repair Automotive Electrical Systems" Motor Books / MBl Publishing Company, 2005.
11. Mehrdad Ebsani, Ali Emadi & Yimin Gao: "Modern Electronic Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press, 2009.
12. Marc E. Herniter and Zac Chambers: "Introduction to Model Based System Design", Rose-Hulman Institute of Technology.

List of Experiments

Note: Experiments 1 to 6 are compulsory; perform any three experiments from 7 to 12.

1. Develop and implement wiper control system using microcontroller.
2. Interface accelerometer sensor to microcontroller and display data.
3. Simulate and implement Vehicle indoor lighting system.
4. Study and implement CAN protocol to transmit data between two ECUs
5. Study the functional design aspects of Hybrid Automotive Systems.
6. Implement any one automotive application using VM Lab software

Using MATLAB Simulink/Stateflow, design :

7. Fault-Tolerant Fuel Control System
8. Automatic Climate Control System
9. Vehicle Electrical System
10. Manage the Data for a Fuel Control System
11. Anti-Lock Braking System
12. Power Window Control

404211 ELECTIVE III

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Objectives:

- To learn various types of algorithms useful in Artificial Intelligence.
- To understand the concepts of machine learning.
- To understand the applications in the field of AI and machine learning.

Course Outcomes:

After successfully completing the course students will be able to

- Develop AI algorithms for various applications.
- Design neural networks
- Use machine learning techniques for various applications

Unit I: Foundation 6L

Introduction and Intelligent systems, What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Applications of A.I. Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents, How the components of agent programs work.

Unit II: Searching 6L

Solving Problems by Searching**,** Depth-first search, Breadth-first search, Greedy best-first search A* search, Local Search Algorithms, Hill-climbing search, Simulated annealing search, Local beam search, Genetic algorithms, AND-OR search trees, Searching with Partial Observations.

Unit III: Knowledge Representation 6L

First order logic, representation revisited, Syntax and semantics for first order logic, Using first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining.

Unit IV: Machine learning 6L

Need of machine learning, Applications, Linear classifiers, decision tree, Bayesian Networks.

Unit V: Neural networks 6L

Artificial neural networks, types of ANN, multilayer neural network, back propagation algorithm, CNN, RBF.

Unit VI: Supervised learning **6L**

Forms of Learning, Supervised Learning, Learning Decision Trees, support vector machine, unsupervised learning, k-Means Algorithm.

Text Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig.
2. Artificial Intelligence and Machine Learning, by Chandra S.S.V, PHI

Reference Books:

1. Artificial Intelligence, 2nd Edition, Rich and Knight
2. Machine Learning, Tom M. Mitchell
3. Building Machine Learning Systems with Python, Richert & Coelho

List of Experiments:

Perform any 8 experiments from the list given below:

1. Implementation of any 2 uninformed search methods with some application.
2. Implement A* approach for any suitable application.
3. Implement genetic algorithm for any suitable application
4. Implementation of Unification algorithm
5. Two clusters of data, belonging to two classes, are defined in a 2-dimensional input space. Classes are linearly separable. Construct a Perceptron for the classification of data.
6. Implement Neural network for any suitable application.
7. Implement CNN network for any suitable application.
8. Implement RNN network for any suitable application.
9. Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non separable Dataset.
10. Implement K - Nearest Neighbor Classifier on Data set of your choice.

404211 ELECTIVE III

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

AUDIO VIDEO ENGINEERING

Course Objectives:

1. Provide students with a strong understanding of the fundamental principles and practical applications of audio and video engineering with latest updates.
2. Make students familiar with basics of Digital television, High Definition Television and various display Devices
3. Provide the latest developments in audio-video engineering with emphasis on HDTV, DTV, LCD, Plasma etc
4. Provide hands-on practice on TV kits to study normal operation and fault diagnosis.

Course Outcomes:

After successfully completing the course students will be able to

1. Describe and differentiate working principles of Digital TV, HDTV etc.
2. Understand the concept of basic television signal processing
3. Identify globally accepted color TV standards.
4. Demonstrate the need of audio and video compression techniques in real life.

Course contents:

UNIT I: Vision Characteristics, Scanning System and Analog Video 6L

Introduction To Basic Television Systems, Characteristics of Human Eye, Resolution Of Brightness, Perception, Persistence of Vision Scanning, Aspect Ratio, Flicker, The Keel Factor, Horizontal And Vertical Resolution, Video Bandwidth, Interlaced Scanning, Composite Video Signal: Video Signal Components, Video Modulation, Vestigial Side Band Signal, Sound Modulation and Inter-Carrier System, Reception of Vestigial Side Band Signal, Television Broadcast Channels And Standards.

UNIT II: Colour Television and standards 6L

Color television: Compatibility considerations, Perception of brightness and color, Color theory, chromaticity diagram, Luminance signal (Y), Color difference signal, Formation of chrominance signal, Color subcarrier frequency.

Standards: NTSC, PAL, SECAM colour system, generalized colour TV receiver block diagram, study of functionality of each block, alignment issues.

Digital video: Concept, sampling of video signal, Digitization, pixel array, Viewing distance and angle, composite vs component video.

UNIT III: Advanced TV systems and techniques **6L**

Introduction to UHDTV: 4K and 8K, IPTV/web TV, smart TV, Wi-Fi TV, digital surveillance, 3D TV concept, over view of H.264 features, camcorders, webcams, HD Video projectors, Video Intercom systems/ Video door phones.
Display techniques: LED, LCD, OLED, 3D, 4D, 5D, 7D, 9D, Smart whiteboard

UNIT IV: Digital TV **6L**

Introduction to Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, advanced MAC signal transmission, Digital TV receivers, Video compression: MPEG 2, MPEG 4. Video restoration, Video streaming, DTH, comparison of SDTV, EDTV and HDTV.

UNIT V: Acoustics **6L**

Human Hearing and sound, frequency range, dynamic range, masking, digital representation of sound wave, intensity, decibel sound level, sound waves in rooms, reverberation, room/studio acoustics as a component in speech system, PA systems, special types of microphones and speakers.

UNIT VI: Audio Engineering **6L**

Fundamentals of Audio-Video Recording: Methods of sound recording & reproduction, optical recording, CD recording, audio standards. Digital Sound Recording, CD/ DVD player, MP3 player, Blue Ray DVD Players, MPEG, MP3 Player.
Characteristics of Sound, Noise Distrotion and High Fidelity, Stereo Control, Surround Sound System, multichannel/Dolby 5.1 sound in DTV.

Text Books:

1. A.M. Dhake, Television and video Engineering, TMH Publication, 2nd Edition,2001
2. R.G.Gupta, Audio and Video Systems, McGraw Hill l Education (India), 2nd Edition,2010.

Reference Books

1. S. P. Bali, Color Television Theory and Practice, McGraw Hill Education (India),1994
2. A.M. Tekalp,Digital Video, Prentice Hall, 1995
3. R.P. Gulathi, Modern Television Practice, 4th edition, New Age International Publisher, 2014
4. Kelth jack, Video Demystified: A Handbook for the Digital Engineer,5th Edition, Newnes, 2007.

List of experiments:

Perform any eight experiments from 1-10.

1. To evaluate the fault simulation and step by step fault finding procedure of different section in color TV Receiver.
3. DTH and STB
4. Study of Digital TV pattern generator.
5. Study of HDTV/UHDTV
6. Study of Wi-Fi TV system
7. To study DVD / Blu Ray player and observe various signal waveforms.
8. Study of audio player: MP3 player
9. Study of audio and video coding scheme (soft)
10. To design and study PA system.
11. Directivity pattern of microphone/speakers.
12. Visit to TV transmitter/ Digital TV studio/ All India Radio/ TV manufacturing factory. (Compulsory)

404211 ELECTIVE III

Teaching Scheme
Lecture:3hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

Testing and Verification for SoC Design

Course Objectives:

1. To introduce design process in VLSI
2. To understand the logical and Fault simulation models
3. To learn techniques for design of testability
4. To study hardware and software verification issues for testing

Course Outcomes:

After successfully completing the course students will be able to

1. Accept challenges in VLSI Testing at different abstraction levels
2. Understand fault models for generation of test vectors.
3. Calculate observability and controllability parameters of circuit
4. Enhance testability of a circuit.
5. Use simulation techniques for designing and testing of VLSI circuits
6. Identify characteristics of verification methods.

Unit I: Introduction to Testing **6L**

Testing Philosophy, Role of Testing , Digital and Analog VLSI Testing, VLSI Technology Trends Affecting Testing, VLSI testing process and test equipment: How to Test Chips?, Automatic Test Equipment, Electrical Parametric Testing

Unit II: Fault Modeling **7L**

Defects, Errors, and Faults, Functional Versus Structural Testing, Levels of Fault Models, A Glossary of Fault Models, Single Stuck-at Fault

Unit III: Logic and Fault Simulation **7L**

Simulation for Design Verification, Simulation for Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-Value Simulation , Algorithms for Fault Simulation, Statistical Methods for Fault Simulation

Unit IV: Combinational & Sequential Circuit Test Generation **6L**

Algorithms and Representations, Redundancy Identification, Testing as a Global Problem, Significant Combinational ATPG Algorithms, Simulation-Based Sequential Circuit ATPG

Unit V: Digital DFT and scan design **6L**

Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan, Random Logic BIST

Unit VI: Boundary Scan Standard 7L

Memory BIST, Motivation, System Configuration with Boundary Scan, Boundary Scan Description Language

Text Books

1. M. L. Bushnell and V.D. Agrawal, *Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits*, Springer, 2005
2. M. Abramovici, M. Breuer, and A. Friedman, *Digital System Testing and Testable Design*, IEEE Press, 1994

Reference Books

1. H. Fujiwara, *Logic Testing and Design for Testability*, MIT Press, 1985
2. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004
3. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000

List of Experiments:

Perform any eight using front end and backend tools

1. Write VHDL/Verilog code for MUX -D scan cell and Level Sensitive/edge triggered MUX - D scan cell.
2. Write a VHDL/Verilog code to realize functioning of clocked scan cell and LSSD scan cell design.
3. To develop an exhaustive test bench for lower level combinational designs:
   a. Adder
   b. Multiplexer.
4. To prepare a complete Test vector set for all possible stuck at faults for parity checker where the data word is of 2-bit.
5. Design and implement ATPG for given combinational circuit
6. To prepare a complete Test vector set for all possible stuck at faults for a 8-line- to-1-line multiplexer
7. To prepare a complete Test vector set for all possible stuck at faults for a 3- to-8 decoder
8. Implement a full adder using AND, OR, and NOT gates and determine the total number of single stuck-at-faults
9. Implement a full adder using AND, OR, and NOT gates and determine the total number of multiple stuck-at-faults
10. Generate and implement a minimum set of test vectors to detect all single-stuck at faults for an n-bit parity checker

404211 ELECTIVE III

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

OPTICAL AND MICROWAVE COMMUNICATION

Course Objectives:

- To lay the foundation for optical and microwave communication engineering.
- To understand the applications of optical and microwave communication engineering.
- To carry out the analysis of optical and microwave network.

Course Outcomes:

After successfully completing the course, students will be able to

- Understand advantages and applications of optical and microwave communication.
- Identify different optical and microwave devices with their operating principle.
- Formulate optical and microwave communication problem for synthesis.

Unit I: Fundamentals of FOC 6L

Basic block diagram of Optical Fiber Communication system, Principles of light propagation through a fiber, Different types of fibers and their characteristics, Attenuation, Distortion, Pulse broadening in GI fibers, Mode coupling, Coupling losses, Material dispersion, Dispersion in single-mode and multimode fibers, Connectors & splicers.

Unit II: Optical Sources and Detectors 6L

Introduction to optical sources: Wavelength and Material Considerations, LEDs & semiconductor LASERs: principle of working & their Characteristics, Line coding.

Introduction to optical detectors: Material Considerations, PIN, Avalanche photodiodes & photo transistors: Principle of working & characteristics, relative merits and demerits of photodiodes. Numericals based on above topics.

Unit III: Multichannel Systems 6L

Overview of WDM, WDM Components: 2 x 2 Fiber Coupler, Optical Isolators and Circulators, Multiplexers and De-multiplexers, Fiber Bragg Grating, FBG applications for multiplexing and De-multiplexing function, Diffraction Gratings, Overview of Optical Amplifiers: SOA, EDFA.

Unit IV: Microwave Devices and Components 6L

Introduction to microwaves, advantages and applications of microwaves, Basic concepts and properties of wave guides, Scattering matrix of microwave passive Network, Properties of S matrix, S matrix formulation of two-port junction, Tee junctions- H plane, E plane and EH plane Tee junctions, its S matrix and properties, Applications of Hybrid Tee junction, Directional coupler, Gyrator, Isolator, Circulator.

Unit V: High Power Microwave Sources 6L

High frequency limitations of conventional tubes, Microwave tubes, Velocity modulation, Two cavity klystron amplifier: construction and working with apple gate diagram, Multi cavity klystron amplifier, Reflex klystron: construction, working, mode curves and characteristics, Travelling Wave Tube: construction, working, advantages of slow wave structures, Magnetron: types, construction and working of Cavity Magnetron

Unit VI: Microwave Solid State Devices and Applications 6L

Unipolar and bipolar microwave transistors, Principle of operation, advantages and applications of Gunn diode, Tunnel diode, PIN diode, Varactor diode, Schottky diode, Transit time devices like IMPATT, TRAPATT diodes.

Text Books:

1. G. Keiser, "Optical fiber communication systems", McGraw-Hill, 3rd Edition, New York, 2000.
2. Mishra and Ugale, "Optical Fiber Communication: system and components", John Wiley,
   India, 2012.
3. Samuel Liao, "Microwave devices and circuit", PHI.

Reference Books:

1. G. P. Agrawal, "Fiber optic communication systems", 3rd Edition, John Wiley & Sons, New York, 2002.
2. M. Kulkarni, "Microwave and Radar Engineering", Umesh Publications.
3. A. K. Maini, "Microwave and Radar", Khanna Publishers.
4. David M. Pozar, "Microwawe Engineering" Wiley India.

List of Experiments:

1. V-I & I-P characteristics of LED.
2. Characteristics of light detector.
3. Measurement of Numerical Aperture.
4. Study of any two optical instruments: Optical Power Meter, OTDR, OSA etc.
5. Measurement of attenuation of optical Fiber Cable of Various lengths.
6. Characteristics of Reflex Klystron.
7. Characteristics of Gunn diode oscillator.
8. Measurement of coupling coefficient, Directivity and insertion loss of a Directional coupler.
9. VSWR, isolation and insertion measurement of Isolators and Circulators
10. S-parameter and VSWR measurements of Tees

404212 ELECTIVE IV

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

ROBOTICS

Course Objectives:

- Describe the history and early beginnings of automated manufacturing & Robotics.
- Aims to Develop understanding Robotics Components.
- To study path planning and robotic programming
- Apply creative approaches to practical applications, identify technological opportunities in robotics.

Course Outcomes:

After successfully completing the course students will be able to

1. Demonstrate use of engineering methods and problem solving towards design of the specified robot.
2. Identify prerequisites of Robotics for small industrial Applications.
3. Understand robotic programming.
4. Describe Robot control & its applications.

UNIT I: Introduction 6L

Robot anatomy, Definition, law of robotics, History and Terminology of Robotics, Accuracy and repeatability of robotics, Simple problems specification of robot, speed of robot, robot joints and links, robot classification, architecture of robotics systems, robot drive system, Hydraulic, pneumatic and electric system.

UNIT II: Robot Transformation, Sensors & End effectors 6L

Transformation types: 2D, 3D. Translation- Homogeneous coordinates multiple transformations, Simple problems. Sensors in robot, Touch sensors, tactile sensor, Proximity and range sensors. Robotic vision sensor, Force sensor, Light sensors, Pressure sensors End effectors: Mechanical grippers, Slider crank mechanism, Screw type, Rotary actuators, cam type, Magnetic grippers, Vacuum grippers, Air operated grippers, Gripper force analysis, Gripper design and simple problems

UNIT III: Kinematics 6L

Rigid body Kinematics, Inverse Kinematics, Rotation matrix, Homogenous transformation matrix, Denavit - Hartenberg convention, Euler angles, RPY representation, Direct and inverse Kinematics for industrial robots for position and orientation Redundancy, Manipulator, Jacobian Joint, End effector, velocity – direct andinverse velocity analysis. Control: Individual joint computed torque.

UNIT IV: Dynamic **6L**

Lagrangian Dynamics, link inertia tensor and manipulator inertia tensor, Newton-Euler Dynamics of Robot, Newton-Euler formulation for RR & RP manipulators, Dynamics of systems of Interacting Rigid Bodies, D-H Convention, Trajectory planning for Flexible Robot, Cubic polynomial linear segments with parabolic blending, static force and moment transformation,solvability, stiffness, Singularities.

UNIT V: Path planning & Programming **6L**

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion, straight line motion, Robot languages, computer control and Robot software.

UNIT VI: Robot Control & Applications **6L**

Control approaches: oscillatory based time varying control law, control law based on vector field orientation approach. Advanced strategies of control: conventional aerial vehicle, Bidirectional X4-flyer. Applications of Fuzzy Logic and Neural network in Robot Control, Neural controllers, Implementation of Fuzzy controllers: Trajectory tracking controller. Applications of Robotic system: complex control system, vision system in complex control system. Human Robot Interaction: Architecture.

Text Books:

1. Thomas R. Kurfess, Robotics And Automation Handbook, CRC Press, 2004
2. Robotics: Appin Knowledge Solutions (Firm), Infinity Science Press , 2007

Reference Books:

1. J. Norberto Pires, Altino Loureiro and Gunnar Bölmsjo, Welding Robots -Technology, System Issues and Applications, Springer-Verlag 2006.
2. Robot Motion and Control (Recent Developments) by M.Thoma& M. Morari
3. Ben-Zion Sandler, Robotics: Designing the Mechanisms for Automated Machinery, 2nd ed. 1999 by Academic Press.
4. Mikell P. Grooveret. al. "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

404212 ELECTIVE IV

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

WIRELESS SENSOR NETWORKS

Course Objectives:

- To learn basic concepts of wireless sensor networks.
- To be familiar with architecture and protocols used in wireless sensor networks.
- To provide knowledge of deployment and security issues of wireless sensor networks.

Course Outcomes:

On completion of the course, students will be able to

1. Explain various concepts and terminologies used in WSN.
2. Describe importance and use of radio communication and link management in WSN.
3. Explain various wireless standards and protocols associated with WSN.
4. Recognise importance of localization and routing techniques used in WSN.
5. Understand techniques of data aggregation and importance of security in WSN.
6. Examine the issues involved in design and deployment of WSN.

Course Contents:

Unit I: Introduction 6L

What are Wireless Sensor Networks, Wireless Sensor Node, Anatomy of a Sensor Node, Architecture of WSN, Performance metrics in WSN, types of WSN.

Unit II: Radio Communication & Link Management 6L

Radio Waves and Modulation/ Demodulation, Properties of Wireless Communications, Medium Access Protocols, Wireless Links Introduction, Properties of Wireless Links, Error Control, Naming and Addressing, Topology Control.

Unit III: Wireless Standards & Protocol Stack 6L

WSN Standards- IEEE802.15.4 low rate WPAN, Zigbee, Wireless HART, ISA 100.11a, 6LoWPAN, IEEE802.15.3, Wibree, BLE, Zwave, ANT, Insteon, Wavenis, Protocol stack of WSNs, Cross Layer Protocol Stack.

Unit IV: Localization & Routing 6L

Localization: Localization Challenges and Properties, Deployment Schemes, Proximity Schemes, Ranging Schemes, Range-Based Localization, Range-Free Localization, Routing Basics, Routing Metrics, Routing Protocols, Full-Network Broadcast, Location-Based Routing, Directed Diffusion, Collection Tree Protocol, Zigbee, Multi-Hop Communications.

Unit V: Data Aggregation & Security **6L**

Clustering Techniques, In-Network Processing and Data Aggregation, Compressive Sampling, Security Issues in Wireless Sensor Networks, Attacks, Defensive Measures, Security requirements and threat model.

Unit VI: Designing & Deploying WSN Applications **6L**

Designing and Deploying WSN Applications, Early WSN Deployments, General Problems, General Testing and Validation, Requirements Analysis, Top-Down Design Process, Bottom-Up Implementation Process.

Text Books:

1. Dargie W. and Poellabauer C., "Fundamentals of Wireless Sensor Networks: Theory and Practice," John Wiley and Sons.
2. Anna Hac, "Wireless Sensor Network Designs," John Wiley and Sons.
3. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks,” John Wiley and Sons.

Reference Books:

1. Edgar H. Callaway Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols," CRC Press.
2. Sohraby K., Minoli D. and Znati T., "Wireless Sensor Networks: Technology, Protocols and Applications,” John Wiley and Sons.

404212 ELECTIVE IV

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

RENEWABLE ENERGY SYSTEMS & DSM

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems.
- To outline utilization of renewable energy sources for both domestic and industrial applications.
- To analyze the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

After successful completion of this course students will be able to:

1. Develop fundamental understanding about Solar Thermal and Solar Photovoltaic systems.
2. Provide knowledge about development of Wind Power plant and various operational as well as performance parameter/characteristics.
3. Explain the contribution of Biomass Energy System in power generation.
4. Use various energy measurement and audit instruments.
5. Solve simple problems on cost benefit analysis.

Unit I: Solar Energy 6L

Solar energy system, Solar Radiation Availability, Measurement and Estimation, Types of PV system: Stand-alone PV systems, Grid connected PV systems. Solar Thermal Conversion Devices and Storage, System sizing: Power and energy estimates, battery sizing, PV array sizing and Applications Solar power system. Case study on installation of Solar power plant.

Unit II: Wind Energy 6L

Wind Energy Conversion, System component, Power vs speed and TSR, Maximum power operation , Types of wind turbines, Wind generators, Wind generator drives, Installation of wind power plant, Stand alone and Grid connected wind power system, Wind data and energy estimation, Safety and environmental aspects, Case study-Applications of wind power system.

Unit III: Biomass Energy System 6L

Biomass Classification, Biomass Resources and their Energy Potential, Biomass Conversion Technologies: Anaerobic Digestion, Ethanol Fermentation, Biomass Gasification: Gasifiers, Fluidized Bed Gasifier, Biogas Technologies and their factor affecting Biogas Production, Biogas Plants: Floating and Fixed Dome type, designing of biogas plant Power Generation from Municipal Solid Waste (MSW), Land Fill Gas and Liquid Waste

Unit IV: Introduction to Demand Side Management **6L**

India's Energy Scenario, Energy supply demand balancing, Traditional supply oriented power planning, need for integrated resource planning, DSM and its relevance, load shape objectives in context to DSM, Electricity Act & regulatory framework, Technology options for DSM in Lightning, Space cooling(Ceiling Fan, AC system), Refrigeration and Water cooling)

Unit V Introduction to Demand Response (DR) **6L**

Demand Response, classification of various DR options, architecture for DR implementation, Energy management system, DR strategies for various load categories, role of communication infrastructure, MDMS, DRAS (Server & client) DR for vertical building, Demand Response as an apart of smart grid initiative

Unit VI: Load research and Energy Auditing **6L**

Load research- understanding variation in demand and supply of electricity, load forecasting, determining sector wise and end use wise load pattern

Energy Auditing- need of energy audits, types of audit, procedures to follow, data and information analysis, energy audit instrumentation, energy consumption, Outcome of energy audit and energy saving potential, action plans for implementation of energy conservation options.

Text Books:

1. Mukund R. Patel, "Wind and Power Solar System", CRC Press
2. Godfrey Boyle, "Renewable Energy", Third edition, Oxford University Press.
3. Energy Auditing made simple by Balasubramanian, Bala Consultancy Services.

Reference Books:

1. D. P. Kothari, K. C. Singal, RakeshRajan," Renewable Energy Sources and Emerging Technologies", PHI Second Edition
2. Paul Gipe, "Wind Energy Comes of Age", John Wiley & Sons Inc.
3. Donald L. Klass, "Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, Academic Press
4. S. Rao, Dr. B. B. Parulekar, "Energy Technology –Non Conventional, Renewable and Conventional", Khanna Publication

404212 ELECTIVE IV

Teaching Scheme
Lecture:3 hr/week

Examination scheme
In Semester Examination Phase I : 30
End Semester Examination: Phase II: 70

TM4C123GH6PM Microcontroller

Course Objectives:

- To study ARM cortex based Microcontroller
- To study detail architecture of TM4C123GH6PM Microcontroller
- To study applications of TM4C123GH6PM Microcontroller

Course Outcomes:

After successfully completing the course students will be able to

- Understand basic concept of ARM cortex based microcontroller
- Understand architecture of TM4C123GH6PM Microcontroller
- Use TM4C123GH6PM Microcontroller for industrial applications

UNIT I: Architecture 6L

The Cortex-M4F Processor, Block Diagram, System-Level Interface, Integrated Configurable Debug, Trace Port Interface Unit (TPIU), Cortex-M4F System Component Details.

UNIT II: Programming Model 6L

Programming Model, Processor Mode and Privilege Levels for Software Execution, Stacks, Register Map, Register Descriptions, Exceptions and Interrupts, Data Types, Memory Model, Memory Regions, Types and Attributes, Memory System Ordering of Memory Accesses Behavior of Memory Accesses, Software Ordering of Memory Accesses , Bit-Banding.

UNIT III: Exception Model 6L

Exception States, Exception Types, Exception Handlers, Vector Table, Exception Priorities, Interrupt Priority Grouping, Exception Entry and Return, Fault Handling, Fault Types, Fault Escalation and Hard Faults, Fault Status Registers and Fault Address Registers Lockup, Power Management, Entering Sleep Modes, Wake Up from Sleep Mode.

UNIT IV: Functional Description 6L

System Timer (SysTick), Nested Vectored Interrupt Controller (NVIC), System Control Block (SCB), Memory Protection Unit (MPU), Floating-Point Unit (FPU), Register Map, System Timer (SysTick) Register Descriptions, NVIC Register Descriptions, System Control Block (SCB) Register Descriptions, Memory Protection Unit (MPU) Register, Floating-Point Unit (FPU) Register Descriptions. Internal Memory, Micro Direct Memory Access

(Mdma, General-Purpose Input/Outputs (GPIOs), General-Purpose Timers, Watchdog Timers, Analog-to-Digital Converter (ADC).

UNIT V: Peripherals **6L**

Universal Asynchronous Receivers/Transmitters (UARTs), Synchronous Serial Interface (SSI), Inter-Integrated Circuit (I2C) Interface, Controller Area Network (CAN) Module, Universal Serial Bus (USB) Controller, Analog Comparators, Pulse Width Modulator (PWM), Quadrature Encoder Interface (QEI).

Unit VI: Applications **6L**

Remote monitoring, electronic point-of-sale machines, test and measurement equipment, network appliances and switches, factory automation, HVAC and building control, gaming equipment, motion control, transportation, and fire and security applications of TM4C123GH6PM Microcontroller.

Reference: TM4C123GH6PM Data sheet : https://www.ti.com

404213 LAB PRACTICE – III

Teaching Scheme:
Practical: 4 Hrs/week

Examination Scheme:
TW:50 Marks
PR: 50 Marks

COMPUTER NETWORKS & SECURITY

(Perform any 8 experiments)

1. Study of network commands & IP address configurations.
2. Study of Cable tester for fault detection of UTP-CAT5 Cross / Straight LAN cable.
3. Implementation of LAN using star topology and connectivity between two computers using cross over UTP CAT5 cable. (Cisco Packet Tracer)
4. Installation and configuration of Web Server and hosting web page using HTML programming. (Cisco Packet Tracer)
2. Installation and configuration of Proxy Server.
3. Installation and configuration of FTP server for FTP communication.
4. Installation and configuration of Telnet server for Telnet Communication. (Teamviewer)
5. Write a program in „C" for Encryption and Decryption (RSA Algorithm).
6. Write a program in „C" for Shortest Path algorithm.
7. Connectivity of LAN computers to Internet using Dial-Up modem/leased line Modem /Mobile Handset. (Installation and configuration).
8. Installation of Suitable Protocol Analyzing software and Analysis of Intranet activities. (Wireshark)
9. Configure RIP using packet Tracer.
10. Study of any network simulation tools-To create a network with three nodes & establish a TCP connection between node 0 & node 1 such that node 0 will send TCP packet to node 2 via node 1.

404214 LAB PRACTICE – IV

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme:
Pr: 50 Marks

Experiments to be chosen based on Elective III.

404215 PROJECT PHASE-II

Teaching Scheme:
Tutorial: 6Hrs/week

Examination Scheme:
TW: 150 Marks
OR: 50 Marks

1. Group Size
The student will carry the project work individually or by a group of students. Optimum group size is in 3 students. However, if project complexity demands a maximum group size of 4 students, the committee should be convinced about such complexity and scope of the work.

2. Selection and approval of topic
Topic should be related to real life application in the field of Electronics OR
Investigation of the latest development in a specific field of Electronics or Communication or Signal Processing
OR
The investigation of practical problem in manufacture and / or testing of electronics or communication equipment
OR
The Microprocessor / Microcontroller based applications project is preferable.
OR
Software development project related to VHDL, Communication, Instrumentation, Signal Processing and Agriculture Engineering with the justification for techniques used / implemented is accepted.
OR
Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

3. Note:
The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by internal and external guides.
Project report must be submitted in the prescribed format only. No variation in the format will be accepted. One guide will be assigned at the most 3 project groups.

4. The assessment is based on Innovative Idea, Depth of understanding, Applications, Individual contributions, presentation, and the grade given by the internal guide based on the work carried out in a semester.

5. A certified copy of report is required to be presented to external examiner at the time of final examination.

6. The examination be conducted by two examiners (internal and external-from industry or teaching staff from other university) appointed by the university.

AUDIT COURSE 6

FOREIGN LANGUAGE (JAPANESE MODULE 4)

About Course: With changing times, the competitiveness has gotten into the nerves and Being the Best‘ at all times is only the proof of it. Nonetheless, being the best differs significantly from communicating the best. The best can merely be communicated whilst using the best suitable Language!

Foreign languages like Japanese are the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer‘s companion in current times with an assertion of a thriving future. Metro cities like Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the resume since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it. The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support
- To get introduced to Japanese society and culture through language.

Course Outcome:

- On completion of the course, learner will be able to–Possess ability of basic communication.
- Possess the knowledge of Japanese script.
- Get introduced to reading, writing and listening skills for language Japanese.
- Develop interest to pursue professional Japanese Language course

Course Contents:

1. Stating existence or a presence of thing (s), person (s), Relative positions, Counters

2. Expressing one's Desire & wants, Verb groups, Asking, Instructing a person to do something

3. Indicating an action or motion is in progress, Describing habitual action, describing a certain continuing state which resulted from a certain action in the past. Express permission & prohibition

References:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

2.http://www.tcs.com
(http://www.tcs.com/news_events/press_releases/Pages/TCSInaugurates-Japan-centric-Delivery-Center-Pune.aspx

AUDIT COURSE 6

Technologies, Disruptions and Entrepreneurial Opportunities

Course Objectives:

- To understand the process of growth of exponential technologies and the resultant disruptive scenarios in business, social, government sectors of economy.
- To understand the few exponentially growing technologies and few business scenarios where disruptions are expected.
- To understand where the entrepreneurial opportunities are emerging and how new engineers will be able to exploit these opportunities.

Course Outcomes

1. Students will have better understanding of the process of technology trends leading to Business Disruptions and entrepreneurial opportunities.
2.Students will appreciate the technologies that they need to learn independently to better achieve their entrepreneurial career goals.

Course Contents

Unit No.	Contents
Unit 1	**Introduction** The process of emerging new technologies with exponential growth potential, how these exponential technologies lead to business disruptions, opportunities created for new businesses, destruction caused of established players, evolution of new businesses, Unicorns.
Unit 2	**Emerging Exponential Technologies** Understand Technology trends worldwide and identify the potential emerging exponential technologies like, Social, Mobile, Analytics, Computing (SMAC), Genetics, AI, 3D, Solar/Wind/Renewable, block chain.
Unit 3	**Emerging Business Disruptions and Business models** Learn business trends worldwide and identify potential business disruptions in multiple sectors like, Healthcare, Transportation, Weapons, Governance, Space, Energy, Finance and Education. Learn the new innovative business models.
Unit 4	**Identify Entrepreneurial Opportunities and Conclusions** Identify use cases and jobs to be done, customer pains and gains, solution development, prototype, problem-solution fit, product–market fit, customer development and validation.

Reference Books:

1. Innovator's Dilemma
   by Clayton Christenson(http://hbx.hbs.edu/hbx-courses/disruptive-strategy.html)
2. Disruption: Emerging Technologies and the Future of Work
   by Victor del Rosal (Paperback)
3. Mastering the Hype Cycle: How to Choose the Right Innovation at the Right Time
   by Jackie Fenn, Mark Raskino (Hardcover)
4. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses
   by Eric Ries (Hardcover)
5. Exponential Organizations: Why new organizations are ten times better, faster, and cheaper than yours (and what to do about it)
   by Salim Ismail, Michael S. Malone, Yuri van Geest (Paperback)
6. Abundance: The Future Is Better Than You Think
   by Peter H. Diamandis, Steven Kotler (Paperback)
7. Wharton on Managing Emerging Technologies
   by George S. Day and Paul J. H. Schoemaker

Savitribai Phule Pune University

FACULTY OF ENGINEERING

Syllabus for the

S.E (Electronics /Electronics & Telecommunications Engineering)

2015 Course

(w.e.f . June 2016)

Savitribai Phule Pune University, Pune
SE(E&TC/Electronics Engineering) 2015 Course

(With effect from Academic Year 2016-17)

Semester I												
Course Code	**Course**	**Teaching Scheme Hours / Week**			**Semester Examination Scheme of Marks**						**Credit**	
		Theory	**Tutorials**	**Practicals**	**In-Sem (On line)**	**End-Sem (Theory)**	**TW**	**PR**	**OR**	**Total**	**TH/TUT**	**PR+OR**
204181	Signals & Systems	3	1	-	50	50	25	-	-	125	4	-
204182	Electronic Devices & Circuits	4	-	2	50	50	-	50	-	150	4	1
204183	Electrical Circuits and Machines	3	-	2	50	50	25	-	-	125	3	1
204184	Data Structures and Algorithms	4	-	2	50	50	-	-	50	150	4	1
204185	Digital Electronics	4	-	2	50	50	-	50	-	150	4	1
204186	Electronic Measuring Instruments & Tools	1	-	2	-	-	50	-	-	50	1	1
204192	**Audit Course 1**	--	--	--	--	--	--	--	--	--		
	Total	19	1	10	250	250	100	100	50	750	20	05
										Total Credits	**25**	

Abbreviations:

Th : Theory
TW: Term Work
OR: Oral
TUT : Tutorial
PR : Practical

Note: Interested students of S.E. (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

SE(E&TC/Electronics Engineering) 2015 Course

(With effect from Academic Year 2016-17)

Semester II

Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tutorials	Practicals	In-Sem (on line)	End-Sem (Theory)	TW	PR	OR	Total	TH/TUT	PR+OR
207005	Engineering Mathematics III	4	1	-	50	50	25	-	-	125	5	-
204187	Integrated Circuits	4	-	2	50	50	25	50	-	175	4	1
204188	Control Systems	3	-	-	50	50	-	-	-	100	3	-
204189	Analog Communication	3	-	2	50	50	-	50	-	150	3	1
204190	Object Oriented Programming	3	-	4	50	50	-	-	50	150	3	2
204191	Employability Skill Development	2	-	2	-	-	50	-	-	50	2	1
204193	**Audit Course 2**	--	--	--	--	--	--	--	--	--		
	Total	19	1	10	250	250	100	100	50	750	20	05
									Total Credits		**25**	

Abbreviations:

TH: Theory
TW: Term Work
OR: Oral
TUT: Tutorial
PR: Practical

Note: Interested students of S.E (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

204181 Signals and Systems

Credits: Th- 03,Tut-01

Teaching Scheme:

Theory : 03 hr/week
Tutorial: 01 hr/week

Examination Scheme:

In-Sem(Online): 50 Marks
End-Sem(Theory):50 Marks
Term Work : 25 Marks

Course Objectives:

- To understand the mathematical description of continuous and discrete time signals and systems.
- To classify signals into different categories.
- To analyse Linear Time Invariant (LTI) systems in time and transform domains.
- To build basics for understanding of courses such as signal processing, control system and communication.
- To develop basis of probability and random variables.

Course Outcomes:

On completion of the course, student will be able to

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

Course Contents

Unit I : Introduction to Signals and Systems (8 Hrs)

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, sampling theorem, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

Elementary signals used for testing: reasons for using standard test signals, exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit II : Time domain representation of LTI System (6 Hrs)

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit III : Fourier Series (6 Hrs)

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon, Discrete Time Fourier Series, properties, convergence of DTFS.

Unit IV : Fourier transform (7Hrs)

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Properties and their significance, Interplay between time and frequency domain using sinc and rectangular signals, Fourier Transform for periodic signals, introduction to Discrete Time Fourier Transform.

Unit V : Laplace transform and its applications (7Hrs)

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform,ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.

Unit VI : Probability and Random Signals (6 Hrs)

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Uniform and Gaussian probability models.

Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF.Statistical averages, mean, moments and expectations, standard deviation and variance.

Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.
2. Charles Phillips, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education.

Reference Books:

1. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.
2. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.
3. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
4. Peyton Peebles, “Probability, Random Variable, Random Processes”, 4th Edition, Tata Mc Graw Hill.
5. A. NagoorKanni “Signals and Systems”, 2nd edition, Mc Graw Hill.
6. NPTEL video lectures on Signals and Systems.

Guidelines for Tutorial / TW Assessment

Tutorials must be conducted batch wise. Batch size should not be more than 20 students. The main objective of this tutorial is to focus on the outcomes defined in the theory syllabus by solving the following assignments based on paper work.

At least 8 tutorials to be conducted. (Any 4 from first 6)

List of Tutorials

1 A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT)
   a) Sine
   b) Rectangular
   c) Triangular
   d) Exponential
   e) Unit Impulse
   f) Unit Step
   g) Ramp
   h) Signum
   i) Sinc

B) Classify and find the respective value for the above signals
   a) Periodic / Non Periodic
   b) Energy / Power /Neither

2. Take any two CT and DT signals and perform the following operation Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.
3. Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.
4. Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible.
5. Perform Convolution Integral of Two Continuous time Signals. (Various Combinations can be taken for this.)
6. To find Fourier series for the signals and plot its magnitude and phase response. (Signals like: Half/Full wave rectified signal, Saw tooth wave etc.)
7. State and prove the various properties of CT Fourier Transform. Take rectangular and sinc Signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.
8. State and prove the properties of CT Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis.
9. To perform auto and cross correlation for DT and CT signals. Also explain the relation between Convolution and Correlation.

10.

A) List and Explain the properties of CDF & PDF, Suppose a certain random variable has the CDF

$$F_X(x)=\begin{cases} 0 & x\le 0 \\ kx^2 & 0<x\le 10 \\ 100k & x>10 \end{cases}$$

Evaluate k, Write the corresponding PDF and find the values of $P(X\le 5)$ and $P(5 < X \le 7)$

(This is only an example. Various Probability functions may be given)

B) Find mean ,mean square , standard deviation , variance of X

when $f_X(x)=ae^{-ax}u(x)$ with a>0

(This is only an example. Various Probability functions may be given)

204182 Electronic Devices and Circuits

Credits: Th- 04, Pr -01

Teaching Scheme:

Theory: 04 hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem (Online): 50 Marks
End-Sem(Theory):50Marks
Practical : 50 Marks

Prerequisites: - Basic knowledge of Semiconductor Physics

Course Objectives:

- To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications.
- To introduce concepts of both positive and negative feedback in electronic circuits.
- To analyse and interpret FET and MOSFET circuits for small signal at low and high frequencies.
- To simulate electronics circuits using computer simulation software and verify desired results.
- To study the different types of voltage regulators.

Course Outcomes:

On completion of the course, student will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

Course Contents

UNIT I: JFET (8 Hrs)

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self). FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.

Unit II :MOSFET& its DC Analysis (8 Hrs)

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing.

Unit III : MOSFET AC Circuit Analysis: **(8 Hrs)**

The MOSFET CS small signal amplifier, Small signal parameters, small signal equivalent circuit, Modeling, Body effect, Analysis of CS amplifier. Introduction to BiCMOS technology. The MOSFET internal capacitances and high frequency model.

Introduction to MOSFET as basic element in VLSI, V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects, MOSFET capacitances.

Unit IV : MOSFET Circuits **(7 Hrs)**

MOSFET as switch, diode/active resistor, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

Unit V : Feedback amplifiers and Oscillators **(8 Hrs)**

Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitts oscillators.

Unit VI : VoltageRegulator: **(7 Hrs)**

Block diagram of an adjustable three terminal positive and negative regulators (317,337).Typical connection diagram, current boosting. Low drop out voltage regulators. Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.

Text Books:

1.MillmanHalkias, “Integrated Electronics-Analog and Digital Circuits and Systems”, Tata McGraw Hill, 2000.

2. Donald Neaman, “Electronic Circuit Analysis and Design”,3rd Edition, Tata McGraw Hill.

Reference:

1. David A.Bell,“ElectronicDevicesandCircuits”,5th Edition, Oxford press
2. R. L. Boylstad, L. Nashlesky, “Electronic Devices and circuitsTheory”, 9thEdition, PrenticeHall of India, 2006.
3. Anil K. Maini and Varsha Agarwal “Electronic Devices and Circuits”, Wiley India
4. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford.
5. K. R. Botkar, “Integrated Circuits”, 5th Edition, Khanna Publication.

Guidelines for Laboratory Conduction

Perform minimum eight experiments out of which at least three experiments should be conducted on bread board.

List of Practical

1. Design a single stage FET Amplifier in CS configuration and verify DC operating point.
2. Build and test single stage CS amplifier using FET. Calculate Ri, Ro and Av.
3. Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.
4. SimulateVoltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
5. Implement current series feedback amplifier and find Rif, Rof, Gmf and Bandwidth.
6. Simulate LC oscillator using FET.

   OR

7. Implement Weinbridge /RC phase shift oscillator using FET/MOSFET.
8. Simulate MOSFET/ CMOS Inverter.

   OR

9. Build and test MOSFET as a switch.
10. Design and implement an adjustable voltage regulator using three terminals voltage regulator IC.

204183 Electrical Circuits and Machines

Credits: Th – 03, Pr -01

Teaching Scheme:

Theory: 03hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem(Online): 50 Marks
End-Sem: (Theory): 50 Marks

Term Work: 25 Marks

Course Objectives:

- To analyse AC and DC networks with network simplification techniques.
- To gain basic knowledge of transformers and their types.
- To conduct experimental procedures on different types of electrical machines.
- To understand the constructional details, characteristics, features and application areas ofvarious types of electric motors.

Course Outcomes:

On completion of the course, student will be able to

1. Analyze basic AC & DC circuit for voltage, current and power by using KVL, KCL, andnetwork theorems.
2. Explain the working principle of different electrical machines.
3. Select proper electrical motor for given application.
4. Design and analyze transformers.

Course Contents

Unit I :Basic Circuit Analysis and Simplification Techniques (8 Hrs)

Kirchhoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, power calculations.

Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Source transformation and source shifting.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual. (AC circuit analysis for all the topics of this unit)

Unit II :Transformer (6 Hrs)

Types, Construction, Transformer on No-load (Transformation ratio, emf equation), impedance transformation, losses in transformer, regulation and efficiency, rating. Auto transformer, coupling transformer, Isolation transformer, C.T. and P.T., Design of single phase transformer for instrument power supply, High frequency transformers.

Unit III :DC Machines (7 Hrs)

Construction of DC Machine, Motoring and generation action, types, EMF equation, Torque equation (Torque-armature current characteristics, Torque-speed characteristics, speed-armature current characteristics), Power flow diagram. Problems on speed, torque & losses. Different methods of speed control, different types of starters for DC shunt motor. Permanent Magnet DC motors, Applications of DC Motors

Unit IV :AC Motors (7 Hrs)

Three phase Induction motors, construction and principle of operation, types, slip and torque equation, Torque-slip characteristics, condition for maximum torque & ratios, types of starters, speed control, V/f control, Applications.

Synchronous motors: Construction, principle of operation, characteristics (V curves) and applications.

Unit V :Special Motors 1 (6 Hrs)

BLDC Motor, Construction, principle, characteristics, control circuit, sensors, applications. Construction, principle & applications of Reluctance Motor, Universal Motor.

Unit VI :Special Motors 2 (6Hrs)

Construction, types, principle, Characteristics, control circuit & applications of Stepper Motor and Servo motor.

Construction, principle, characteristics, Types and applications of single phase Induction Motor.

Text Books:

1. Abhijit Chakrabarti & Sudipta Debnath, “Electrical Machines”,Tata McGraw-hill Publication.
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin, “Engineering Circuit Analysis”, TataMcGraw Hill.

Reference:

1. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans,“Electrical Machinery”, TataMcGraw-hill Publication 6th Edition.
2. I.J Nagarath& D.P Kothari, “Electrical Machines”, Tata McGraw-hill Publication 4th Edition.
3. T. J. E. Miller, “Brushless permanent-magnet and reluctance motor drives”,OxfordUniversity Press(1989)
4. Ned Mohan, “Electric Machines and Drives”: A first course, Wiley.
5. B. L. Theraja, ”Electrical technology” volume 2, S. Chand

Guidelines for Laboratory Conduction

Perform any 8 experiments:

List of Practical

1. Network Theorems : To verify Thevenin's and Norton's theorem (DC or AC)
2. O.C. And S.C. Test on single phase transformer
3. Polarity test on single phase transformer.
4. Equivalent Circuit of a Single Phase Induction Motor by performing the no- load and blocked rotor tests.
5. Study of BLDC Motor Drive.
6. Speed control of DC motor using armature voltage and field current control method. Measure RPM and plot graph of speed versus armature voltage and field current.
7. Load test on 3-phase induction motor
8. Determination of equivalent circuit parameters of 3-phase induction motor using no load & blocked-rotor test.
9. To plot speed- torque characteristic of three phase induction motor.
10. To study various operating modes of stepper motor.

Data Structures and Algorithms
Credits: Th – 04, Pr -01

Teaching Scheme:
Theory: 04 hrs/week
Practical: 02 hrs/week

Examination Scheme:
In-Sem(Online): 50 Marks
End-Sem: (Theory):50 Marks

Oral : 50 Marks

Prerequisites: Basic knowledge of C language is required.

Course Objectives:

- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.

To employ the different data structures to find the solutions for specific problems

Course Outcomes:

On completion of the course, student will be able to :

1. Discuss the computational efficiency of the principal algorithms such as sorting & searching.
2. Write and understand the programs that use arrays & pointers in C
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. Implement stacks & queues for various applications.
5. Understand various terminologies and traversals of trees and use them for various applications.
6. Understand various terminologies and traversals of graphs and use them for various applications.

Course Contents

Unit I : Introduction to C and Algorithm (8 Hrs)

Constants, variables and keywords in C, operators and control structure in c(decision, loop and case), functions, macros, arrays and string manipulation, structure, union, enumeration, bitwise operations Functions: Parameter passing call by value and call by reference, scope rules, functions and pointers, function returning pointer, pointer to function, String manipulations using Arrays, pointer to pointer, Dynamic memory management.

Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big ‘O’ notation

Unit II :Searching and Sorting (8 Hrs)

Need of searching and sorting, why various methods of searching and sorting, Sorting methods: Linear, binary search and Fibonacci Search.

Sorting methods: Bubble, insertion, selection, merge, Time complexity of each searching and sorting algorithm, Hashing Techniques.

Unit III : Stack and Queues (7 Hrs)

Stacks: Concept, Basic Stack operations, Array representation of stacks, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.

Queues: Concept, Queue operations, Array representation of queues, Queue as ADT, Circular queues, Application of queues: Categorizing data, Simulation of queues.

Unit IV : Linked List (7 Hrs)

Concept of linked organization, singly linked list, stack using linked list, queue using linked list, doubly linked list, circular linked list, Linked list as ADT. Representation and manipulations of polynomials using linked lists, ,comparison of sequential linked organization with linked organization

Unit V : Trees (7 Hrs)

Introduction to trees: Basic Tree Concepts, Binary Trees:Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Binary Search Trees (BST): Basic Concepts, BST operations.

Unit VI : Graphs (7 Hrs)

Basic Concepts & terminology, Sequential representation of graphs; Adjacency matrix, Path matrix, Linked representation of a graph, Operations on graph, Traversing a graph, Spanning trees; Minimum Spanning tree, Kruskal's Algorithm, Prim's Algorithm. Dijkstra's Shortest Path Algorithm

Text Books:

1. Ellis Horowitz, SartajSahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN:10: 0716782928
2. Richard F. Gilberg& Behrouz A. Forouzan, Data Structures APseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803

Reference:

1. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata McGrawHill. ISBN-10: 1259029964
2. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill, Third Edition. ISBN-10: 1259004619
3. YedidyahLangsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, Second Edition). ISBN 10: 8120311779

List of Practical

Note: Practical 1-8 are compulsory. Practical 9-15 are optional.

Write C program to implement

1. Write C program to store student information (e.g. RollNo, Name, Percentage etc.).
   a. Display the data in descending order of Percentage (Bubble Sort).
   b. Display data for Roll No specified by user (Linear Search).
   c. Display the number of passes and comparisons for different test cases (Worst, Average, Best case).

2. Perform following String operations with and without pointers to arrays (without using the library functions): a. substring, b. palindrome, c. compare, d. copy, e. reverse.

3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.(For any database like Employee or Bank database with andwithout pointers to structures)

4. Create a singly linked list with options:
   a. Insert (at front, at end, in the middle),
   b. Delete (at front, at end, in the middle),
   c. Display,
   d. Display Reverse,
   e. Revert the SLL.

5. Implement Stack using arrays & Linked Lists. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display

6. Implement Queue using arrays & Linked Lists. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display

7. Binary search tree: Create, search, recursive traversals.

8. Graph using adjacency Matrix with BFS & DFS traversals.

9. Implement set operations using arrays and perform union, intersection, difference, symmetric difference

10. Accept input as a string and construct a Doubly Linked List for the input string with eachnode contains, as a data one character from the string and perform:
    a) Insert b) delete, c) Display forward, d) Display backward

11. Represent graph using adjacency list or matrix and generate minimum spanning tree using Prism's algorithm

12 Read & write operations in a text file.

13 Polynomial addition using array of structure.

14 Evaluation of postfix expression (input will be postfix expression)

15 Implement following Matrix operations:

   a. addition with pointers to arrays

   b. multiplication without pointers to arrays

   c. transpose with pointers to arrays

204185 Digital Electronics
Credits: Th – 04, Pr -01

Teaching Scheme	Examination Scheme
Theory: 04 hrs/week	**In-Sem(Online): 50 Marks**
Practicals: 02 hrs/week	**End-Sem (Theory):50 Marks**
	Practical : 50 Marks

Course Objectives:
- To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
- To lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor.

Course Outcomes:
On completion of the course, student will be able to
1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of microcontrollers for basic operations and Simulate using simulation software.

Course Contents

Unit I : Combinational Logic Design (8 Hrs)
Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, demultiplexer trees. Introduction to Quine-McCluskey method.

Unit II :Sequential Logic Design (8 Hrs)
1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals,
Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.

Unit III : State Machines (8 Hrs)
Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequencedetector. Introduction to Algorithmic state machines- construction of ASM chart and realization forsequential circuits

Unit IV : Digital Logic Families (8 Hrs)

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements.TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic , open drain output. Interfacing CMOS and TTL. Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.

Unit V : Programmable Logic Devices and Semiconductor Memories (6 Hrs)

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM,DRAM.

Unit VI : Introduction to Microcontroller 8051 (7 Hrs)

Microprocessors and Microcontrollers comparison, 8051 architecture, Pin description, addressing modes, instruction set of 8051, concepts of Counters and Timers with the help of status registers, Port Structure and Interrupts. Simple programming examples – for addition, subtraction, multiplication and delay.

TextBooks:

1. R.P. Jain , “Modern digital electronics” , 3rd edition , 12threprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, “Digital Logic and Computer Design” 4th edition,Prentice Hall of India, 2013.

Reference:

1. Anand Kumar, “Fundamentals of digital circuits” 1st edition, Prentice Hall of India, 2001
2. MykePredko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2003.
3. Muhammad Mazidi, Janice Mazidi and RolinMcKinlay, ‘The 8051 Microcontroller and Embedded Systems using Assembly and C’, Pearson Education, 2nd edition.

Instructions for Laboratory Conduction

At least six practical (on bread board) from list 1 to 8 and two practicals from list 9 to 11.

List of Practicals

1. Study of IC-74LS153 as a Multiplexer. (Refer Data-Sheet).
   Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.
   Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
2. Study of IC-74LS138 as a Demultiplexer / Decoder (Refer Data-Sheet). Practical) (Test Benches and FSM excluded). Design and Implement full adder and subtractor function using IC- 74LS138.
   Design & Implement 3-bit code converter using IC-74LS138.(Gray to Binary/Binary to Gray)
3. Study of IC-74LS83 as a BCD adder,(Refer Data-Sheet).
   Design and Implement 1 digit BCD adder using IC-74LS83
   Design and Implement 4-bit Binary sub tractor using IC-74LS83.
4. Study of IC-74LS85 as a magnitude comparator,(Refer Data-Sheet)
   Design and Implement 4-bit Comparator.
   Design and Implement 8-bit Comparator
5. Study of Counter ICs (74LS90/74LS93). (Refer Data-Sheet)
   Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram.
   Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
6. Study of synchronous counter
   Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram
7. Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).

8. Study of Shift Register (74HC194/74LS95), (Refer data-Sheet)
   Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift/left shift). Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.
9. Write a assembly/C language program to perform arithmetic operations.
10. Write a assembly/C language program to perform internal and external memory transfer operations
11. Write a assembly/C language program to use port pin for simple application

204186 Electronic Measuring Instruments and Tools
Credits: Th – 01, Pr -01

Teaching Scheme:
Theory: 01hrs/week
Practical: 02 hrs/week

Examination Scheme:
Term work : 50 Marks

Course Objective:
- To make student competent for handling measuring instruments and to able to select right instrument for the purpose of measurement under different conditions.

Course Outcomes:
On completion of the course, student will be able to:
1. Understand fundamental of various electrical measurements.
2. Understand and describe specifications, features and capabilities of electronic instruments.
3. Finalize the specifications of instrument and select an appropriate instrument for given measurement.
4. Carry out required measurement using various instruments under different setups.
5. Able to compare measuring instruments for performance parameters
6. Select appropriate instrument for the measurement of electrical parameter professionally.

Course Contents

Theory
It is expected that operating principle, block diagram and other details shall be taught in theory sessions. Teachers will explore these instruments in detail in respective laboratory sessions. Specification sheet / functions of the instrument should be listed and attached in file/journal.

Theory lectures shall cover following topics along-with discussion of practicals
1. Measurement: Necessity, units, ways of measurements.
2. Performance parameters for measuring instruments.
3. Information about OIML standards.
4. Statistical analysis (Definitions and Introductions only), sources of errors and remedies
5. Calibration and Maintenance of Instruments.
6. Techno-commercial Comparative Analysis and Ordering Information of Instruments.

TextBooks:
1. Instrument manuals published by respective Manufactures.
2. KalsiH.S " Electronic Instrumentation", Tata McGraw Hill, 2004.

Guidelines for Laboratory Conduction
At least eight practical must be performed.
1. Use of everyday practicing testing/measuring instruments.
   Electrical tester, cable (continuity) tester, Indicators with Neon and LEDs Megger for insulation test, open/short circuit test Digital Panel Meter (DPM)
2. Perform following using analog and digital multimeter: Measurement of DC voltage, DC current, AC (rms) voltage, AC (rms) current, resistance, capacitance. Understand the effect of decimal point of resolution. Comment on bandwidth (only for digital multimeter) to test continuity, PN junction and transistor. Calculate mean, standard deviation, average deviation and variance of measured quantity.

3. Set up Power Supply for Conduction of Laboratory experiments (30V / 300 V) Set up Current limit, Check Over current (CC mode) and Short circuit. Setting Individual / Dual Power Supply Series / Parallel Operation of Power Supplies
4. Perform following using CRO : Set up CRO for operation: Ground check, Probe check, Dual/ Mono/Component Tester
    1) Check signal coupling. Observe alternate, chop modes.
    2) Perform Probe check and calibration of CRO, adjust if necessary

   Measure unknown frequency and phase using XY mode. Perform locking of input signal using auto, normal, external, edge trigger modes.
5. Perform following using DSO
    1) Perform Roll, Average, Peak detection operations on signal, Capture transients.
    2) Perform FFT analysis of sine and square signals.
    3) Perform various math operations like add, subtract and multiplication of two waves.
    4) Check store and retrieval of signals. Use Print, save on disk/USB
6. Compare True RMS meter with Multi-meter

   Measure RMS, peak and average voltages for half controlled rectifier or Full controlled rectifier by varying firing angle.

   Compare readings of DMM and/or Power-scope with TRMS for analyzing why TRMS is better.
7. Signal Analysis using Logic Analyzer

   Set up logic analyzer for 8/16/32 channels. Use logic analyser in stand-alone mode or with PC / Mixed Signal Oscilloscope. Verify timing diagram for any digital circuit like counter / shift register
8. Measurements using Spectrum Analyzer. Perform harmonic analysis and Total Harmonic Distortion (THD) measurement for sine and square waves. Verify frequency response of filters& high frequency (HF) amplifier.

   Analyze Spectrum of AM & FM and to measure percent modulation and bandwidth.
9. Measurements using programmable LCR meter: Measure L, C & R in series / parallel operation, at different frequencies. Comment on readings in different connections / at different frequencies. Measure Q and Dissipation factor.
10. Set up function generator/Arbitrary waveform generator. Generate signal of required amplitude, frequency, duty cycle, offset etc. Generate special signals such as noise, ECG, sweep, burst, AM, FM, PM etc. Check generated signal on oscilloscope and verify under different attenuation.
11. Compare Frequency Counter with Oscilloscope. Carry out measurements through different modes of measurement. Measure frequency, time, ratio, events & pulse width. Measure signals using oscilloscopes and compare readings with frequency counter. Comment on bandwidth of oscilloscope and compare specifications of scope and freq. counter
12. Measure Sound / Video signal strength using db-meter. Measure signal strength before / after signal amplifier. Measure loss of signal strength in connection splitters / attenuator. Plot signal strength at different frequencies

Audit course-I

204192:Japanese Language module-I

About course:

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:
On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

Course Contents

Unit 1 **:** Introduction to Japanese Language.
Hiragana basic Script, colors, Days of the week

Unit 2 : Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo
Long vowels, Greetings and expressions

Unit 3 : Self Introduction, Introducing other person,
Numbers, Months, Dates, Telephone numbers, Stating one's age.

Text Book:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Language Lab

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

Audit Course-I
204192: Road Safety Management

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

- Provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
- Insight into the transportation system management (TSM) techniques.
- Overview of the engineering & legislative measures for road safety.
- Discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, society will observe –

- Changes in awareness levels, knowledge and understanding
- A change in attitudes / behavior e.g. against drink-drive;
- Casualty Reduction;
- That remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points;
- Improving Road Safety Together

Course Contents

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Vehicle Technology – CMVR & Road Safety
5. Regulatory / Legislative Provisions for Improving Road Safety
6. Behavioral Training for Drivers for Improving Road Safety
7. Road Safety Education
8. Road Engineering Measures for Improving Road Safety

Guidelines for Conduction (Any one or more of following but not limited to)

- Guest Lectures
- Visits and reports
- Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road)
- Mini Project

Guidelines for Assessment(Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

207005 Engineering Mathematics -III
Credits: Th – 04 ,Tut-01

Teaching Scheme:
Theory : 04 hr/week
Tutorial: 01 hr/week

Examination Scheme:
In-Sem(Online): 50 Marks
End-Sem (Theory):50 Marks
Term Work : 25 Marks

Prerequisites: - Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

- Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
- Transforms such as Fourier transform, Z-transform and applications to Communication systems and Signal processing.
- Vector differentiation and integration required in Electro-Magnetics and Wave theory.
- Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

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

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Z-transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Course Contents

Unit I: Linear Differential Equations (LDE) and Applications (09 Hours)

LDE of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

Unit II: Transforms (09 Hours)

Fourier Transform (**FT**): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.

Z - Transform **(ZT):** Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III: Numerical Methods (09 Hours)

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error,

Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods.

Unit IV: Vector Differential Calculus (09 Hours)

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications (09 Hours)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

Unit VI : Complex Variables (09 Hours)

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series, Residue theorem.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9e, Wiley India.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7e, Cengage Learning.

Reference Books:

1. M. D. Greenberg, “Advanced Engineering Mathematics”, 2e, Pearson Education.
2. Wylie C.R. & Barrett L.C. , “Advanced Engineering Mathematics”, McGraw-Hill, Inc.
3. B. S. Grewal, “Higher Engineering Mathematics” Khanna Publication, Delhi.
4. P. N. Wartikar & J. N. Wartikar, “Applied Mathematics”, Volumes I and II, Pune VidyarthiGrihaPrakashan,.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw-Hill.
6. Thomas L. Harman, James
7. Dabney and Norman Richert, “Advanced Engineering Mathematics with MATLAB”, 2e, Brooks/Cole, Thomson Learning.

Guidelines for Tutorial and Term Work:

i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

204187 Integrated Circuits
Credits: Th – 04, Pr -01

Teaching Scheme:

Theory: 04hrs/week
Practical: 02 hrs/week

Examination Scheme:

In-Sem(Online): 50 Marks
End-Sem (Theory) :50 Marks
Practical : 50 Marks
Term Work : 25 Marks

Course Objectives:

- To understand characteristics of IC and Op-Amp and identify the internal structure.
- To introduce various manufacturing techniques.
- To study various op-amp parameters and their significance for Op-Amp.
- To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
- To analyse and identify linear and nonlinear applications of Op-Amp.
- To understand functionalities of PLL and its use in various applications in communication and control systems.

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

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.
9. Understand and apply the functionalities of PLL to Frequency synthesizer, multiplier, FM, and AM demodulators

Course Contents

Unit I : OP-AMP Basics (6 Hrs)
Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations using ‘r’ parameters, Need and types of level shifter, current mirror circuits. Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II : Linear Applications of OP-AMP (8 Hrs)

Inverting and Non-inverting amplifier, voltage follower. Summing, averaging scaling amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator withfrequency response. Instrumentation amplifiers.

Unit III : Non-linear Applications of OP-AMP (8 Hrs)

Comparator, characteristics of comparator, applications of comparator, Schmitt trigger (symmetrical/asymmetrical), clippers and clampers, voltage limiters, Square wave generator, triangular wave generator, Need of precision rectifier, Half wave , Full wave precision rectifiers, peak detectors, sample and hold circuits.

Unit IV : Converters using OP-AMP (6 Hrs)

V-F, I-V and V-I converter, DAC: types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC, ADC: types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC.

Unit V : Phase Locked Loop &Oscillators (8 Hrs)

Block diagram of PLL and its function, PLL types, characteristics/parameters of PLL, and different applications of PLL. Oscillators principle, types and frequency stability, design of phase shift, wein bridge, Quadrature, voltage controlled oscillators.

Unit VI : Active filters (8 Hrs)

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworthfilters and notch filter. All pass filters.

TextBooks:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill,India 2008

Reference:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.
3. Bali,”Linear Integrated Circuits”, Mc Graw Hill 2008.
4. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications.

Instructions for Laboratory Conduction

1- 8 experiments are compulsory and should be conducted on bread board.

List of Practical's

1. Measure Op-Amp parameters and compare with the specifications.
Input bias current, input offset current and input offset voltage. slew rate , CMRR
Compare the result with datasheet of corresponding Op-Amp.
2. Design, build and test integrator for given frequency f_a.
3. Design, build and test three Op-Amp instrumentation amplifiers for typical application
4. Design, build and test precision half & full wave rectifier.
5. Design, build and test Schmitt trigger and plot transfer characteristics.
6. Design, build and test PLL.
7. 2 bit DAC and 2 bit ADC.
A) Design and implement 2bit R-2R ladder DAC.
B) Design and implement 2bit flash type ADC.
8. Design, build and test square & triangular wave generator.

Optional Experiments:

1. Verify and understand practically virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Plot DC transfer characteristics of emitter coupled differential amplifier.
3. Study effect of emitter resistance and constant current source on figure of merit (CMRR) of emitter coupled differential amplifier.
4. Design and implement V-I converter.
5. Any experiment based on application of Op-Amp.

204188 Control Systems
Credits: Th – 03

Teaching Scheme:
Theory : 03 hr/week

Examination Scheme:
In-Sem(Online): 50 Marks
End-Sem(Theory): 50 Marks

Course Objectives:
- To introduce the elements of control system and their modelling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

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

1. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
2. Determine the (absolute) stability of a closed-loop control system.
3. Perform time domain and frequency domain analysis of control systems required for stability analysis.
4. Perform time domain and frequency domain correlation analysis.
5. Apply root-locus, Frequency Plots technique to analyze control systems.
6. Express and solve system equations in state variable form.

Course Contents

Unit I :Control System Modeling (6 Hrs)
Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph

Unit II :Time Response Analysis (6 Hrs)
Standard input signals, Time response analysis of First Order Systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.

Unit III : Stability Analysis (6 Hrs)
Concept of Stability, Routh-Hurwitz Criterion, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram.

Unit IV :Frequency Response Analysis (6 Hrs)

Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots and development of Nyquist Plots. Frequency Domain specifications from the plots, Stability analysis from plots.

Unit V :State Variable Analysis (6 Hrs)

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability.

Unit VI :Controllers And Digital Control Systems (6 Hrs)

Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram. Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method.

Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability and response of sampled-data systems.

TextBooks:

N. J. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.

Reference:

1. Benjamin C. Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition,1995.
2. M. Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.
3. Schaum’s Outline Series, “Feedback and Control Systems” Tata McGraw-Hill, 2007.
4. John J. D’Azzo& Constantine H. Houpis, “Linear Control System Analysis and Design”, Tata McGraw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Addison – Wesley, 1999.

204189 Analog Communications
Credits: Th – 03, Pr -01

Teaching Scheme:
Theory: 03hrs/week
Practical: 02 hrs/week

Examination Scheme:
In-Sem(Online): 50Marks
End-Sem (Theory): 50 Marks
Practical : 50 Marks

Course Objectives:
The students are expected to demonstrate the ability to:
- Describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
- Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques.

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

1. Understand and identify the fundamental concepts and various components of analogcommunication systems.
2. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
3. Describe analog pulse modulation techniques and digital modulation technique.
4. Develop the ability to compare and contrast the strengths and weaknesses of variouscommunication systems.

Course Contents

Unit I :AM Transmission (8 Hrs)
Base band & Carrier communication, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC, ISB & VSB, their generation methods & Comparison, Block Diagram of AM Transmitter and Broadcast technical standards.

Unit II :AM Reception (8 Hrs)
Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

Unit III : FM Transmission (8 Hrs)

Instantaneous frequency, Concept of Angle modulation, frequency spectrum& Eigen Values, Narrow band & wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function and its mathematical analysis, Generation of FM (Direct & Indirect Method), FM stereo Transmitter, Two way FM Radio Transmitter, Comparison of FM and PM.

Unit IV : FM Reception (6 Hrs)

Block diagram of FM Receiver, FM Stereo Receiver , Two way FM Radio Receiver, FM detection using Phase lock loop(PLL) ,Slope detector, Balanced Slope detector etc.

Unit V :Noise (6 Hrs)

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.

Unit VI : Pulse Analog Modulation (6 Hrs)

Band limited & time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. PAM PWM & PPM. Introduction to Pulse Code Modulation.

TextBooks:

1. George Kennedy, "Electronic Communication Systems" 5th Edition, McGraw-Hill.
2 Dennis Roddy &Coolen, "Electronic Communication",4th Edition, Prentice Hall.

Reference:

1. B. P. Lathi, "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press.
2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons.
3. Taub& Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
4. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill.

Instructions for Laboratory Conduction

Perform any 8 experiments from following

List of Practical

1. Design, Build & Test class C tuned amplifier for AM Generation / Simulate using desirable Software
2. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
3. Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
4. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
5. SSB modulator using Filter method/ phase shift method & its detection
6. Frequency modulator & demodulator using IC 565 (PLL based), calculation of modulation index & BW of FM.
7. Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO.
8. Study of AM & FM Spectrum: Observe Spectrum of AM & FM on Spectrum Analyzer, Compare & comment on AM & FM spectrum. Observe Effect of Eigen values on carrier power in FM.
9. Measurement of Performance Characteristics of Receiver: Sensitivity, Selectivity, Fidelity
10. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.Following can be performed using suitable software(Any One)
11. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
12. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.
13. SNR and PSD of any system (Baseband or AM)(Kit based/Simulated)

Note: Visit to Broadcasting Station is desirable.

204190 **Object Oriented Programming**

Credit:Th-03,Pr-02

Teaching Scheme:
Theory: 3 Hrs/ Week
Practical : 4 Hr/Week

Examination Scheme:
Online: 50 Marks
Paper: 50 Marks
Oral : 50 Marks

Course Objectives:

- Make the students familiar with basic concepts and techniques of object oriented programming in C++ & Java.
- Develop an ability to write programs in C++ and Java for problem solving.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Describe the principles of object oriented programming.

2. Apply the concepts of data encapsulation, inheritance in C++.

3. Understand basic program constructs in Java

4. Apply the concepts of classes, methods and inheritance to write programs Java.

5. Use arrays, vectors and strings concepts and interfaces to write programs in Java.

6. Describe and use the concepts in Java to develop user friendly program,

UNIT I: Introduction to Object Oriented Programming (6L)

Principles of OOP: Software crisis, Software evolution, OOP paradigm, Basic Concepts of OOP, Benefits & applications of OOP.

Beginning with C++: What is C++, Applications of C++, A Simple C++ Program, More C++ statements.

Moving from C to C++: Declaration of variable, Reference variables, Scope resolution operator, Member dereferencing operator, memory management operators.

Functions in C++: Function prototyping, Call by reference.

Unit II: Concepts of Object Oriented Programming with C++ (6L)

Classes & Objects: Specifying a class, Defining member functions, A C++ program with class, Making

an outside function inline, Nesting of member function, Private member function, Arrays within class, Member allocation for objects, Arrays of objects, Objects as function arguments.

Constructors & Destructors: Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments.

Operator overloading concept: Use of operator overloading, defining operator overloading, Binary operator overloading.

Introduction to Inheritance: Concept and types of Inheritance, Defining derived classes, Single inheritance, Making a private member inheritable, multilevel inheritance.

UNIT III: Java Fundamentals (6L)

Evolution of Java, Comparison of Java with other programming languages, Java features, Java Environment, Simple Java Program, Java Tokens, Java Statements, Constants, variables, data types. Declaration of variables, Giving values to variables, Scope of variables, arrays, Symbolic constants, Typecasting, Getting values of variables, Standard default values, Operators, Expressions, Type conversion in expressions, Operator precedence and associativity, Mathematical functions, Control statements- Decision making & branching, Decision making & looping.

UNIT IV: Classes, Methods & Objects in Java (6L)

Class Fundamentals, Declaring Objects, Assigning Object reference variables, Methods, Constructors, The This keyword, Garbage collection, finalize method, Overloading methods, using objects as parameters, Argument passing, returning objects, Recursion, access control, static, final, arrays, strings class, Command line arguments.

UNIT V: Inheritance, Packages and Interfaces (6L)

Inheritance basics, Using Super, Creating Multilevel hierarchy, Constructors in derived class, Method overriding, Dynamic method dispatch, Using Abstract classes, Using final with inheritance, Object class, Packages, Access protection, Importing packages, Interfaces: Define, implement and extend. Default interface methods, Use static method in interface.

UNIT VI: Multithreading, Exception handling & Applets (6L)

Introduction to multithreading: Introduction, Creating thread and extending thread class.

Concept of Exception handling: Introduction, Types of errors, Exception handling syntax, Multiple catch statements.

I/O basics, Reading console inputs, Writing Console output.

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating a simple applet.

Text Books:

1. E Balagurusamy, Programming with C++, Tata McGraw Hill, 3rd Edition.

2. Herbert Schildt, Java: The complete reference, Tata McGraw Hill, 7th Editon.

Reference Books:

1. Robert Lafore, "Object Oriented Programming in C++", Sams Publishing, 4th Edition.

2. T. Budd, Understanding OOP with Java, Pearson Education.

3. Matt Weisfeld, "The Object-Oriented Thought Process", Pearson

4. Cox Brad, "Object –Oriented Programming: An Evolutionary Approach", Addison –Wesley

5. E Balagurusamy, Programming with Java A Primer, Tata McGraw Hill, 3rd Edition.

List of Practical:

(Perform any 4 from group I and any 12 from group II)

Group I

1. Write a program in C++ to implement database of persons having different profession e,g. engineer, doctor, student, laborer etc. using the concept of multiple inheritance. The objective of this assignment is to learn the concepts of inheritance.
2. Write a program in C++ to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference in C++.
3. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts classes and objects
4. Write a program in C++ to implement Stack. Design the class for stack and the operations to be

performed on stack. Use Constructors and destructors. The objective of this assignment is to learn the concepts classes and objects, constructors and destructors.

5. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts operator overloading.

Group II

6. Write some simple programs in Java such as
   i) To find factorial of number.
   ii) To display first 50 prime numbers.
   iii) To find sum and average of N numbers.
7. Write a program in Java to implement a Calculator with simple arithmetic operations such as add, subtract, multiply, divide, factorial etc. using switch case and other simple java statements. The objective of this assignment is to learn Constants, Variables, and Data Types, Operators and Expressions, Decision making statements in Java.
8. Write a program in Java with class Rectangle with the data fields width, length, area and colour. The length, width and area are of double type and colour is of string type. The methods are get_length(), get_width(), get_colour() and find_area(). Create two objects of Rectangle and compare their area and colour. If the area and colour both are the same for the objects then display " Matching Rectangles", otherwise display " Non-matching Rectangle".
9. Write Programs in Java to sort i) List of integers ii) List of names. The objective of this assignment is to learn Arrays and Strings in Java
10. Write a Program in Java to add two matrices. The objective of this assignment is to learn Arrays in Java
11. Write a program in Java to create a player class. Inherit the classes Cricket_player, Football_player and Hockey_player from player class. The objective of this assignment is to learn the concepts of inheritance in Java.
12. Write a Java program which imports user defined package and uses members of the classes contained in the package.
13. Write a Java program which implements interface.
14. Create an applet with three text Fields and four buttons add, subtract, multiply and divide. User will enter two values in the Text Fields. When any button is pressed, the corresponding

operation is performed and the result is displayed in the third Text Fields.

15. Write a java program which use try and catch for exception handling.

16. Implement Java program to implement a base class consisting of the data members such as name of the student, roll number and subject. The derived class consists of the data members subject code, internal assessment and university examination marks. The program should have the facilities. i) Build a master table ii) List a table iii) Insert a new entry iv) Delete old entry v) Edit an entry vi) Search for a record. Use virtual functions.

17. Write a program to implement stack or any other data structure in Java

18. Write a program to create multiple threads and demonstrate how two threads communicate with each other.

19. Write a program to implement addition, subtraction and multiplication of two complex numbers in Java

20. A Mini project in Java: A group of 4 students can develop a small application in Java.

204191 EMPLOYABILITY SKILL DEVELOPMENT

Credits:Th – 02, Pr -01

Subject Code:

Teaching Scheme		**Examination Scheme**
Theory / Week	**: 2 Hrs**	**Term Work: 50 Marks**
Practical /Week	**: 2Hrs.**	

Course Objectives:

1. To develop analytical abilities
2. To develop communication skills
3. To introduce the students to skills necessary for getting, keeping and being successful in a profession.
4. To expose the students to leadership and team-building skills.

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

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

Unit I :Soft Skills & Communication basics (4Hrs)

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills. Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing

Unit II: Arithmetic and Mathematical Reasoning (4 Hours)

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem)

Unit III: Analytical Reasoning and Quantitative Ability (4 Hours)

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

Unit IV: Grammar and Comprehension (4 Hours)

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

Unit V: Skills for interviews (4Hours)

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

Unit VI: Problem Solving Techniques (4 Hours)

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

Text Books:

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016, Wiley.
2. Wren and Martin, "English grammar and Composition", S. Chand publications.
3. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.

Reference Books:

1. Philip Carter, "The Complete Book Of Intelligence Test", John Willey & Sons Ltd.
2. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page
3. Eugene Ehrlich, Daniel Murphy, "Schaum’s Outline of English Grammar", McGraw Hills.
4. David F. Beer, David A. McMurrey, “A Guide to Writing as an Engineer”, ISBN : 978-1-118-30027-5 4th Edition, 2014, Wiley.

List of Practical:

1. Every student should collect five questions of each type
   a. Number sequence
   b. Mental arithmetic
   c. Square, square roots
   d. LCM, HCF
   e. Speed calculations

   Note: Teacher should distribute the question set randomly amongst the students.

2. Write up on
    a. Blooms taxonomy
    b. Multiple intelligence theory
    c. Every student should identify his/her strength and weaknesses
    d. Action plan to improve the weaknesses
3. Every student should collect five questions of each type
    a. Matching
    b. Selection
    c. Arrangements
    d. Verifications

    Note: Teacher should distribute the question set randomly amongst the students.

4. Every student should collect five questions of each type
    a. Verbal aptitude
    b. Synonym
    c. Antonym
    d. Analogy

Note: Teacher should distribute the question set randomly amongst the students.

5. Solve exercises from book (Wren and Martin, "English grammar and Composition") based on
    a. English sentences and phrases
    b. Paragraph writing
    c. Story writing
    d. Letter writing
6. Formulate suitable assignment to solve a real problem using problem solving techniques
7. Practice tests (aptitude, analytical abilities, logical reasoning)
8. Extempore, group discussions and debate.
9. Technical report writing and Seminar Presentation.
10. Mock interviews.

Audit course-II

204193:Japanese Language module II

About course:

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best… suited Language!!

Japanese is the new trend of 21st century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

Course Contents

Unit 1 : Katakana basic Script, Denoting things (nominal & prenominal demonstratives)

Purchasing at the Market / in a shop / mall (asking & stating price)

Unit 2 : Katakana : Modified kana, double consonant, letters with ya, yu, yo,

Long vowels

Describing time, describing starting & finishing time (kara ~ made)

Point in time (denoting the time when any action or the movement occurs)

Unit 3 : Means of transport (Vehicles), Places, Countries,

Stating Birth date, Indicating movement to a certain place by a vehicle

Text Book:

1.Minna No Nihongo, “Japanese for Everyone”, (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Langauge Lab

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

Audit course-II

204193:Cyber Crime and law

Introduction to Cyber Crime and law:

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes,Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000

Introduction to Cyber Crime Investigation

Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

Guidelines for Conduction

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report