Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Syllabus for
T.Y.B.Tech.
Electronics & Telecommunication
(Pattern 2017)

Department of
Electronics & Telecommunication
Engineering

VISION:

- Excellence in Electronics & Telecommunication Engineering Education

MISSION:

- Provide excellent blend of theory and practical knowledge
- Establish centre of excellence in post graduate studies and research
- Prepare engineering professionals with highest ethical values and a sense of responsible citizenship

Program Educational Objectives (PEO):

1. Graduates of the program will become competent electronic engineers suitable for industry.
2. Graduates of the program will apply the mathematical and analytical abilities gained through core courses of Electronics and Communication engineering.
3. Graduates of the program will apply problem solving skills to develop hardware and/or software.
4. Graduates of the program will become responsible citizen.

Program Outcomes (PO):

A graduate of the program will have

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding ofthe engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

Graduates will be able to

1. Apply and demonstrate the usage of hardware and software platforms for variety of applications.

2. Apply different mathematical and statistical methods for analysis and design of signal processing and communication systems.

Graduate attributes:

1. Engineering knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Investigations of Complex Problems
5. Modern Tool Usage
6. The Engineer and Society
7. Environment and sustainability
8. Ethics
9. Individual and Teamwork
10. Communication
11. Project management and Finance
12. Life –long Learning

Third Year B. Tech. Electronics & Telecommunication Engineering (TYBT) – Semester V (Pattern 2017)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE T1	ISE T2	CE	ESE	PR/ OR		
ETUA31171	Discrete Time Signal Processing*	TH	3	-	-	15	15	20	50	-	100	3
ETUA31172	Microcontroller and Applications*	TH	3	-	-	15	15	20	50	-	100	3
ETUA31173	Communication Engineering – II*	TH	3	-	-	15	15	20	50	-	100	3
ETUA31174	Electromagnetic Engineering	TH	3	-	-	15	15	20	50	-	100	3
IE31175	Elective-I (Interdisciplinary)	TH	3	-	-	15	15	20	50	-	100	3
ETUA31176	Lab Practice – III	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
ETUA31177	Employability (Skills in Electronic Design)	CE-PR/OR	2	-	2	-	-	50	-	-	50	3
ETUA31178	Mini Project	CE	-	1	2	-	-	50	-	-	50	2
A3	Audit Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**17**	**1**	**10**	**75**	**75**	**250**	**250**	**50**	**700**	**23**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Audit Course: No Credits
*Courses have lab practice component of 2 hrs./week each under Lab Practice III head.

Elective I (Interdisciplinary)
IE31175CS: Internet of Things
IE31175ET: Industrial Automation
IE31175ME: Product Design and Engineering
IE31175CV: Optimization Techniques
IE31175IT: Human Computer Interaction

Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

BoS Chairman **Dean Academics** **Director**

Third Year B. Tech. Electronics & Telecommunication Engineering (TYBT) – Semester VI
(Pattern 2017)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
						ISE		CE	ESE	PR/ OR		
			L	T	P	T1	T2					
ETUA32171	Power Electronics- I*	TH	3	-	-	15	15	20	50	-	100	3
ETUA32172	Information Theory and Coding Techniques*	TH	3	-	-	15	15	20	50	-	100	3
ETUA32173	Elective – II*	TH	3	-	-	15	15	20	50	-	100	3
ETUA32174	Lab Practice – IV	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
ETUA32175A / ETUA32175B / IE32175B	Internship / Value added Course	CE-PR/OR	0/ 4	-	16/ 8	-	-	50	-	50	100	8
A3	Audit Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	**9/ 13**	**-**	**22/ 14**	**45**	**45**	**160**	**150**	**100**	**500**	**20**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Audit Course: No Credits
*Courses have lab practice component of 2 hrs./week each under Lab Practice IV head.

Course Code	Elective II
ETUA32173A	Advanced Micro processors & DSP Processors
ETUA32173B	Fiber Optic Communication
ETUA3173C	Digital System Design using Verilog

Course Code	Value added course
ETUA32175B1	Machine Learning
ETUA32175B2	Mechatronics and Robotics
IE32175B1	General Studies for Indian Services and National Service Scheme
IE32175B2	Social Enterprise and Entrepreneurship
IE32175B3	National Service Scheme and Social Entrepreneurship

Internship / Value Added Course:
Value added course (Theory 60 Hrs. and Practical 120 Hrs.) will have 4 hrs. theory/week and 8 hrs. practical/week. Students those who will register for value added course will earn the required credits in the regular semester. However, Students who will register for internship, commencement of internship will start from 1st June and will be of Eight weeks (June-July). However, students will be encouraged to register for both the value added course and Internship. In that case, two courses; **Elective-IV** (Final Year B.Tech., Semester-I) and **Open elective** (Final Year B.Tech., Semester-II) will be waived off to compensate the additional eight credits earned by the student for value added course and Internship at Third Year B.Tech. (Semester- II).

Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

BoS Chairman **Dean Academics** **Director**

Semester – I

ETUA31171: Discrete Time Signal Processing

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite : Readers/students are expected to know the following concepts:
1) Mathematics III 2) Signals and Systems

Course Objectives:
- To build an understanding of sampling and aliasing
- To introduce students to transforms for analysis of discrete time signals and systems.
- To build an understanding of design of FIR and IIR systems and their implementation.
- To build an understanding of multirate systems.

Course Outcomes:
On completion of the course, students will be able to
1. Apply the fundamentals of engineering mathematics for understanding sampling and equivalence between analog and digital domain frequencies.
2. Apply Fourier transform and analyze signals in time and frequency domain.
3. Apply Z transform and analyze discrete time system behavior.
4. Design FIR filters for the given passband and stopband specifications.
5. Design IIR filters for the given passband and stopband specifications.
6. Understand the fundamentals of multirate systems.

Unit- I : Introduction
Review of signals and systems: types of signals and systems. Basic elements of DSP and its requirements, advantages of digital over analog signal processing. Sampling & aliasing, DT signals, sampling theorem in time domain, continuous time signals and discrete time signals, relation between analog frequency and digital frequency. Convolution and correlation, recursive and non-recursive discrete time systems.

Unit –II : Discrete Fourier Transform
DTFT, 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. Analyze audio signals using FFT.

Unit III : Z transform
Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, 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
Ideal filter requirements, 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. Design of filters from prototype low pass filter. Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form. Design notch filter to remove power line interference from ECG signal.

Unit V: FIR Filter Design

Concept of linear phase in FIR filters. Design of FIR filters using window method, Gibbs phenomenon, characteristics and comparison of different window functions, design of FIR filter using frequency sampling method. FIR filters realization using direct form, cascade form.

Unit VI : Finite word length effects and Multirate DSP

Concept of multirate DSP, sampling rate conversion by a non-integer factor, design of two stage sampling rate converter. Subband coding of speech signal. Effect of finite word length in FIR and IIR filters.

Text Books :

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, algorithms and applications" Fourth edition, Pearson Prentice Hall.
2. Ifaeachor E.C., Jervis B. W., " Digital Signal processing : Practical approach", Pearson Publication
3. Monson Hayes "Schaums Outline of Digital Signal processing", McGraw Hill.

Reference Books:

1. A. V. Oppenheim, R. W. Schaffer, "Discrete Time Signal Processing", Third edition, Prentice-Hall Signal Processing Series.
2. S. Salivahanan, A. Vallavaraj, C. Gnanpriya, "Digital Signal Processing", McGraw Hill.
3. Shaila Apte, "Digital Signal Processing", Second edition, Wiley India.
4. P. Ramesh Babu, "Digital Signal Processing", Fourth edition, Scitech Publications.

Course Co-ordinator BoS Member BoS Chairman

ETUA31172: Microcontroller and Applications

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite : Students are expected to know the following concepts:
1) Digital Electronics, 2) Semiconductor devices and circuits

Course Objectives:

- To give an overview of 8 bit architecture
- To justify the use of microcontroller in embedded system.
- To understand architecture and features of 8051 and AVR microcontroller.
- To learn interfacing of real world peripherals inputs (sensors) and output (actuators) with microcontroller.
- To study various hardware and software tools for developing applications
- To develop small application based assignment using Microcontrollers and sensors.

Course Outcomes:
After completion of this course student should be able to

1. Describe the CISC architecture based 8051 microcontroller.
2. Demonstrate modern engineering tools necessary for simulating, configuring and monitoring embedded system
3. Implement system with commonly used peripherals with microcontroller.
4. Demonstrate bus standards used in industrial environment.
5. Describe the RISC architecture based AVR microcontroller.
6. Develop system using different microcontroller based for embedded applications.

Unit- I: Introduction to 8051 CISC Microcontrollers
Microprocessor & Microcontroller comparison, Harvard & Von Neumann architecture, RISC & CISC comparison, evolution of microcontrollers, microcontroller selection criteria for particular application MCS-51 architecture, family devices & its derivatives. Pin configuration, port architecture, memory organization, interrupt structure, timers and its modes, serial communication and its modes.

Unit- II: 8051 Instruction Set and Programming
Addressing modes: Introduction, instruction syntax, data types, subroutines, immediate addressing, register addressing, direct addressing, indirect addressing, relative addressing, indexed addressing, bit inherent addressing, bit direct addressing. **8051 Instruction set:** Instruction timings. data transfer instructions, arithmetic instructions, logical instructions, branch instructions, subroutine instructions, bit manipulation instruction. **Programming environment:** Study of software development tool chain (IDE), hardware debugging tools (timing analysis using logic analyzer), **Programs:** Assembly language programs, C language programs.

Unit –III: 8051 Microcontroller based Real World Interfacing and programming – I
Interfacing peripheral devices using GPIO: LEDs 7 segment LED, generating various delays using timer, counter, switches, relay, stepper motor, LCD interfacing, keyboard interfacing, ADC0809 and DAC interfacing.

Unit IV : 8051 Microcontroller based real world interfacing and programming – II

Basics of serial communication protocol: Synchronous and asynchronous communication, RS232, RS485, SPI, I2C. **Interfacing of devices using protocols:** Interfacing of peripherals using UART, interfacing RTC DS1307 using I2C protocol**,** interfacing of memory using SPI protocol**. Programs in C.**

Unit V: Introduction to AVR RISC Microcontroller Architecture

Overview of AVR family, AVR microcontroller architecture, introduction To 8-bit AVR microcontroller, AVR register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin, Addressing modes of AVR, data transfer arithmetic, logic and compare, rotate and shift, branch and call instructions. AVR data types and assembler directives, AVR assembly language programs.

Unit VI: AVR microcontroller based Real World Interfacing and programming - III

Interfacing peripheral devices: Servo motor interfacing, input capture and wave generator, PWM programming and DC motor control, SPI protocol and LCD display interfacing, I2C protocol with RTC interfacing, temperature sensor LM35 interfacing. **Implement simple multichannel data acquisition system using AVR/8051.**

Text Books :

1. Mazidi Muhammad Ali; Mazidi Janice Gillispie; McKinlay Rolin D, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Dorling Kindersley.
2. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
3. AVR ATmega32 data sheet

Reference Books :

1. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education
2. Richard Barnett, Sarah Cox , Larry O'Cull, "Embedded C Programming and the AVR Microcontrollers", 2nd edition Thomson publication.
3. Ayala Kenneth J, Gadre Dhananjay V, "8051 Microcontroller and Embedded Systems ", Cengage Learning.

Course Co-ordinator BoS Member BoS Chairman

ETUA31173: Communication Engineering – II

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite:
Readers/students are expected to know the following concepts:
1) Basics of Communication Engineering-I, 2) Signals and systems

Course Objectives:

- To make students familiar with mathematical interpretation related to the fundamentals of analog and digital communication system.
- To impart knowledge regarding concepts of Digital modulation and detection techniques.
- To explore working principle of Radio receivers.
- To familiarize the students to pulse and digital modulation and its reconstruction techniques.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To impart concept of spread spectrum communication system with respect to the modern communication systems

Course Outcomes:
On completion of the course, students will be able to:

1. Interpret transmitter & receiver for digital communication system with interpretation of time & frequency domains
2. Utilize mathematical background for communication signal analysis and select the blocks in a design of digital communication system.
3. Analyze conversion techniques of analog signal into digital signal, various line coding techniques and evaluate the performance.
4. Analyze and compare different digital modulation techniques and select the appropriate one.
5. Interpret the concept of spread spectrum modulation and able to analyze the performance.
6. Use the simulation tools necessary for analyzing digital communication system in terms of error rate and spectral efficiency.

Unit- I : Signal representation and spectral analysis
Correlation and autocorrelations, response of linear system, normalized power in frequency domain, PSD, Effect of transfer function on PSD, orthogonal representation of signal: completeness of orthogonal set, Gram-Schmidt procedure, correspondence between signal and vectors, distinguishability of signal. Random signal and processes.

Unit –II : Digital Baseband Modulation Techniques and Waveform Coding Techniques
Introduction to Digital Communication System: Block diagram, digital communication nomenclature. digital versus analog performance criteria, sampling process, PCM generation and reconstruction, quantization noise, non-uniform quantization and companding, PCM with noise: decoding noise, error threshold, delta modulation, adaptive delta modulation, delta sigma modulation, differential pulse code modulation.

Unit III : Multiplexing and Line coding
Digital Multiplexing: Multiplexers and hierarchies, data multiplexers. data formats and their spectra, bit and frame synchronization.

Unit IV: Baseband Receiver
Baseband and pass band transmission and detection, integrate and dump type receiver, error probability, coherent detection of binary signals in presence of noise, optimum filter, matched filter, probability of error of matched filter, correlation receiver.

Unit V: Passband Digital Transmission
Pass band transmission and detection techniques: BPSK, BFSK and QPSK, M-ary PSK, QAM, minimum shift keying, geometric representation.

Unit VI : Spread Spectrum Techniques
Introduction, pseudo noise sequences, a notion of spread spectrum, direct sequence spread spectrum with coherent bpsk, signal space dimensionality & processing gain, concept of jamming, frequency hop spread spectrum.

Text Books :

1. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGraw Hill.
2. B P Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
3. Simon Haykin, "Digital Communication Systems", John Wiley & Sons, Fourth Edition.

Reference Books :

1. Ha Nguyen, Ed Shwedyk, "A First Course in Digital Communication", Cambridge University Press.
2. B. P. Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
3. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
4. P. Ramkrishna Rao, Digital Communication, McGraw Hill Publication
5. A.B. Carlson, P. B. Crully, J. C. Rutledge, "Communication Systems", Fourth Ed., McGraw Hill Publication.

Course Co-ordinator BoS Member BoS Chairman

ETUA31174: Electromagnetic Engineering

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite : Readers/students are expected to know the following concepts:
1) Vectors, 2) Differential equations

Course Objectives:

- To revise coordinate systems and vector concepts.
- To study basic electrostatic and magnetostatic laws, theorems.
- To understand Maxwell's equations and apply to the basic electromagnetic problem.
- To analyze boundary conditions and understand the field at the interface of two different media.
- To analyze time varying electric and magnetic fields, wave propagation in different types of media.

Course Outcomes:

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

1. Apply basic mathematical concepts to electromagnetic vector fields.
2. Relate electrostatic and magnetostatic laws and theorems to solve electric and magnetic field problems.
3. Interpret the electromagnetic problem and solve using Maxwell's equations.
4. Apply boundary conditions to different media for electromagnetic fields.
5. Verify Maxwell's equations for time varying fields.
6. Formulate uniform plane wave equation.

Unit- I : Review of coordinate systems and vector calculus

Introduction to coordinate systems: cartesian, cylindrical, spherical systems, differential length, area, volume , line, surface, and volume integrals, del operator , gradient of a scalar, divergence, curl, Stoke's theorem, divergence theorem

Unit –II : Electrostatics

Coulomb's law & electric field intensity, electric field due to point charge, line charge and surface charge distributions, electric flux density, Gauss's law and its application to differential volume element, Electric potential, relationship between E & V, potential gradient.

Unit III : Magnetostatics

Biot-Savart's law, Ampere's circuital law and its applications, magnetic flux density, magnetic scalar and vectors potentials, derivations of Biot-Savarts law and Ampere's law based on magnetic potential , energy density in electrostatic field, current and current density, continuity equation.

Unit IV: Boundary Conditions

Poisson's and Laplace's equation, general procedures for solving Poisson's and Laplace's equations. Boundary conditions with conducting and dielectric medium for electrostatic and magnetostatic fields

Unit V: Time Varying Fields and Maxwell's equations

Faraday's law, displacement current, Maxwell's equations in point form and integral form, power and Poynting theorem, boundary conditions for time varying field, time harmonic field.

Unit VI : Uniform plane waves

Wave equations, plane wave in lossless dielectric medium, derivation of field equations, lossy dielectrics, conducting medium, primary and secondary constants of the medium, skin depth, phase velocity, group velocity, velocity of propagation.

Text Books :

1. Matthew N.O. Sadiku , "Principles of Electromagnetics", 4th Edition, Oxford University Press, 2009.
2. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw-Hill Education, 2005

Reference Books :

1. Edminister J. A, "Electromagnetics", Tata McGraw - Hill.
2. Hayt & Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw- Hill\
3. Narayana, "Elements of Engineering Electromagnetics" PHI

Course Co-ordinator BoS Member BoS Chairman

IE31175CS : Elective I - Internet of Things

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concept:
Data Communication

Course Objectives:

- To understand fundamentals of IoT
- To understand Building Blocks of Iot and apply the knowledge for implementing small IoT systems
- To gain knowledge of IoT proctools
- To understand fundamentals of security in IoT
- To learn how secure infrastructure for IoT is implemented
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

Course Outcomes:

After completion of this course, students will be able to -

1. Understand the fundamental of IoT
2. Understand Building Blocks of Iot & Implement small IoT Systems
3. Learn the IoT protocols
4. Understand the security issues in IoT
5. Learn the concepts of Cloud & Fog Computing
6. Know the real world applications of IoT

Unit I : Introduction to IoT

IoT: Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications.

Unit II : IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Software define Network for IoT, IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino Introduction to Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Beagle board and Other IoT Devices.

Unit III : Protocols for IoT

Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4,BACNet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer.

Unit IV: Security in IoT

IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT.

Unit V: Cloud Computing and Fog Computing

Introduction to Cloud Computing, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middle ware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things

Architecture. Challenges and issues in cloud Computing. Fog Computing, Need of Fog computing, Fog Computing Architecture.

Unit VI: IoT Case Studies

Case Studies: Home Intrusion Detection, Weather Monitoring, System, Air Pollution Monitoring, Smart Irrigation, Smart cities, Health Care.

Text Books :

1 Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2 Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. ISBN : 9781439892992
3 Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011. ISBN: 978-3-642-19156-5

Reference Books :

1. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.ISBN : 978-0-470-90356-8
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley 2014, ISBN: 978-1-118-43063-7

Course Co-ordinator BoS Member BoS Chairman

IE31175ET: Elective I - Industrial Automation

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:

1. Basic Electronics devices and their operations
2. Basic understanding of Operational Amplifier.
3. Brief introduction to Controllers, analog and digital control actions.

Course Objectives:

- To give the students a comprehension of Industrial Instrumentation Design.
- To give the students a comprehension of the relation between Instrumentation and controller design in industrial applications.
- To make the students able to analyze the control loops and to achieve the control actions with different Controllers

Course Outcomes:

After completion of this course, students will be able to -

1 Select an appropriate sensor or transducer to meet requirements of an industrial application.
2 Select and design a signal conditioning circuit for given application based on applied sensing method.
3 Design a data acquisition system using various Bus standards and communication Protocols.
4 Choose different final control elements and Actuators.
5 Design industrial solutions for complex engineering problems using programmable logic controllers.
6 Understand advanced systems in industrial automations.

Unit I : Sensors and Transducers

Performance terminology - displacement, velocity and motion sensors - proximity sensors, force, pressure, flow, level and temperature sensors – humidity, ph and conductivity sensors – specifications and selection criteria – inputting data by switches

Unit II : Transmitters, Signal conditioning and Converters

Analog signal conditioning for different sensors – Use of bridge circuits and Instrumentation amplifiers – Design guidelines – Signal converters V/I, I/V, V/F, F/V, I/P & P/I converters – Evolution of two wire transmitters – Isolated two wire transmitters – Smart and Intelligent transmitters

Unit III : Data Acquisition, Bus Standards and Protocols

Multichannel data logging and computer based data acquisition system like LABVIEW, – RS 232C standard, IEEE 488 bus, I2C bus, HART protocols – foundation field bus and Profibus

Unit IV: Actuators and Final Control elements

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.

Unit V:Programmable Logic Controllers, Applications and Interfacing

PLC Architecture – Input / Output processing – Interfacing of Input / Output devices with PLC – Analog Input / Output - Ladder logic programming – Selection of PLC – PLC based automated systems.

Unit VI: Advances in Industrial Automations

Direct digital control systems, Distributed control systems (DCS): Introduction, DCS flow sheet symbols, architecture of DCS controller, DCS communication, DCS supervisory computer tasks, Features and advantages of DCS. Supervisory control and Data acquisition (SCADA): SCADA introduction, elements of SCADA, features of SCADA.

Text Books :

1. K. Krishna Swamy, "Process Control"; New Age International Publishers.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition
3. W. Bolton; " Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering "; Pearson Education; 3rd Edition

Reference Books :

1 Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education.
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

Course Co-ordinator BoS Member BoS Chairman

IE31175ME : Elective I - Product Design and Engineering

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Engineering Mechanics, Strength of Material, Material Science, CAE and CAMD, MD I and MD II

Course Objectives:

- To understand basic techniques for particular phases of product development
- Make and manage design teams for product development in a company.

Course Outcomes:

After completion of this course, students will be able to -

1. Describe an engineering design and development process
2. Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product
3. Create 3D solid models of mechanical components from the perspective of aesthetic, ergonomic and functional requirement using CAD software
4. Work collaboratively on a team.
5. Create new product based on mechanical design engineering.
6. Investigate contemporary issues and their impact on provided solution

Unit I : Introduction to Product Design

Characteristics of Successful Product Development, Innovative Thinking, Challenges to Product Development, Product Development Process, Concept Development, Economics – Cost Vs Performance, Design Considerations

Unit II : Product Development Process

Product development process- Identification of customer needs- customer requirements, product development process flows. Product specifications and concept generation, concept selection, concept screening, concept testing, reverse engineering, product architecture.

Unit III : Product Design Tools

Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving (TRIZ), Product function tree, Life cycle analysis, Quality Function Deployment, Competing Product Analysis, SWOT analysis, Failure Mode Effect Analysis.

Unit IV: Design for Manufacture and Assembly

Design for assembly, design for disassembly, design for environment, design for graphics and packaging.

Unit V: Rapid Prototyping

Understanding Prototypes, Principles of Prototyping, Prototyping Technologies, Planning for Prototypes.

Unit VI: Product Testing and Validation

Time value of Money, Analytical technique, Product and Process, Evaluation of component, subassembly, assembly, Reliability Goals, Computer simulations and Bench test results, Comprehensive test plans and reports.
Text Books : 1 Product Design-Techniques in Reverse Engineering and New Product Development, Kevin Otto, Kristion Wood, Pearson Education, ISBN 978-81-7758-821-7. 2 Karl T.U. And Steven D.E., Product Design and Development, McGraw Hill, Ed, 2000
Reference Books : 1 Dieter GE, Engineering Design-Material and Processing Approach, McGraw Hill, Ed 2000

Course Co-ordinator BoS Member BoS Chairman

IE31175CV : Elective I - Optimization Techniques

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: NIL

Course Objectives:

- To introduce students to optimization techniques and applications of same in Civil Engineering.
- To impart the knowledge of different Stochastic Methods of optimization
- To equip the students with advance Linear Programming techniques.
- To impart the knowledge of Non-Linear Programming through unconstrained optimization techniques.
- To make students aware of dynamic programming.

Course Outcomes:

After completion of this course, students will be able to -

1 Discuss optimization techniques and its components
2 Implement sequencing, queuing theory and simulation to stochastic problems
3 Implement LPP with all its variants
4 Construct Linear optimization models
5 Use of NLP like constrained and unconstrained optimization
6 Use of Dynamic Programming for problems related to project investment

Unit I : Introduction of systems approach

Introduction to System approach, Operations Research and Optimization Techniques, Applications of systems approach in Civil Engineering.
Introduction to Linear and Nonlinear programming methods (with reference to objective function, constraints), Graphical solutions to LP problems.
Local & Global optima, unimodal function, convex and concave function.

Unit II : Stochastic Programming

Sequencing– n jobs through 2, 3 and M machines.
Queuing Theory: elements of Queuing system and its operating characteristics, waiting time and ideal time costs,Kendall's notation, classification of Queuing models, single channel Queuing theory: Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS/ /).
Simulation: Monte Carlo Simulation.

Unit III : Linear programming (A)

The Transportation Model and its variants.
Assignment Model, and its variants

Unit IV: Linear programming (B)

Formulation of Linear optimization models for Civil engineering applications. The simplex method.
Method of Big M, Two phase method, duality.

Unit V: Nonlinear programming

Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section.
Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality constraints - Lagrange Multiplier Technique.

Unit VI: Dynamic programming, Games Theory & Replacement Model

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D. P.Games Theory – 2 persons games theory, various definitions, application of games theory to construction Management.

Replacement of items whose maintenance and repair cost increase with time, ignoring time value of money.

Text Books :

1 Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).
2 Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell— Wiley India.
3 Engineering Optimization by S. S. Rao.
4 Operations Research by Hamdy A. Taha.
5 Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill).
6 Operations Research by Pannerselvam, PHI publications

Reference Books :

1 Topics in Management Science by Robert E. Markland(Wiley Publication).
2 An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen.
3 A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell (Harper Row Publishers).

e – Resources :

1 Mathematical Model for Optimization (MMO Software). nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION METHODS/Newindex1. html.

Course Co-ordinator BoS Member BoS Chairman

IE31175IT : Elective I - Human Computer Interaction

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Problem Solving and Object Oriented Technologies.

Course Objectives:

- To introduce the field of human-computer-interaction study.
- To gain an understanding of the human part of human-computer-interactions.
- To learn to do design and evaluate effective human-computer-interactions.
- To study HCI models and theories.
- To understand HCI design processes.
- To apply HCI to real life use cases.

Course Outcomes:

1 After completion of this course, students will be able to -
2 Explain the importance of HCI principles of user-centered design (UCD) approach.
3 Understand various human factors in HCI design.
4 Explore the models, paradigms and context of human interactions with computer system.
5 Design effective user-interfaces following a structured and organized UCD process.
6 Evaluate usability of a user-interface design.
7 Apply cognitive models for predicting human-computer-interactions.

Unit I : Introduction and basic concepts

Need for Design - Examples from Design of everyday things, case studies, Evolution of the web and digital interfaces, Design thinking and wicked problems .Exercise - Identify problems around us requiring design solution Or problems solved using design.

Unit II : Understanding the Human

Human senses: Human input-output channels, human memory, Thinking - reasoning and problem solving, Human emotions, individual differences, Designing interfaces for all, User research and techniques, Understanding Personae, Good and poor design, Ergonomics. Exercise - Creating personae for different application in everyday use.

Unit III : Understanding the Interaction

Understanding device specific interactions and human aspects involved, Interaction styles, Interacting with voice, visual and audio visual interfaces, Understanding Scenarios and context of use for user.
Exercise - Listing down scenarios for an application/system, critical task list for each scenario.
Understanding user journey and user journey maps.
Exercise - Creating a user journey map for a particular task.

Unit IV: HCI Design Process and Standards

Introduction to UX design process and case study, Understanding Information Architecture, Exercise - Open and closed card sorting technique - Creating information architecture for a system Understanding navigation models based on information architecture, High level concept sketches/wireframes Exercise - Creating low fidelity concept sketches for critical tasks of a system/problems, Overview of tools

Unit V: UI Evaluation Techniques

What, why and when to evaluate, Design guidelines, Golden rules and heuristics, Goals of Evaluation, Evaluation criteria, Evaluation through: Expert analysis, User participation, Testing techniques - Formative and Summative testing, surveys, peer reviews and so on.

Case study - ROI on UX/HCI methodology.

Unit VI: HCI Models and Theories

Cognitive models, Goal and Task hierarchy models, Linguistic models, Physical and Device models, Design principles.

Exercise - Conduct evaluation of different sample interfaces using different models

Introduction to Prototyping tools, UX - Industry overview.

Text Books :

1 Alan J, Dix. Janet Finlay, Rusell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9
2 Preece, Rogers, Sharp, "Interaction Design-beyond human-computer Interaction", WILEY-INDIA, ISBN 81-265-0393-9

Reference Books :

1 Ben Shneiderman, "Designing The User Interface", Pearson Education, 2001, ISBN 81-7808-262-4
2 Alan Cooper, Robert Reimann, David Cronin, "The Essentials of Interaction Design", WILEY-INDIA, ISBN-10 81-265-1305-5
3 Wilbert O. Galitz, "The Essential Guide to User Interface Design", WILLY, ISBN 81-265-0280-0
4 Donald A. Norman, 2013, The Design of Everyday Things Basic Book, ISBN 978-0-465-07299-6.

Web-links :

1 http://hcibib.org
2 https://developer.android.com/guide/practices/compatibility
3 https://developer.apple.com/design/human-interface-guidelines

Course Co-ordinator BoS Member BoS Chairman

ETUA31176: Lab Practice-III

Teaching Scheme
Credits : 3
Practical : 6 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

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

1. Analyze discrete time signals using appropriate tool.
2. Analyze and design discrete time systems using appropriate tool.
3. Demonstrate modern engineering tools necessary for simulating, configuring and monitoring embedded system.
4. Design and Built microcontroller based system with peripheral interfacing and programming for real time applications.
5. Interpret signal representation in time and frequency domain and compare and contrast spectrums of various digital modulation techniques.
6. Compare and contrast various digital modulation techniques by practically observing various parameters e.g. bandwidth, data rate signal and noise power.

A. Discrete Time Signal Processing (List of Experiments)

1. Verification of sampling theorem.
2. To study the properties of DFT. Write programs to confirm DFT properties.
3. To study the circular convolution for calculation of linear convolution and aliasing effect.
4. Plot the pole zero diagram and frequency response of the given system function
5. To design FIR filter using window method.
6. Design Butterworth filter using Bilinear transformation method.
7. Design notch filter to remove power line interference from ECG signal.
8. Effect of coefficient quantization on frequency response of filter.
9. Design and implement decimator / interpolator.
10. To plot the spectrum of music signal using FFT using (LABVIEW)

Note: Any 8 experiments

B. Microcontroller and Applications (List of Experiments)

I. 8051 based practical's (Programs in assembly language)

1. Interfacing of LED's, switches, buzzer, relay with 8051 Microcontroller.
2. Interfacing of 16x2 LCD in 8 bit and 4 bit mode with 8051 Microcontroller and display message on it.
3. Interface 4x4 matrix keyboard with 8051 Microcontroller. Display value of pressed switch on LCD.
4. Interface Computer with 8051 Microcontroller using UART communication.
5. Interface stepper Motor with 8051Microcontroller and write program to rotate it in clockwise and anticlockwise direction using different drives (Full step drive, Half step drive and wave drive).
6. Interfacing of ADC PCF8591 with 8051 Microcontroller using IIC protocol read the analog voltage from ADC and display its equivalent digital value on LCD.

II. AVR based practical's (Programs in C language)

7. Interfacing of 16x2 LCD with AVR Microcontroller board and display message on it.
8. Interface 4x4 matrix keyboard with AVR microcontroller. Display value of pressed switch on LCD.

9. Interface temperature sensor LM35 with AVR Microcontroller board and display temperature on LCD.
10. Interface Servo motor with AVR Microcontroller.
11. Generate PWM using AVR Microcontroller and use it for speed control of DC motor

III. Case study (PBL)
Implementation of hardware and software for specific application using 8051 or AVR microcontroller

Note: Any 9 experiments from 1 to 11 and Case study is compulsory

C. Communication Engineering – II (List of Experiments) Study of PCM and Companded PCM.

1. Study of DM and ADM.
2. Study of Pulse shaping, ISI and eye diagram
3. Study of Generation &detection of BPSK and QPSK.
4. Study of Generation &detection of BFSK.
5. Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.
6. Study of Detection of digital base band signal in presence of noise.
7. Study of Generation of PN Sequence and its spectrum.
8. Study of Generation &detection of DS-SS coherent BPSK & its spectrum.
9. Simulate any two (Compulsory)
   a) Generation of DM and ADM b) Generation of BPSK/QPSK c) FSK d) DD-SS

Note: Any 7 experiments, 10th is compulsory

Course Co-ordinator BoS Member BoS Chairman

ETUA31177: Employability (Skills in Electronic Design)

Teaching Scheme
Credits : 3
Lecture : 2 Hrs./week
Practical : 2 Hrs./week

Examination Scheme
Formative assessment : 50 Marks

Prerequisite : Readers/ Students are expected to know the following concepts:
1) Digital Electronics, 2) Semiconductor Devices and Circuits 3) Power Electronics
4) Microcontrollers and Application

Course Objectives:
- To impart the skill of applying basic concepts for designing electronic systems.
- To imbibe good design practices for robust design of electronic systems.
- To explore the importance and significance of customer specifications/requirements.
- To impart the knowledge of 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 the completion of this course student will be able to
1. Interpret and summaries the specifications of different power supply requirement.
2. Select optimal design topologies for data acquisition system.
3. Evaluate and decide appropriate components and devices for designing modern data acquisition system.
4. Design an electronic filters system/sub-system and validate its performance by simulating the same using EDA tools

Unit- I : Design of Linear Power Supplies
Typical specifications, concept of ideal power supply & voltage regulation, rectifier and filter design, basic shunt regulator design, series pass transistorized regulator, variable output voltage regulator, protection circuits for critical devices in regulator circuits (short-circuit, over-voltage protection circuits), heat-sink selection, three terminal IC regulator, design examples of IC based power supplies.

Unit II: Design of Switched Mode Power Supply
Advantages of SMPS, basic concept of switching regulator, basic topologies, step down converter, step up converter, polarity inverter, characteristics of components, switching element, BJT, MOSFET, IGBT, switching diode, filter capacitor and inductor, PWM circuit, general block diagram of SMPS, high frequency transformer design (steps only), practical topologies of SMPS, fly back design, push pull design, startup circuit design, pwm control circuit, isolation circuit.

Unit III: Environmental Parameter Sensing Systems and design of Modern Data Acquisition System.
Generalized control system, concept of set point and error, typical control mechanisms, role of data acquisition system, transducers, sensor and actuator, active and passive transducers and their characteristics, instrumentation amplifiers(IA), characteristics of an ideal IA, selection criteria of IA, signal conditioning circuits, different environmental and industrial parameter sensors interfacing (light, humidity, pressure, flow, temperature, position, obstacles)

Design of signal conditioning circuits, Selection criteria for MCU, overview of interface devices and storage, RS-232 interface, RTC, I2C EEPROM, LCD, keyboard interface, DC motor driver, relay driver interface.

Unit IV: Design of Active Filters and Case Study based on Industry Interaction

Design of various filter types , Low-pass filter (second order), High-pass filter (second order), Band-pass filter, Band-reject Filter , All-pass filter, State variable filter design, Selection of components , Sensitivity analysis and Applications.

Students will form groups and visit / interact with different types of manufacturing as well as service industries to gather information regarding various atomization and debugging techniques used by the industries. Study based on minimizing the distortion, THD, EMI and EMC effect inside the electronic design.

Text Book:

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

Reference Books :

1 "The Circuit Designer's Companion", Peter Wilson, Elsevier Ltd, 2012
2 "Switching Power Supply Design,"3E, Abraham I. Pressman et. al, The McGraw-Hill Companies, 2009
3 "Measurement, Instrumentation, and Sensors Handbook", John G. Webster, CRC Press,1999
"Electronic Filter Design Handbook",4E, Arthur Williams, Fred Taylor, McGraw-Hill, 2006

List of Design Assignments:

1. Design of Linear Power Supply
   a) Single Polarity (Variable/Fixed, Display)
   b) Dual Polarity (Variable/Fixed, Display)
   c) Dual Polarity (tracking, display)
2. Design of Switched Mode Power Supply
   a) Single polarity , multiple outputs (Flyback/ Push-pull)
3. Design of Environment parameter sensing based system
   a) Designing different automation and environment parameter sensing circuits.
4. Design of Modern Data Acquisition System
   a) Multi-channel data acquisition systems
5. Design of Active Filter
   a) Second-order LPF/HPF/BRF/BPF
6. Case Study Case Study based on Industry Interaction
   a) Report submission based on the topic given with Industry Interaction.

Course Co-ordinator BoS Member BoS Chairman

ETUA31178: Mini Project

Teaching Scheme
Credits : 2
Tutorial : 1Hr/week
Practical: 2Hrs/week

Examination Scheme
Formative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Basic electronics components, Basic design concepts for Analog and Digital Circuits. Data sheet reading (Electronic Workshop Practice I, Electronic Workshop Practice II)

Course Objectives:

- To interpret the Project Development Process including budgeting through Mini Project.
- To apply different EDA tools for Mini Project completion.
- To relate the processes and importance of documentation in Mini project.

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

1. Follow the different phases of Project development cycle.
2. Use Different EDA tools like Multisim, Proteus and Altium etc and Microcontroller IDE like MPLAB for designing, simulating the working of the mini project.
3. Test and troubleshoot the hardware project and prepare technical documentation on mini project

Unit- I : Mini Project Development Cycle

Various domains, Project Selection, Project time line, Literature survey, Feasibility of project, Formulation of project definition and objectives, Detailed specifications of project, Block diagram, Synopsis guidelines. Various hardware platforms, Power Budget, Hardware design canvas, Module based design, Design process, Component selection and validation using datasheet, Selection criteria, Circuit diagram.

Unit –II : EDA Tools

Simulation, EDA Tools, Various software development tools like Multisim, Proteus and Altium .etc and Microcontroller IDE like MPLAB. Algorithm/Flowchart guidelines, PCB design principles, PCB design rules, PCB specifications, PCB artwork, Gerber file, PCB output files, PCB manufacturing guidelines, Layout Versus Schematic verification report, Systematic coding techniques.

Unit III : Testing and Documentation

Breadboard testing. Troubleshooting and Testing Techniques, Integration of hardware and software, Validation and verification. Role of enclosures, IP/NEMA Standard Table, Product specific enclosure design, Layout of front panel and rear panel using EDA Tool (Ex. PROTOCASE), safety standard, Layout of documentation, Manufacturing documentation, Bill of material, Mini Project Report Format.

Text Books:
1.Kim Fowler," Electronic Instrument Design" Oxford university press.
2.Thomas C Hayes, Paul Horowitz, "The Art of Electronics", Newens Publication

Guidelines for Mini Project

A:Project group shall consist of not more than 4 students per group.
· Mini Project Work should be carried out in the Projects Laboratory.
· Project designs ideas can be referred from recent issues of electronic design magazines like Elektor, Everyday Practical Electronics (EPE) or application notes from well-known device manufacturers.
· Use of Hardware devices/components is mandatory.
· PCB Layout versus schematic verification is mandatory.
· Assembly of components and enclosure design is mandatory.

B: Following are the Domains for Mini projects but not limited to:
. Embedded Systems
. Power Electronics
.Biomedical Electronics
.Mechatronic System
· Instrumentation Systems
· Electronic Communication Systems
·Microcontroller based projects should preferably use controllers (Ex. ATmega Controller/AVR/PIC)

C: Following Activities should be completed in Project Laboratory:
1: Formation of groups, Finalization of Mini project & Distribution of task.
2: Circuit Design, PCB design using an EDA tool, Simulation.
3: PCB manufacturing through PCB Manufacturer, Hardware assembly and soldering, programming (if required), Testing, Enclosure Design, Fabrication etc
4: Testing of final project, Checking & Correcting of the Draft Copy of Project Report
5: Final Demonstration and Group presentations of Mini Project.

Maintain Log book which includes all these activities.

Course Co-ordinator BoS Member BoS Chairman

Semester – II

ETUA32171: Power Electronics - I

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following –
Semi-conductor Devices and Circuits

Course Objectives:

- To introduce students to different power devices, to study their construction, characteristics and triggering circuits.
- To give students an exposure of working and analysis of controlled rectifiers, inverters, choppers, AC voltage controllers and resonant converters for different types of loads.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and protection circuits.

Course Outcomes:

On completion of the course, students will be able to:-

1. Apply the fundamentals of Semi-conductor devices for understanding working of power semiconductor devices such as SCR, MOSFET and IGBT.
2. Apply the fundamentals of engineering mathematics and analyze the performance of different controlled AC-DC power converters for different types of loads.
3. Analyze the performance of DC-AC power converters for R and R-L loads.
4. Analyze and verify the performance of different DC-DC power converters for R and R-L loads.
5. Apply the knowledge of power electronics for different applications such as UPS system, DC drives.
6. Design and implement different over voltage / over current protection circuits.
7. Comprehend and present technical literature in the field of power electronics.

Unit- I : Power Devices

Construction, Steady state characteristics & Switching characteristics of SCR, SCR ratings: I_L, I_H, V_{BO}, V_{BR}, dv/dt, di/dt, surge current & rated current. Gate characteristics, Gate drive requirements, Construction, Steady state characteristics and ratings of Power MOSFET & IGBT. Gate drive requirements, gate drive circuits for Power MOSFET / IGBT.

Unit –II : AC-DC Power Converters

Concept of line & forced commutation, Single phase Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, Three phase Semi & Full converters for R load. Simulation of converter circuits using P-sim software.

Unit III : DC-AC Converters

Single phase bridge inverter for R and R-L load using MOSFET / IGBT, performance parameters, single phase PWM inverters. Three phase voltage source inverter for balanced star R load. 120 and 180 degree mode of operation. Concept of harmonic reduction. How to reduce harmonics.

Unit IV: DC-DC converters & AC Voltage Controller

Working principle of step down chopper for R-L load (highly inductive), control strategies. Performance parameters, Step up chopper, 2-quadrant & 4-quadrant choppers,

SMPS**:-** Types i.e. half bridge ,full bridge smps , buck boost convertors.

Single-phase full wave AC voltage controller with R load.

Unit V: Power Electronics Applications

On-line and OFF line UPS with battery. Electronic ballast: Characteristics of fluorescent lamps and advantages over conventional ballast. Induction heating. DC motor drive, Single phase separately excited DC motor drive. Simulation of drive circuit using P-sim software.

Unit VI : Resonant Converters & Protection of Power Devices & Circuits

Need for resonant converters, SLR half bridge DC/DC converter in low frequency, Introduction of zero current switching (ZCS) and zero voltage switching (ZVS) resonant converters. Cooling & heat sinks, over voltage conditions, over voltage protection circuits, over current fault conditions, over current protection. Electromagnetic interference: Sources, minimizing techniques.

Text Books :

1. M. H. Rashid, "Power Electronics circuits devices and applications", PHI 3rd edition, 2004 edition, New Delhi.
2. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi.
3. M.D. Singh, K.B. Khanchandani, " Power Electronics", 2nd edition, TMH, New Delhi.

Reference Books :

1. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi.
2. M. S. Jamil Asghar, "Power Electronics", PHI, 2004, New Delhi
3. "GE SCR MANUAL" 6th edition, General Electric, New York, USA.
4. Ned Mohan, T. Undeland & W. Robbins, "Power Electronics Converters applications and design" 2nd edition, John Willey & Sons, Singapore.

Course Co-ordinator BoS Member BoS Chairman

ETUA32172: Information Theory and Coding Techniques

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
1. Basics of Probability
2. Basics of Digital Communication
3. Basics of signals and systems(only in a specific topic of convolution encoders)

Course Objectives:
- To equip students with the basic understanding of the fundamental concept of entropy and information theory.
- To understand the theoretical framework upon which error-control codes are built
- To understand the implications and consequences of fundamental theories and laws of information theory and coding theory with reference to the application in modern communication and computer systems
- To analyze performance of communication system with coding and modulation

Course Outcomes:
1. Comprehend and apply the fundamentals of probability and information theory
2. Apply the concept of mutual information to analyze the performance of the given channel model.
3. Formulate, design and implement linear block codes using fundamentals of linear algebra.
4. Analyze, implement and interpret cyclic codes.
5. Design and evaluate the performance BCH and RS codes for given application
6. Identify the need to design and evaluate the performance of convolutional encoder

Unit- I : Information Theory and Source Coding
Introduction to probability, law of total probability, Bayes theorem, information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm (LZW, LZ77), Arithmetic coding, Run Length Encoding, JPEG, MPEG (as case studies for compression)

Unit –II : Information Capacity and Channel Coding
Discrete memory less channel, Mutual information, Channel capacity, types of channels, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Implications of information capacity theorem

Unit III : Linear Block Codes
Linear Block Codes: Generator matrix, parity check matrix, Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code

Unit IV : Cyclic Codes
Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.

Unit V : BCH and RS Codes
Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code, CRC code, FEC and ARQ systems

Unit VI : Convolutional Codes

Introduction of convolution code, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding, Known good convolution code, Introduction to LDPC and Turbo codes, Introduction and concept of Trellis coded modulation (TCM), Error Probability plane, Bandwidth efficiency plane, Modulation and coding tradeoffs. Applications of coding in recent technologies (InfiniBand, PCI express for clock recovery, maintain DC balance) , applications in block chain, stock market, Ethernet receiver.

Text Books :

1. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition
2. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition.

Reference Books :

1. Bernad Sklar, "Digital Communication Fundamentals & applications", Pearson Education. Second Edition.
2. Simon Haykin, "Communication Systems", John Wiley &Sons, Fourth Edition.
3. Shu lin and Daniel J Costello., "Error control Coding" Pearson, 2nd Edition.
4. Todd Moon, "Error Correction Coding : Mathematical Methods and Algorithms", Wiley Publication
5. Khalid Sayood, "Introduction to Data compression", Morgan Kaufmann Publishers

Course Co-ordinator BoS Member BoS Chairman

ETUA32173A :Advanced Micro processors & DSP Processors

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment:50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
1) Digital Electronics 2) Microcontroller 3) DSP Fundamentals

Course Objectives:

- To study 32 bit architecture for an application design and implementation
- To impart philosophy of ARM core evolution
- To explore ARM7 and ARM CORTEX architecture and its impact on embedded solutions.
- To use tool chain for ARM based microcontroller software
- To design and implement software components for hardware initialization and programming.
- To impart knowledge of hardware architecture for digital signal processing.

Course Outcomes:

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

1. Recognize ARM 7 architecture to provide optimal solution for embedded system.
2. Identify controller features for application functionality.
3. Understand and experiment an embedded application with ARM-7 architecture.
4. Distinguish Cortex architecture philosophy and features from its predecessor
5. Develop an embedded application with Cortex M3 architecture.
6. Recognize fundamentals of DSP processor with reference to an application.

Unit- I : ARM7, ARM9, ARM11 Processor

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

Unit –II : ARM based Microcontroller

ARM7 Based Microcontroller LPC22xx: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider) , Memory Map, GPIO, Pin Connect Block, timer.

Unit III : Application development with ARM7 Based Microcontroller

Interfacing the peripherals to LPC22XX: LED, LCD, GLCD, KEYPAD, GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC for waveform generation, USB.

Unit IV : ARM CORTEX Processor

Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Need of operating system in developing complex applications in embedded system, desired features of operating system & hardware support from processor, Firmware development using CMSIS standard for ARM Cortex. Survey of CORTEX M3 based controllers, its features and comparison.

Unit V : ARM CORTEX M3 based Microcontroller

ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), System Control, Clock & Power Control, GPIO, Pin Connect Block, interfacing with RGB LED, Seven Segment, TFT Display, MOTOR control using PWM, CAN.

Unit VI : DSP Processor Fundamentals Introduction to TMS-320 architecture, Features, block diagram, Suitability in embedded applications, introduction to Da-vinci architecture.
Text books : 1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", ELSEVIER 2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER 3. Texas TMS-320 /DM55manual
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.

Course Co-ordinator BoS Member BoS Chairman

ETUA32173B: Fiber Optic Communication

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative assessment:50 marks
Summative assessment: 50 marks

Prerequisite: Readers/students are expected to know the following concepts:
1. Analog Communication 2. Digital Communication

Course Objectives:
- To introduce major components topologies and their operational principles in OFCS
- To understand the limitation of bandwidth constraint for conventional media and explore carrier with unconventional media like glass.
- To establish communication using optical link to attain lowest attenuation.
- To learn fiber optic network components, variety of networking aspects and its operational principles
- To design optical communication system for different modulation techniques

Course Outcomes: On completion of the course, students will be able to:
1. Apply FOC fundamentals to compare among the structures / types of optical fibers. Apply theory and principles of optical fiber communication to derive different parameters for Ray theory transmission and to solve numerical based on Ray theory transmission.
2. Identify various causes for signal attenuation, dispersions, coupling losses over the communication channel and interpret the concepts related to transmission characteristics of optical fibers to solve a problem / numerical.
3. Identify the limitations of the optical sources, causes and apply those concepts to design optical transmitter. Identify the necessity of using couplers and connectors in energy transmission.
4. Identify the limitations of the optical detectors, causes, understand their working principles and apply those concepts to design optical receivers.
5. Design fiber optic link for transmission of analogue and digital signals. Evaluate optical power link budget and rise time budget. Identify design constraints for required performance criteria.
6. Identify the strengths and limitations of advanced optical components and apply those concepts to select proper components for designing optical communication system within realistic constraints.

Unit- I : Fiber optic communications system
Electromagnetic Spectrum & Optical spectral bands, Key elements of fiber optic communications system, Advantages of optical fiber communication over other communication systems, Ray theory transmission: TIR, Acceptance angle, Numerical aperture, Fiber types according to: materials used; refractive index profiles & mode transmission.

Unit –II : Optical Fiber for Telecommunication
Transmission characteristics of optical fibers: Attenuation due to absorption, scattering & bending, Signal Distortion in optical fibers: Intra modal Dispersion: Material & Waveguide dispersion; Intermodal dispersion: MMSI, MMGI, Overall fiber dispersion: MM & SM fibers.

Unit III : Optical Sources & Transmitters

Introduction to optical sources: Wavelength and Material Considerations, LEDs & semiconductor LASERs: principle of working & their Characteristics. Optical transmitters: LED drive circuits for digital and analog transmission. Power launching & Coupling: Fiber optic splices, connectors & couplers & Coupling losses.

Unit IV: Optical detectors & Receivers

Introduction: Material Considerations, PN, P-i-N, Avalanche photodiodes & photo transistors: Principle of working & characteristics and relative merits and demerits of photodiodes. Receiver Noise: Noise considerations in PN, P-i-N & Avalanche photodiodes.

Unit V: Light wave Systems

System Architectures, Point-to-Point Links: System Considerations, Design Guidelines: Optical Power Budget, Rise Time Budget, Long-Haul Systems.

Unit VI : Advanced Multichannel Optical Systems

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 and EDFA in brief.

Text Books :

1 Gerd Keiser, Optical Fiber Communications, Tata McGraw Hill, Fourth Edition.
2 John M. Senior, Optical Fiber Communications-Principles and Practice, Prentice Hall of India, second Edition

Reference Books :

1 Djafar K. Mynbaev and Lowell L.Scheiner, "Fiber Optic Communications Technology", Pearson Education
2 Govind P.Agrawal, "Fiber Optic Communication Systems", WILEY INDIA, Third Edition

Course Co-ordinator BoS Member BoS Chairman

ETUA32173C: Digital System Design using Verilog

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Digital Logic Design

Course Objectives:

- To get the knowledge of Verilog Hardware Description Language to design digital circuits.
- To explore features and architectures of various PLDs.
- To learn different modeling styles using Verilog.
- To learn various advanced verification techniques
- To implement digital designs on PLDs (CPLDs/FPGAs).

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

1. Comprehend the basic concepts in the Verilog language
2. Write efficient Verilog codes using different modeling styles
3. Describe and differentiate the architectures and features of PLDs like CPLDs and FPGAs
4. Cognize switch level modeling and user defined primitives
5. Comprehend the concept of synthesizable codes and write efficient synthesizable codes of different digital circuits
6. Understand different verification techniques to analyze the design

Unit- I : Basic Verilog HDL
Design Flow, HDL overview Modules and Instances, Data types, Operators, Identifiers, Keywords, Modules and ports

Unit –II : Modeling styles
Gate-level modeling: Gate types, Gate delays, Dataflow modeling, Behavioral modeling: Structured Procedures, Procedural assignments, conditional statements, multiway branching, Loops, Blocks, Test benches

Unit III : Programmable Logic Devices
Basic PLDs (PAL, PLA, and ROM), CPLDs (Features and architecture), Spartan-3E FPGAs (Features, IOB architecture, and CLB/Slice architecture), Overview of Artix-7 FPGAs.

Unit IV: Advanced Verilog topics
Timing and Delays: types of delay models, Switch level modeling: switch modeling elements, examples, User defined primitives: UDP basics, combinational UDP's, Sequential UDP's, guidelines for UDP design.

Unit V: Logic Synthesis with Verilog
Impact of Logic Synthesis, Verilog HDL synthesis, Synthesis Design Flow**,** Verification of gate level netlist, modeling tips for logic synthesis, example of sequential circuit synthesis.

Unit VI :Advanced Verification Techniques
Traditional verification flow, Architectural modeling, Functional verification environment, Simulation, Analysis, coverage, Assertion checking, Formal verification

Text Books : Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson
Reference Books : 1. Jayaram Bhasker, "A Verilog HDL Primer", Star Galaxy Publication 2. Jayaram Bhasker, " Verilog HDL Synthesis: A Practical Primer", Star Galaxy Publication

Course Co-ordinator BoS Member BoS Chairman

ETUA32174: Lab Practice-IV

Teaching Scheme
Credits : 3
Practical : 6 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

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

1. Choose appropriate hardware/software tools to conduct the experiment.
2. Simulate the given power circuits using P-SIM software.
3. Explore and experiment interfacing of on chip and off chip peripherals with ARM7 microcontroller
4. Explore and experiment interfacing of on chip and off chip peripherals with cortex and DSP processor
5. Use appropriate optical instruments like Optical Power Meter, OTDR, SOA to collect and analyze data
6. Design digital circuits and analyze the results using hardware and software.
7. Analyze the circuit response by interpreting the synthesis report and schematic

A: Power Electronics - I (List of Experiments))

1. Characteristics of SCR
   How to read data sheet of SCR
   a. Plot V-I characteristics
   b. Observe the effect of gate current
   c. Measure IH & IL
2. V-I Characteristics of MOSFET / IGBT
   How to read data sheet of MOSFET
   a. Plot output characteristics
   b. Plot transfer characteristics
3. Triggering circuit for SCR (Using UJT or IC-785)
   a. Verify the range of firing angle
   b. Turn on the SCR, observe waveforms across load & SCR
4. Single phase Semi / Full Converter with R & R-L load
   a. Observe load voltage waveform,
   b. Measurement of firing angle, average o/p voltage across loads,
   c. Verification of theoretical values with practically measured values.
5. Single-Phase PWM bridge inverter for R load
   Observe output r.m.s. voltage waveforms,
   OR
   Three phase inverter for R - load (120 and 180 degree mode of operation)
   Observe the line voltage and phase voltage waveforms and harmonics.
6. Step down dc chopper using power MOSFET / IGBT. Measure duty cycle and observe effect on average load voltage for DC chopper
7. Find load & line regulation of given SMPS.
8. Speed control of DC motor / stepper motor / ac motor
   a. Speed control of DC motor using armature voltage control / field control method. Measure RPM and plot graph of speed versus armature voltage and field current
   OR

b. Study drive circuit for stepper motor- phase sequencing and micro stepping

OR

c. Plot speed-torque characteristic of three phase induction motor.

9. To study over voltage / over current protection circuit.
10. Mini Project based on above syllabus –
    a. SCR/TRIAC based fan regulator,

    OR

    b. Light dimmer

    OR

    c. 12V to 5V step down converter

    OR

    d. 5V to 48 V step up converter

    OR

    e. SCR based battery charger
11. Simulation of converter circuits using P-Sim software.

Note: Any Eight experiments from above list

B: Information Theory and Coding Techniques (List of Experiments)

1 Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as a) Noise free channel. b) Error free channel c) Binary symmetric channel d) Noisy channel Compare channel capacity of above channels.
2 Write a program for generation and evaluation of variable length source (Huffman/Shannon Fano)
3 Write a Program for coding & decoding of linear block codes.
4 Write a Program for coding & decoding of cyclic codes.
5 Write a program for coding and decoding of convolutional codes
6 Write a program for coding and decoding of BCH and RS codes.
7 Write a program to study performance of a coded and uncoded communication system (Calculate coding gain, error probability, Bit energy vs. error performance)
8. Write a simulation program to implement source coding and channel coding for transmitting a text file.
9 Implementation of any compression algorithm by using various toolboxes in MATLAB or any other platform for either audio, image or video data.
10 Write a simulation program to implement ARQ techniques

Note: Perform any 8 practical Assignments out of 10

C: Advanced Micro processors & DSP Processors (List of Experiments)

1. Interfacing LPC2148 to LCD/GLCD
2. UART Interfacing LPC2148 in embedded system (GSM/GPS)
3. Interfacing LPC2148 for internal ADC on interrupt basis
4. Interfacing LPC1768 to Seven Segment / RGB LED
5. Generation of PWM signal for motor control using LPC1768
6. Interfacing TFT display to LPC1768
7. Write a programme to generate sine wave of specific frequency.
8. Write a programme to generate swar (Sa, Re, Ga, Ma, Pa, Dha, Ni)

C: Fiber Optic Communication (List of Experiments)

1 Plot the electrical and optical characteristics of different LEDs.
2 Plot the electrical and optical characteristics of different LASERs.
3 Estimation of the numerical aperture of given fiber.
4 Measurement of the attenuation of given MMSI and SMSI fibers. Also study the effect of length and effect of bending on attenuation.
5 Plot the frequency response of detectors with different values of load resistor.
6 Estimation of the bandwidth of given fiber.
7 Design, build and test a simple fiber optic link for transmission of analogue signal.
8 Design, build and test a simple fiber optic link for transmission of digital signal.
9 Study of any two optical instruments: Optical Power Meter, OTDR, OSA etc.

C: Digital System Design using Verilog (List of Experiments)

To write Verilog design and test bench code, simulate, synthesize, and implementation on FPGA.

1. 4 bit full adder
2. 4:1 Multiplexer
3. 4-bit up/down counter with output displayed on 7-segment display.
4. ALU (any two logical and any two arithmetic operations)
5. Traffic Signal controller
6. 4 bit shift register
7. Random Access Memory (RAM)
8. Sequence detector
9. Parity checker
10. Code for user defined primitive to implement a given function

Course Co-ordinator BoS Member BoS Chairman

ETUA32175B1: Machine Learning

Teaching Scheme
Credits : 8
Lectures : 4 Hrs/week
Practicals: 8 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
Fundamentals of Programming

Course Objectives:

- To introduce to the concepts of machine and deep machine learning techniques.
- To study basics of Python programming and study tensorflow and MATLAB toolbox.
- To learn neural networks as tools for classification and regression.
- To study various optimization algorithms used in back propagation neural networks.
- To develop concept of deep learning and introduce to theoretical and practical aspects of convolutional neural networks and variants of recurrent neural networks.

Course Outcomes: At the end of the course student will be able to

1. Develop and implement the fully connected neural and deep neural network for applications like classification and regression.
2. Code the neural network architectures in open source Python language and tensorflow and keras tools.
3. Implement a real time project like live predictions or object detection and classification for security applications.
4. Explore the application areas in domains like agriculture and medicine.

The course will comprise of a blend of theory and practical. Students are exposed to Python programming language and machine learning toolboxes like Tensorflow and Keras. At the end of the course students will go through 3-4 case studies (live projects) demonstrated by industry experts. Finally students will be asked to build a project on which his/her acquired skills will be judged/evaluated.

The course will be covered in approximately 120 hours. (40 Hrs. Theory + 80 Hrs. Practical)

The topics covered will be as follows:

- Introduction to Machine /Deep Learning – Techniques and Applications
- Basics of Python Programming, Introduction to Tensor flow and MATLAB statistics and Machine learning toolbox.
- Neural Network Basics – Concept of Neuron and Perceptron, Single and Multilayer Networks, Regression and Classification. Typical Supervise Network Setup, Learning Algorithms, Activation functions Loss functions and Gradient Descent.
- Backpropagation algorithm with gradient descent .Stochastic and mini batch GD, Other optimization techniques like Momentum based gradient descent, Nestrov accelerated gradient, Adagrad , RMS Prop and Adam.
- Other Machine learning techniques like Support Vector Regression and Machines.

- Feedforward Network Implementation using Python and tensorflow.
- Covolutional Neural Networks (CNN) –Concept of CNN, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, object detection using CNN
- Regularization Techniques in Machine Learning
- Implementation of CNN using Tensorflow
- Recurrent Neural Networks, Backpropagation through time (BPTT
- Case studies by Industry experts.

Course Co-ordinator BoS Member BoS Chairman

ETUA32175B2: Mechatronics and Robotics

Teaching Scheme
Credits : 8
Lectures : 4 Hrs/week
Practicals: 8 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Prerequisite: Readers/students are expected to know the following concepts:
1. Basic Electronics devices and their operations
2. Brief introduction to Controllers, analog and digital control actions.

Course Objectives:
- To give the students a comprehension of Robotics and Industrial Automations.
- To give the students a comprehension of the relation between Instrumentation and controller design in industrial applications.
- To make the students able to design and implement the control loops to achieve the control actions with different Controllers and PLC

Course Outcomes: At the end of the course student will be able to
1. Understand basic functioning of robotic system (Hardware + software)
2. Analyze functional component for PLC based industrial systems.
3. Interface peripheral devices as per the requirement of System
4. Design and apply problem based case study

The course will comprise of a blend of theory and practical. Students are exposed to know basic controller programming and basic electronic hardware for automation system. Finally students will be asked to build a project on which his/her acquired skills will be judged/evaluated.

The broad topics covered will be as follows:

- Introduction to robotics science and basic peripheral systems.
- Basic programming techniques for ARM, AVR controller and PLC
- Use of simulation software for PLC training
- Interfacing of peripheral systems with CPU/Controller and PLC
- Programming for driving robotic platform
- Building case study with reference to real life/industrial application
- Case studies by Industry experts.

Course Co-ordinator BoS Member BoS Chairman

IE32175B1: General Studies for Indian Services and National Service Scheme

Teaching Scheme
Credits : 8
Lectures : 4 Hrs/week
Practicals: 8 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- To inculcate & improve the understanding about general studies knowledge and analytical qualities which required for various technical & non-technical competitive exams.
- To foster the student's social work identity including professional use of supervision and consultation, self-awareness.
- To prepare students with critical thinking skills in various areas of practice, research, and aware them about various social work programs.

Course Outcomes: At the end of the course student will be able to

1. Able to develop better understanding about importance of ongoing Current events and general studies knowledge required for various competitive exams.
2. Comprehensive understanding of various concepts of economy, history, our country's constitutional system & its significance.
3. Understand for environmental issues relevant to engineering industry and its impact on society through engineering prospect as future technocrat.
4. Understand the community in which they live & work to gain skills in mobilizing community participation for the purpose of finding practical solutions to individual and community problems.
5. Understanding and awareness about various health habits and importance of fitness for successful life style through yoga technique.

Unit 1: Indian History & Geography
History of India (with special reference to Maharashtra) and Indian National Movement.
Maharashtra, India and World Geography- Physical, Social, Economic Geography of Maharashtra, India and the World.

Unit 2: Indian Political System & Governance
Constitution, Political System, Panchayati Raj Institutions, Urban Governance, Public Policy, Rights issues, various constitutional and non-constitutional agencies etc

Unit 3: Indian Economy
Economic and Social Development - Sustainable Development, Poverty, Inclusion, Demographics, Social Sector initiatives, etc., Banking system and financial transaction techniques.(Including Digital)

Unit 4: - Environmental Studies & Current Affairs
Current events of state, national and international importance.
General issues on Environmental Ecology, Bio-diversity and Climate Change

Unit 5: Introduction To NSS & Village Adoption Program
Orientation and structure of NSS: The history of NSS, Objectives, Symbol and meaning, NSS hierarchy from national to college level, Roles and responsibility of various NSS functionaries.

Definition and importance of Life Competencies: Four aspects of development – Physical, Mental, Social, and Moral, Qualities of constructive leadership, Rapport building with community and role of leadership. Degeneration of value system, family system, Gender issues ,Regional imbalance, Problems of Rural areas, **Approaches and strategies in adopting a village** with special reference to involving people participation in N.S.S. Activities, Govt. and Non-Government agencies (NGO), political and village leadership for effective implementation of N.S.S. program and activities in adopted villages.

Unit 6 : Health, Hygiene, Sanitation & Yoga

Definition, need and scope of health education, Food and nutrition, Safe Drinking water ,water Borne Diseases and sanitation (**Swachh Bharat Abhiyan**),National health program, Reproductive Health, HIV Different Yoga Traditions and Their impact, Yoga as a tool for healthy Lifestyle

Text Books :

1. Modern Indian History by Rjiv Ahir, Spectrum Publication
2. Indian Polity by M. Laxmikant
3. Indian Geogrphy Majjid Husain
4. Rural Housing: Policies and Practices by Bhaskar Majumder
5. TISS : Training Programme on National Programme Scheme.

Reference Books :

1. Imagining India : Nandan Nilkani
2. I do What I do : Dr. Raghuram Rajan
3. An Uncertain Glory: India and its contradictions: Dr. Amratya Sen.
4. Indian Economy by D.D.Basu
5. Rural Sociology: Dr. Desai A.R. , Ellis Horowitz,
6. Fundamentals of Data Structures: Sartaj Sahni Computer Science Press.
7. Introduction to Social work: Chowdhry Paul

List of Practicals:

1. Practice of Easy writing on current & contemporary issues.
2. Reading Comprehension, Translation practice and precise writing.
3. Visit & report writing on any local government administrative institution / PRI.
4. Report on government scheme of various ministries & Scholarship programs for higher studies.
5. Plantation of trees, their preservation & Watershed management with waste land development program.
6. Village Visit: Construction & maintenance of village streets, drains, etc. so as to keep the environment clean; Construction of sanitary latrines & Cleaning of village ponds and wells;
7. Popularization and construction of Gobar Gas Plants, use of non-conventional energy sources;
8. Study of Environmental sanitation and disposal of garbage & composting with solid waste management technique;
9. Study of Prevention of soil erosion, and work for soil conservation technique.

10. Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.(Field visit recommended if possible)
11. Visit & case study of any one Non-governmental origination (NGO) work.

Note: **Any 8 practical's have to be performed out of 11 suggested but minimum any 2 field visits are mandatory**

Course Co-ordinator BoS Member BoS Chairman

IE32175B2: Social Enterprise and Entrepreneurship

Teaching Scheme
Credits : 8
Lectures : 4 Hrs/week
Practicals: 8 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Course Objectives:
This course will lead to the learning of

- Acquiring Entrepreneurial spirit and resourcefulness
- Familiarization with various uses of human resource for earning dignified means of living
- Understanding the concept and process of entrepreneurship -its contribution in and role in the growth and development of individual and the nation
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture

Course Outcomes: At the end of the course student will be able to

1. Understand the concept of Entrepreneurship
2. Assess how entrepreneurship can help shape one's career
3. Differentiate between various types of entrepreneurs
4. Identify different and your own personality type to become an entrepreneur
5. Appreciate the role of global and Indian innovations in entrepreneurial ventures

Unit 1: Entrepreneurship -What, Why and How
Entrepreneurship –Concept, Functions, Need and Importance, Why Entrepreneurship For You, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, Startup and its stages, Entrepreneurship –The Indian Why be an Entrepreneur, Types of Entrepreneurs ,Competencies and characteristics: Ethical Entrepreneurship ,Entrepreneurial Values, Attitudes and Motivation ,Mindset of an employee and an entrepreneur difference , Intrapreneur: Importance in any organization Scenario

Unit 2: Entrepreneurship Journey
Self-Assessment of Qualities, Skills, Resources and Dreams., Generation of Ideas., Business Ideas vs. Business Opportunities, Opportunity Assessment –Factors, Micro and Macro Market Environment, Feasibility Study , Business Plan Preparation, Execution of Business Plan ,Role of networking in entrepreneurship

Unit 3: Entrepreneurship as Innovation and Problem Solving
Entrepreneurs -as problem solvers., Innovations and Entrepreneurial Ventures –Global and Indian, New Industries of New Age Economy, Role of Technology –E-commerce and Social Media, Social Entrepreneurship as Problem Solving-Concept and Importance,Risk Taking-Concept; types of business risks.

Unit 4: - Understanding the Market
Business Idea and Concept, Types of Business: Manufacturing, Trading and Services,Stakeholders: sellers, vendors and consumers and Competitors. Market Research -Concept, Importance and Process, Market Sensing and Testing, Business Model, Proof of Concept, Pricing and Factors affecting pricing. , Launch Strategies after pricing and proof of concept

Unit 5: Introduction to Social Entrepreneurship

Profile of social entrepreneurs, Create your own profile of a social entrepreneur, Grounding in social entrepreneurship, Typology of ventures, Definitional disputes.Creating social change: The social value proposition and identifying a social business opportunity, Seizing social business opportunities, Social entrepreneurship profiles, Community asset mapping, Profile of a social entrepreneur: Dr. Venkataswamy, Aravind Eye Institute, India. Understanding poverty: The Sustainable Development Goals, The critical need to alleviate poverty, Ecosystem approach, The role of cooperatives in addressing poverty, Profile of a social organization: Grameen Bank. Profile of a social organization: IDEO, The role of mind mapping in creating solutions, Empowerment model: Partnering with targeted community.

Unit 6 : The Business model: Creating a social business model

The role of the business model in starting a social venture, Equitable distribution of value, The role of the business model: The business model canvas, Social business model framework, Profile of a social entrepreneur: Husk Power Systems, Business model canvas exercise, Business model execution failure. Sustainable funding sources: Earned income, Profile of a social entrepreneur: Furniture Resource Centre, Traditional funding sources, Social investment funding sources, Investing in a social venture, Relationship building with donors and investors

Text Books :

1. Udyamita (in Hindi) by Dr. MMP. Akhouri and S.P Mishra, pub. By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla
2. Everyday Entrepreneurs - The harbingers of Prosperity and creators of Jobs - Dr. Aruna Bhargava.
3. Bornstein, D. and Davis, S., *Social Entrepreneurship: What Everyone Needs to Know* (Oxford, Oxford University Press, 2010)
4. Social Entrepreneurship: The Art of Mission-Based Venture Development, by Peter C. Brinckerhoff.

Reference Books :

1. Udyamita Samachar Patra (Monthly, Hindi), Pub. By centre for Entrepreneurship Development, M.P. (CEDMAP), 60 Jail Road, Jhangerbad, Bhopal-462008.
2. Science Tec. Entrepreneur (A Bi Monthly Publication), centre for Enterprenurship Development, M.P (CEDMAP), 60 Jail Road, Jhangerbad, Bhopal - 462008

Project Work:

1) Identify a social problem and its impact
2) Visit and report of Industry or Case Study of the startup associated with the identified problem.
3) Identifying possible solutions and analyzing them
4) Business Plan design

Course Co-ordinator BoS Member BoS Chairman

IE32175B3: National Service Scheme and Social Entrepreneurship

Teaching Scheme
Credits : 8
Lectures : 4 Hrs/week
Practicals: 8 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- To equip social workers with generalist knowledge, values, and skills and to prepare competent professionals for entry level social work practice.
- To prepare social workers who understand and values social and economic justice while also respecting and appreciating diversity.
- To foster the student's social work identity including professional use of supervision and consultation, self-awareness.
- To prepare students with critical thinking skills in areas of practice, research, and ethics to help ensure success in graduate social work programs.
- Developing creative solutions to address social problems.
- Learning the process and skills of creation and management of social entrepreneurial venture.

Course Outcomes: At the end of the course student will be able to

1. Understand the community in which they work to gain skills in mobilising community participation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social and civic responsibility
4. Utilise their knowledge in finding practical solutions to individual and community problems
5. Identify innovative solution for identified problems
6. Appreciate the role of global and Indian innovations in social entrepreneurial ventures.

Unit 1:Introduction to NSS and development of Life competencies
Orientation and structure of NSS, The history of NSS, Objectives, Symbol and meaning, NSS hierarchy from national to college level, Roles and responsibility of various NSS functionaries. Definition and importance of Life Competencies, Four aspects of development – Physical, Mental, Social, and Moral, Qualities of constructive leadership, Rapport building with community and role of leadership.

Unit 2: Basic social issues in India and Benefits of Village adoption programme
Degeneration of value system, family system, Gender issues ,Regional imbalance, Problems of Rural areas, Approaches and strategies in adopting a village with special reference to involving people participation in N.S.S. Activities, Govt. and Non Government agencies, political and village leadership for effective implementation of N.S.S. programme and activities in adopted villages.

Unit 3: Health, Hygiene and Sanitation
Definition, need and scope of health education, Food and nutrition, Safe Drinking water ,water Borne Diseases and sanitation(Swachh Bharat Abhiyan),national health programme, Reproductive Health

Unit 4:Youth Health and Yoga
Healthy Lifestyles, Aids, HIV, Drugs, Substance abuse, Home Nursing, First aid, Different Yoga Traditions and Their impact, Yoga as a tool for healthy Lifestyle

Unit 5: The Business model: Creating a social business model

Profile of social entrepreneurs, Create your own profile of a social entrepreneur, The role of the business model in starting a social venture, Equitable distribution of value, The role of the business model: The business model canvas, Social business model framework, Profile of a social entrepreneur: Husk Power Systems, Business model canvas exercise, Business model execution failure.

Unit 6 :Funding social ventures: Strategies for success

Sustainable funding sources: Earned income, Profile of a social entrepreneur: Furniture Resource Centre, Traditional funding sources, Social investment funding sources, Investing in a social venture, Relationship building with donors and investors.

Text Books :

1. Rural Housing: Policies and Practices by Bhaskar Majumder | 1 December 2007
2. Singh Surendra and Srivastava S. P. (ed) 2005), Social Work Education in India, Challenge and opportunities, New Royal Book Publications, Lucknow
3. Bornstein, D. and Davis, S., *Social Entrepreneurship: What Everyone Needs to Know* (Oxford, Oxford University Press, 2010)

Reference Books :

1. Dr. Desai A.R. : Rural Sociology in India
2. Siddiqui, H.Y.2015, Social Work and Human Relations,Rawat Publications, Jaipur.
3. Raising the Bar : Integrity and Passion in Life and Business: The Story of Clif Bar, Inc., By Gary Erickson

NSS

Students will work on a particular problem in the respective area.

i. Plantation of trees, their preservation and upkeep
ii. Creation of NSS parks/gardens.
iii. Construction & maintenance of village streets, drains, etc. so as to keep the environment clean.
iv. Construction of sanitary latrines etc.
v. Cleaning of village ponds and wells.
vi. Popularization and construction of Gobar Gas Plants, use of non-conventional energy.
vii. Environmental sanitation and disposal of garbage & composting.
viii. Prevention of soil erosion, and work for soil conservation.
ix. Watershed management and wasteland development.
x. Organic farming

SOCIAL ENTREPRENEURSHIP

i. Visit and report of Industry or Case Study of the startup associated with the identified problem.
ii. Identifying possible solutions and analyzing them.
iii. Design a business Plan

Course Co-ordinator BoS Member BoS Chairman