"Education for knowledge , science and culture"

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Electronics

B. Sc. Part – III

CBCS Syllabus with effect from June, 2020

B.Sc-III Electronics
Course structure

Semester	Paper code	Title of Paper	Type of Paper	No. of Credits
Sem-V	DSE 1005E1	Linear Integrated Circuits and 8051 Microcontroller Interfacing and Embedded C	Elective	4
	DSE 1005E2	Instrumentation & Antenna and Wave Propagation	Elective	4
	DSE 1005E3	Optoelectronics and PIC Microcontroller	Elective	4
	SEC 3	Renewable energy	Compulsory	2
Sem-VI	DSE 1005F1	Industrial Process control and PLC programming and Advanced Microcontroller	Elective	4
	DSE 1005F2	Power Electronics and FPGA & VHDL Programming	Elective	4
	DSE 1005F3	Digital Signal Processing	Elective	4
	SEC 4	Introduction to Arduino and IoT	Compulsory	2

B. Sc. Part – III Electronics

Subject: Semester: V Paper- DSE 1005E1

Linear Integrated Circuits and 8051 Microcontroller Interfacing and Embedded C

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objective:

- To understand the concepts, working principles and key applications of linear integrated circuits and 8051 Microcontroller Interfacing and Embedded C.
- To perform analysis of circuits based on linear integrated circuits and 8051 μC interfacing circuits.
- To design circuits and systems for particular applications using linear integrated circuits and 8051 Microcontroller.

Course Outcomes:

At the end of the course, a student will be able to:

- Understand the fundamentals and areas of applications for the integrated circuits and 8051 microcontroller.
- Analyze important types of integrated circuits and various interfacing circuits.
- Demonstrate the ability to design practical circuits that perform the desired operations.
- Understand the differences between theoretical, practical results in integrated and interfacing circuits.

Select the appropriate integrated circuit/interfacing modules to build a given application.

Section – I Linear Integrated Circuits

Unit	Contents	Hours
1	**Operational Amplifier and Linear IC's** Transistor dc amplifier, Differential amplifier, Emitter coupled differential amplifier with its Operation, characteristics and parameters (I/O impedances, common mode and differential mode gain, CMRR), Dual input and single ended output configuration of differential amplifier. Method to improve CMRR (constant current bias and current mirror bias), Introduction to op-amp, block diagram of op-amp, offset balancing technique of op-amp, drift Parameters of op-amp, study of IC741 and comparative study of IC's OP 07, LM324, AD620.	(10)
2	**Applications of Op-amp** Virtual ground concept, Op-amp as inverting and non- inverting amplifier, summing amplifier (adder and subtractor), V to I and I to V converter, voltage follower, bridge amplifier, Differentiator and integrator, log and antilog amplifier. Op-amp as comparator, regenerative comparator (Schmitt trigger), sine wave oscillators (phase shift and Wien -bridge), Triangular wave generator, square and pulse generator. Peak detector, clipping and clamping circuits.	(10)
3	**Precision Rectifier and Active filters** Precision rectifier, Op-amp as precision rectifier, Absolute value precision rectifier. Advantage of active filters over passive filters. Study of filter response (Butterworth, Chebyshev.) Different types of active filters. Study and design of low pass, high pass, band pass and band stop filters	(09)
4	**Phase Locked Loops (PLL)** Block diagram of PLL with functioning of each block, calculation of capture range and lock range frequencies, application of PLL (frequency multiplier, FM	(07)

	modulator, frequency synthesizer and FSK) Study of IC565, IC8038. IC555 timer as variable duty cycle (10% to 90%), sequential timer, ramp generator.	

Section - II 8051 Microcontroller Interfacing and Embedded C

Unit	Contents	Hours
1	**Introduction to embedded C** Advantages and disadvantages of programming in 8051-C & Assembly Language. Data types, operators and loops, I/O programming, Accessing SFR addresses, Logical operation. Data conversion programs, Accessing ROM space, programming for Time delay generation (using timer), external interrupts (Level and edge triggering).	(10)
2	**Real World Interfacing of 8051** Interfacing to output devices – LED, Relay, LCD, seven segment display, seven segment display (multiplexing mode), DC Motor, Stepper Motor. Interfacing to input devices – Switch, 4X4 matrix keyboard, opto-coupler, thumb wheel switch. Interfacing to DAC0808 and ADC0804.	(15)
3	**Serial communication in 8051.** Serial Port : Serial port of 8051, RS-232 standard and IC MAX–232, Concept of Baud rate, Baud rate in 8051, SBUF register, SCON register, various modes of serial port, Importance of TI and RI flags, programming for data transmission and reception.	(05)
4	**Applications of 8051** Case study's: i) Gate Emulator (Logic Gate study using microcontroller) ii) Water level controller iii) speed control of DC motor iv) Temperature measurement using LM35, ADC0804, LCD. v)Bluetooth module interfacing. Vi) Speed control of Stepper Motor	(06)

Reference Books:

1. Integrated Electronics - Millman-Halkias (MGH)
2. Op-Amps and Linear circuits – Ramakant Gaikwad (PHI)
3. Linear Integrated circuit - D Roy Choudhari, Shail Jain, (Wiley Eastern Ltd)
4. The 8051 Microcontroller -K. J. Ayala, (Penram International)
5. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi, J. G. Mazadi,Pearson Education, Asia
6. Programming and customizing the 8051 Microcontroller - MYKE Predko(TMH, New Delhi)
7. C and the 8051: Programming and Multitasking, Schultz, P T R Prentice-Hall, Inc.
8. Embedded C, Michael J. Pont,

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Subject: Semester: V Paper- DSE 1005E2

Instrumentation & Antenna and Wave Propagation

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objectives:

- To make students familiar with the constructions and working principle of different types of sensors and transducers.
- To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.
- To give insight of the radiation phenomena of antenna.
- To get familiarize with different parameters of antenna.
- To get familiarize with application of antenna according to types of antenna.
- To create awareness about the different types of propagation of radio waves at different frequencies.

Course Outcomes:

At the end of the course, a student will be able to:

- Classify and explain transducers with examples, including those for measurement of temperature, flow, motion, position and light.
- Knowledge of sensor and Actuators
- Analyze the performance characteristics of each instrument
- Illustrate basic Digital instruments such as Digital voltmeters and Multimeter, Bio- Medical Instrument
- Apply the principles of electromagnetic to explain antenna characteristics such as radiation pattern and directivity.
- Understand the structure and working of special antennas such as Dipole antenna, Yagi-Uda antenna and Microstrip patch antennas.
- Identify the suitable antenna for a given communication system.
- Be familiar with the basic propagations namely ground wave propagation, free space propagation and sky wave propagation.

Section – I Instrumentation

Unit	Contents	Hours
1	**Measurements, Instrument & Calibration:-** Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Instrument: Static and Dynamic characteristics of instruments, dead zone, hysteresis, threshold, resolution, input & output impedance, loading effects. Calibration of instruments and Standards	(10)
2	**Transducers and Sensors:-** Definition, Classification of Transducers, Selection criterion for Transducers, Detail Study of Transducers: Thermister, RTD, Thermocouple, Strain gauge, LVDT, Capacitive transducer (microphone), Opto-electric transducer – LDR, Photo diode, PIR , Loud speaker, Piezoelectric transducer, Proximity sensor- Inductive, capacitive.	(11)

3	**Signal Conditioning and Data Acquisition System:** Introduction, Sample and Hold circuit, Thermister Wheatstone bridge amplifier, Instrumentation amplifier, Attenuator, Introduction to Data Acquisition System (DAS), Single channel & multi channel DAS. Data logger.	(9)
4	**Digital Instruments:-** Introduction to digital instrument: Advantages of Digital instruments, Digital Tachometer, Digital Capacitance meter, Digital Phase Meter, Digital Frequency Meter. Digital Multi-meter,	(6)

Section-II: Antenna and Wave Propagation

Unit	Contents	Hours
1	**Electromagnetic Radiation:-** Radiation phenomenon from an oscillation dipole in free space, induction and radiation fields, Retarded potentials, Radiated power and radiation resistance from a short dipole , Theory of point sources, Hertzian dipoles, half-wave dipoles and quarter wave monopole.	(08)
2	**Antenna Fundamentals and Parameters:-** Antenna Definition and Function of antenna. Antenna parameters: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half-power beamwidth, bandwidth, polarization, input impedance, radiation efficiency. Current Distribution on a Thin Wire Antenna,	(10)
3	**Antenna Types:** $\lambda/2$ antenna, $\lambda/4$ antenna, antenna arrays, horn antennas, parabolic dish antennas, Helical antenna, Yagi-Uda antenna, Patch antenna, Microstrip antennas.(Structure, ,Working and Applications) .	(10)
4	**Radio Wave Propagation** Different Modes of Wave Propagation, Structure of atmosphere, Ground wave propagation, effect of Earth's Curvature on Ground wave propagation. Space Wave propagation. Sky Wave Propagation - Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, Virtual Height and Skip Distance, Relation between MUF and skip Distance, Multi-hop Propagation.	(08)

Reference Books:

1. Electronic Instruments- K.S. Kalsi (Tata Mc-Graw Hill)
2. Transducers & Instrumentation - by D V S Murty
3. Instrumentation, Measurements and Analysis- B.S. Nakara and VSV Mani (TMH)
4. The Measurement, Instrumentation and Sensors Handbook by John G. Webster
5. Antenna Theory: Analysis and design –C. Balanis ,Wiley India.
6. Antenna Theory and Design, Robert S. Elliott, Wiley-India, 2007
7. Antenna Theory and Design, W. L. Stutzman and G. A. Thiele, 2nd Ed., Wiley, 1997
8. Antenna & Wave Propagation by K.D. Prasad, Satyaprakash Publications.

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Semester: V Paper- DSE 1005E3

Optoelectronics and PIC Microcontroller

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objective:

- To make students familiar with the constructions and working principle of different types of optoelectronics devices, sensors and optical communications.
- To understand the concepts, working principles and key applications of PIC Microcontroller (architecture, instructions and facilities).
- To make students aware about the opto-electronics, PIC microcontroller and its applications in industry.

Course Outcomes:

At the end of the course, a student will be able to:

- Use optoelectronics devices for optical communication.
- Can implement optical sensor/ detectors for any security system.
- Understand the fundamentals and areas of applications for the optoelectronic devices and PIC microcontroller.
- Can write assembly language Program for any logical control problem of industry
- Can successfully use the MPLAB SOFTWARE for the demonstration of working of PIC microcontroller.

Section I: Optoelectronics

Unit	Contents	Hours
1	**Unit –I:** Introduction to optoelectronics Devices, Energy bands in solids, the E-k diagram, Density of states, Occupation probability, Fermi level and quasi Fermi levels, p-n junctions, Schottky junction and Ohmic contacts. Semiconductor optoelectronic materials, Bandgap modification.	(04)
2	**Unit –II :**Optical Sources: LASER, Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics. LED: power and efficiency, LED structures, LED characteristics.	(05)
3	**Unit –III :**Optical detectors: p-n photodiodes, p-i-n photodiodes, Avalanche photodiodes, Phototransistor. Optical receiver: Receiver operation, digital receiver performance and noise.	(05)
4	**Unit – IV : optical communication** Principle of optical communication, total internal reflection, optical fiber modes and configuration, step index & graded index fiber, single mode fiber, fiber materials, fiber fabrication, basic structure of optical fiber. Overview of optical fiber communication system, transmission link, fiber optic transmitter and receiver, advantages and applications of optical fiber communication.	(12)

5	**Unit – V : characteristics of optical fibers** Signal degradation in optical fiber, attenuation, intrinsic & extrinsic absorption losses, scattering losses, bending losses and joint loss linear & nonlinear scattering losses, distortion in optical wave guide, fiber to fiber joints, fiber splicing technique, fiber connectors.	(10)

Section II : PIC Microcontroller

Unit	Contents	Hours
1	**UNIT 1. Introduction** Comparison of PIC12XX, PIC16XX, PIC18XX, PIC24XX and PIC32XX PIC families, WREG register, PIC file register, SFRs, GPR, GP RAM vs EEPROM, File register and access bank in the PIC18, PIC status register, Pin diagram, Minimum connection(Clock and reset circuit), uses of Configuration register and LIST directive, stack and stack pointer in PIC18, ROM width in the PIC18,bank switching, pipelining, instruction cycle time, branch penalty, loop inside a loop delay.	(09)
2	**UNIT 2. Instruction set and programming of PIC18** Instruction set, Addressing modes, I/O ports programming, I/O bit manipulation programming, program for square wave generation at port pin and port, reading single bit, BCD to ASCII, ASCII to BCD conversion.	(09)
3.	**UNIT 3.Facilities in PIC18 Part-I** Programming timers 0: T0CON, PIR1 register, steps to programming((ALP/C)) timer 0 in 16 bit mode and 8-bit mode, delay calculation (Timer count calculation), comparison of T0CON, T1CON, T2CON and T3CON timers of PIC18, ADC programming in the PIC18: features of ADC, programming, ADCON0 , ADCON1 register, conversion time, steps for programming(ALP/C) the ADC using polling, use of PIC as a digital thermometer(Display on LED)	(09)
4	**UNIT4. Facilities in PIC18 Part-II** PIC18 serial communication: serial port programming, SPBRG, TXREG, RCREG, TXSTA, RCSTA register, Interfacing MAX232 to PIC18, programming(ALP/C) PIC18 to transfer and receive data serially, importance of TXIF and RCIF flag, quadrupling baud rate . PIC18 Interrupts: Interrupt vector table in PIC18, sources of interrupts, INTCON register, interrupts enabling, programming(ALP/C)of external hardware interrupts, setting interrupt priority.	(09)

Reference Books:

1. Optical Fiber Communication – G. Keiser - MGH
2. Fundamentals of Optics – Jenkins & White - MGH
3. Optical Fiber Communication – J.M. Senior - PHI
4. Semiconductor Optoelectronics Devices-Bhattacharya &Pallab - Pearson Education.
5. Optoelectronics an Introduction to Materials and Devices - Singh, &Jasprit - McGraw-Hill
6. Muhammad Ali Mazadi et al. *"PIC microcontroller and Embedded Systems using assembly and C for PIC 18,"* Pearson Education publication,1st Edition, Fourth Impression 2011(Indian Edition).
7. Design with PIC microcontrollers. By Peatman & John B. Simon & Schuster Trade, 1997.

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Semester: V Paper- SEC 3
Renewable energy

Mark: 40 **Teaching Hours 36** **Credits 2**

Course Objective:

- Understand the principles of operation of the broad spectrum of renewable energy technologies.
- The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

Course Outcomes:

At the end of the course, a student will be able to:

- To understand the Need, importance and scope of non-conventional and alternate energy resources.
- To understand role significance of solar energy.
- To provides importance of Wind Energy.
- To understand the role of ocean energy in the Energy Generation.
- To understand the concept of energy Conservation.

Renewable energy

Unit	Contents	Hours
1	***Introduction:*** Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.	(06)
2	**Solar energy** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	(10)
3	**Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.	(06)
4	**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **Geothermal Energy:** Geothermal Resources, Geothermal Technologies. **Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources	(08)
5	**Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power	(06)

Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy Sources and Emerging Technologies, Kothari et.al., 2nd Edition, PHI Learning.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa publication.

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Semester: VI Paper- DSE 1005 F1

Industrial Process Control and PLC Programming and Advanced Microcontroller and Embedded System

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objective:

- To provide knowledge levels needed for PLC programming.
- To train the students to create ladder diagrams from process control descriptions.
- Apply PLC Timers and Counters for the control of industrial processes
- To make the students understand PLC functions
- To make students aware of the idea of embedded system, basic evaluation, implementation and designing of embedded system.
- To get familiar with embedded C programming for AVR
- Students will able to design and interface different embedded system.

Course Outcomes:

At the end of the course, a student will be able to:

- Describe typical concepts and components of a Programmable Logic Controller.
- Use timer, counter, and other intermediate programming functions.
- Design and program basic PLC circuits for entry-level PLC applications.
- Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.
- Understand the architecture and function of each pin of AVR 8-bit Microcontroller.
- Write, debug and simulate embedded C language programs.
- Understand Timer operation, Interrupt environment and Serial Communication.
- Understand the interfacing of various systems with AVR microcontroller

Section – I Industrial Process control and PLC programming

Unit	Contents	Hours
1	**Introduction to control system:** Significance Transfer Function, Types and order of transfer function (Open loop and Close loop transfer system), Block diagram of Control System and reduction rules, Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, comparison closed-loop system and open-loop control, feed-forward control system, adaptive control system, classification of control system. ON-OFF controller, proportional control, PI controller, PD controller and PID control. Introduction to Fuzzy Controller.	(10)
2	**Components of Control System:** Op-amp as a zero crossing detector, non-inverting comparator, inverting comparator, two positioncontrol using op-amp, proportional controller, integral controller using Op-amp , derivative controller, PI controller, PID controller.	(06)
3	**Introduction to PLC :** Programmable logic controller (PLC) basics: Definition, overview of PLC systems, block diagram of PLC, input/output modules, power supplies, isolators, features like scan time, system scale, user interface. Modular PLC	(10)

	and Redundant PLC and Applications. Industrial Communication **Buses: RS485, Profibus** .Distributed control system, DCS components/block diagram, SCADA, adaptive control system.	
4	**Ladder Programming basics** **Basic components:** fuse, pushbutton, selector switches, limit switches, indicators, relay, timedelay relays functions and symbols. General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions. Ladder Programming: Programs for Boolean logic and flip-flops, counters , timers, flasher. Application program Bottle filling plant, elevator control, washing machine control.	(10)

Section – II Advanced Microcontroller and Embedded System

Unit	Contents	Hours
1	**Unit 1: Embedded Systems Design** What is embedded system, embedded system basic blocks, embedded system hardware and software, embedded system characteristics, embedded system applications	(04)
2	**Unit 2:Introduction to AVR microcontroller** Overview of AVR family, ATmega8 pin configuration & function of each pin. AVR Microcontroller architecture, status register, Special function registers, SRAM, ROM & EEPROM space, On-Chip peripherals.	(06)
3	**Unit 3: AVR programming in C** AVR Data types, AVR I/O port programming, Timer programming, Input capture and Wave Generator, PWM programming, External Interrupt programming, ADC programming, Serial Port programming.	(10)
4	**Peripheral interfacing and embedded system** Interfacing of Switches, Relays, LEDs, seven segment display 16x2 LCD Interfacing, Stepper interfacing.	(07)
5	**Designing of an Embedded System** DC Motor speed control using PWM technique, Measurement of Temperature of an environment using sensor LM35, Dual channel Digital Voltmeter. (Block diagram, Schematic and Flowchart is only necessary)	(09)

Reference Books:

1. Control System Engineering- I.J. Nagrath & M.Gopal (New Age International Pub 5th Edit 2006)
2. Feedback Control System Principles And Control System R.A. Barapate (Techmax Pub.)
3. Modern Control Engineering-Katsuhiko Ogata (Prentice Hall, 2010)
4. Computer Based Industrial Control- Krishna Kant (PHI Learning 2004)
5. Programmable Logic Control Programming And Applications - John R. Hackworth
6. Frederic D. Hackworth (Pearson Education India fourth edition 2008)
7. Introduction to Programmable Logic Controller- Gray & Dunning (2nd ed Thomson Edu.).
8. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
9. Embedded system design with Atmel AVR microcontroller, by Steven F Barrett, Morgan & Claypool Publishers.
10. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education.

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Semester: VI Paper- DSE 1005F2

Power Electronics and FPGA & VHDL Programming

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objective:

- To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
- To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
- To provide strong foundation for further study of power electronic circuits and systems
- Familiarization with simulation and synthesis VHDL structures
- The course aims to enable the student to design Digital Systems to implement their design using VHDL in to FPGAs.

Course Outcomes:

At the end of the course, a student will be able to:

- Understand the basics of Power Electronics
- Learn the detail of power semiconductor switches (Construction, Characteristics and Operation).
- Understand the working of various types of converters.
- Learn how to analyze the converters and design the components of them, under various load types..
- Understand single-phase and three-phase Supply converters
- Design and Analyze Three phase uncontrolled and controlled Rectifier
- Understand the syntax and behavior of the VHDL language.
- Use modern development tools to design complex digital circuits
- Simulate and make a synthesis of extensive designs in so called "Field Programmable Gate Array" (FPGA).

Section I –Power Electronics

Unit	Contents	Hours
1	**Power semiconductor devices:** Definition of power electronics, Need for semiconductor power devices, Applications of power electronics, classification of power semiconductor devices, Power diode: structure, operation, conductivity modulation, I-V characteristics, Reverse recovery effect, series and parallel connection of diode, Power transistor: structure, operation, effect of drift layer. Switching characteristics, specifications, Base drive circuits. Power MOSFET : MOSFET structure, characteristics, operation and drive circuits	(10)
2	**Thyristors** Types of Thyristors, Structure of SCR, SCR Characteristics, two transistor analogy - Methods of turning ON and turning OFF, dv/dt and di/dt protection, gate protection circuits Diac and Triac: Basic structure, working and V-I characteristic, application of a Diac as a triggering device for a Triac.	(08)

	IGBT: Structure, characteristics, Operation and drive circuits, Comparison of power transistor, MOSFET and IGBT.	
3	**Controlled Rectifiers** Basics of single and three phase supply phase and line voltage waveforms, SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with resistive & inductive loads. (Analysis of all these circuits with resistive load only)	(08)
4	**Power Systems** Power Supplies: Switch mode power supply (DC): flyback, forward, half bridge and full bridge converters. Uninterrupted power supply (UPS), Electronic Ballast, power factor correction.	(10)

Section – II FPGA AND VHDL Programming

Unit	Contents	Hours
1	**Introduction to Programmable Logic Devices** Evolution of Programmable logic devices, PAL, PLA and GAL. CPLD and FPGA architectures. Placement and routing. Logic Cell structure, Programmable interconnects, Logic blocks and I/O Ports. Clock distribution in FPGA	(8)
2	**Basics of VHDL** Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, introduction to VHDL, data objects, classes and data types, operators, overloading, logical operators, Types of delays, Entity and Architecture declaration, Introduction to behavioral, dataflow and structural models.	(8)
3	**VHDL Programming** VHDL statements: Assignment statements, sequential statements and process, conditional statements, case statement, Array and loops, resolution functions, packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, Component declaration, structural layout and generics	(10)
4	**Sequential and Combinational Circuit Design:** VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders ,decoders, code converters, comparators, implementation of Boolean functions etc. Sequential Circuits Design: VHDL Models and Simulation of sequential Circuits, Shift Registers, counters etc.	(10)

Reference Books:

1. Power Electronics – M.H. Rashid (PHI)
2. Power Electronics-P.C. Sen (TMH)
3. Power Electronics Principles and Applications-S. Biswas (Dhanapat Rai Publications)
4. Power Electronics- I by J.S. Katre (Tech-Max)
5. Power Electronics- Dr. P.S. Bhimbhra (Khanna publications)
6. Douglas L. Perry, "VHDL Programming by Example"
7. Lizy Kurien and Charles Roth. Principles of Digital Systems Design and VHDL.Cengage Publishing. ISBN-13: 978-8131505748 .
8. Wayne Wolf. FPGA Based System Design. Pearson Education.

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Semester: VI Paper- DSE 1005E3

Digital Signal Processing

Mark: 80 **Teaching Hours 72** **Credits 4**

Course Objective:

- The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.
- To study about discrete time systems and to learn about FFT algorithms.
- To study the design techniques for FIR and IIR digital filters
- To study the finite word length effects in signal processing

Course Outcomes:

At the end of the course, a student will be able to:

- Interpret, represent and process discrete/digital signals and systems
- Understanding of frequency domain analysis of discrete time signals.
- Ability to design & analyze DSP systems like FIR and IIR Filter
- Understand the handling of discrete/digital signals using MATLAB.

Section I – Digital Signal Processing I

Unit	Contents	Hours
1	**Discrete-Time Signals** Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals.	(05)
2	**Discrete-Time Systems** System Properties. Impulse Response, Convolution Sum; Graphical Method, Analytical Method, Properties of Convolution, Commutative, Associative, Distributive, Shift, Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response, Causality, Stability, Invertibility, Unit Step Response.	(10)
3	**Discrete-Time Fourier Transform:** Fourier Transform Representation of Aperiodic Discrete-Time Signals, Periodicity of DTFT, Properties, Linearity, Time Shifting; Frequency Shifting, Differencing in Time Domain, Differentiation in Frequency Domain, Convolution Property. The *z*-Transform: Bilateral (Two-Sided) *z*-Transform, Inverse *z*-Transform, Relationship Between *z*-Transform and Discrete-Time Fourier Transform, *z*-plane, Region-of-Convergence; Properties of ROC, Properties, Time Reversal, Differentiation in the *z*-Domain, Power Series Expansion Method (or Long Division Method), Analysis and Characterization of LTI Systems; Transfer Function and Difference-Equation System. Solving Difference Equations.	(15)
4	**Filter Concepts:** Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters, Averaging Filters, Notch Filters.	(06)

Section – II Digital Signal Processing II

Unit	Contents	Hours
1	**Discrete Fourier Transform** Frequency Domain Sampling (Sampling of DTFT), The Discrete Fourier Transform (DFT) and its Inverse, DFT as a Linear transformation, Properties; Periodicity; Linearity; Circular Time Shifting; Circular Frequency Shifting; Circular Time Reversal; Multiplication Property; Parseval's Relation, Linear Convolution Using the DFT (Linear Convolution Using Circular Convolution), Circular Convolution as Linear Convolution with aliasing.	(10)
2	**Fast Fourier Transform:** Direct Computation of the DFT, Symmetry and Periodicity, Properties of the Twiddle factor (WN), Radix-2 FFT Algorithms; Decimation-In-Time (DIT) FFT Algorithm; Decimation-In-Frequency (DIF) FFT Algorithm, Inverse DFT using FFT Algorithms.	(05)
3	**Realization of Digital Filters:** Non Recursive and Recursive Structures, Canonic and Non Canonic Structures, Equivalent Structures (Transposed Structure), FIR Filter structures; Direct-Form; Cascade-Form; Basic structures for IIR systems; Direct-Form I.	(06)
4	**Finite Impulse Response Digital Filter:** Advantages and Disadvantages of Digital Filters, Types of Digital Filters: FIR and IIR Filters; Difference Between FIR and IIR Filters, Desirability of Linear-Phase Filters, Frequency Response of Linear-Phase FIR Filters, Impulse Responses of Ideal Filters, Windowing Method; Rectangular; Triangular; Kaiser Window, FIR Digital Differentiators. **Infinite Impulse Response Digital Filter:** Design of IIR Filters from Analog Filters, IIR Filter Design by Approximation of Derivatives, Backward Difference Algorithm, Impulse Invariance Method.	(15)

Reference Books:

1. Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edition. Prentice Hall.
2. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
3. Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
4. Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.

B. Sc. Part – III Electronics

Semester: V Paper- SEC 4

Introduction to Arduino and IoT

Mark: 40 **Teaching Hours 36** **Credits 2**

Course Objective:

This Course focuses on hands-on IoT concepts such as sensing, actuation and communication. It covers the development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help you develop skills and experiences. The Internet of Things (IOT) is the next wave, world is going to witness. Today we live in an era of connected devices the future is of connected things.

Course Outcomes:

At the end of the course, a student will be able to:

Co1:- Familiarize with Arduino Board & Accessories.

Co2:- Familiarizing with interfacing with display devices and sensors.

Co3:- Design some IoT based prototypes

Co4:- Understand the physical and logical design of IoT

Unit	Contents	Hours
1	**Introduction to Arduino Board & Accessories** The Arduino Platform, Block diagram, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC, etc..	(06)
2	**Display Interfacing:** Interfacing arduino to LED's- blinking single LED, blinking multiple LED's. 7 segment display , traffic light ,LED flashes ,LED dot matrix . Interfacing to LCD's- Basic LCD control, display a message on LCD screen.	(10)
3	**Interfacing sensors:** Sensors- Definition, Types. Interfacing arduino to different sensors- light sensor, temperature sensor, humidity sensor, pressure sensor sound sensor, distance ranging sensor, water/detector sensor, smoke, gas, alcohol sensor, ultrasonic range finder.	(10)
4	**Introduction to IoT:** Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.	(10)

Reference Books

1. Beginning Arduino, Michal Mc Roberts, Second Edition
2. Massimo Banzi, "Getting started with Arduino" 2nd Edition, Orelly 2011.
3. The internet of things - Sean Dodson and Rob van Kranenburg, 2009

ELECTRONICS LAB B.Sc. III Semester - (V & VI)
Credits: 02

GROUP A : (LIC & PLC) ***(minimum 08)***

1. Instrumentation amplifier using OPAMP
2. Precision rectifier using OPAMP
3. Log amplifier using OPAMP
4. Study of active filter : Low and High pass
5. Study of active filter : band pass
6. Study of V to F and F to V using PLL.
7. Study of PLC Simulator (TriLOGI Software)/ codesys-software/ hardware and implementing Boolean function.
8. Programming with PLC (TriLOGI Software)/ codesys-software/ hardware) for sequential logic RS -FF,JK-FF,T-FF,D-FF
9. Study of PLC timers and counters in PLC ((TriLOGI Software)/ codesys-software/ hardware)

GROUP B: (Antenna and Power Electronics) ***(minimum 08).***

1. Study of simple dipole λ/2 antenna
2. Study of folded dipole λ/2 antenna
3. Study of simple dipole λ/4 antenna
4. Study of Yagi-Uda with 3 and 5 element simple dipole antenna
5. Study of SCR characteristics (static)
6. Study of AC / DC Timer
7. SCR firing by UJT
8. AC Voltage controller
9. Speed Control of DC Motor.
10. Study of ON/OFF Temperature controller (LM34/LM35/AD590)
11. Phase Shift control of SCR
12. Study of Introduction to MATLAB/Scilab
13. To study the simulation of single phase half wave controlled rectifier with R & RL-load using MATLAB - simulink/Scilab
14. To study the simulation of single phase half controlled bridge rectifier with R using MATLAB - simulink/Scilab
15. Amplitude Modulation-Modulation & Demodulation using MATLAB & Simulink/Scilab
16. Sampling Theorem using MATLAB & Simulink/Scilab

GROUP C: (Microcontroller 8051 & FPGA) ***(minimum 08).***

1. Arithmetic and logical operations using 8051microcontroller.
2. Switch and Relay interfacing to 8051 microcontroller.
3. DC motor interfacingto 8051microcontroller.
4. Study of Timers in 8051 Microcontorllers.
5. Stepper Motor interfacing to 8051 microcontroller.
6. DAC0808 interfacing to 8051microcontroller.
7. ADC0804 interfacing to 8051microcontroller.
8. Serial communication with PC using 8051microcontroller.

9. Write VHDL code to realize basic and derived logic gates.
10. Write VHDL code to realize Half adder, Full Adder using basic and derived gates.
11. Write VHDL code to realize Half subtractor and Full Subtractor using basic and derived gates.
12. Design and simulation of a 4 bit Adder using VHDL.
13. Write VHDL code to realize Multiplexer (4x1) and Demultiplexer(1x4) using logic gates.
14. Write VHDL code to realize Decoder and Encoder using logic gates.
15. Write VHDL code to realize Clocked D, JK and T Flip flops (with Reset inputs)
16. Write VHDL code to realize 3-bit Ripple counter

GROUP D: (AVR and Instrumentation) ***(minimum 08).***

1. Interfacing of Switches and LED with Arduino/AVR microcontroller.
2. LCD Interfacing with Arduino/AVR microcontroller.
3. Stepper Motor Interfacing with Arduino/AVR microcontroller.
4. Interface temperature sensor LM35 with Arduino board and display temperature on LCD.
5. Interface temperature sensorHumidity Sensor (DHT11) with Arduino/AVR board and display temperature and humidity values on LCD.
6. Accelerometer Sensor Interfacing with Arduino/AVR microcontroller.
7. Study of temperature sensor RTD and Thermister
8. Function generator using IC 8038
9. Automatic Porch light control using LDR and relay.
10. Study of the characteristics of Resistance Temperature Detector (RTD)
11. To study transducer (Thermistor/ Thermocouple) and plot necessary graph.

Distribution of Marks for Practical exam(LAB):

Group	A	B	C	D	Project	Journal	Industrial Visit	Seminar	Total
Marks	35	35	35	35	40	08	04	08	200

Nature of Question Paper

Vivekanand College, Kolhapur (Autonomous)
B.Sc. Part – III Electronics Semester V Examination ____
Course Code and Name: DSE 1005E1: Linear Integrated Circuits

Day: **Time:**
Date: **Total Marks: 40**

Instructions: 1) All the questions are compulsory.
2). Figures to the right indicate full marks.
3) Draw neat labeled diagrams wherever necessary.

Section-I

Q.1) Select correct Alternatives from the following (08)

i) ----------
a) b) c) d)

ii) ----------
a) b) c) d)

iii) ----------
a) b) c) d)

iv) ----------
a) b) c) d)

v) ----------
a) b) c) d)

vi) ----------
a) b) c) d)

vii) ----------
a) b) c) d)

viii) ----------
a) b) c) d)

Q.2) Attempt Any Two (16)

i) ----------
ii) ----------
iii) ----------

Q.3) Attempt Any Four (16)

i) ----------
ii) ----------
iii) ----------
iv) ----------
v) ----------
vi) ----------

Evaluation Pattern:

Semester	Course Codes	End Semester Examination Marks	CIE/Internal assessment Marks and Pattern	Practical Examination Marks	Total Marks
V	DSE-1005E1-Section-I	40	10 (Test)		50
	DSE-1005E1 Section-II	40	10 (Test)		50
	DSE-1005E2 Section-I	40	10 (Test)		50
	DSE-1005E2 Section-II	40	10 (Test)		50
VI	DSE-1005F1-Section-I	40	10 (Test)		50
	DSE-1005F1 Section-II	40	10 (Test)		50
	DSE-1005F2 Section-I	40	10 (Test)		50
	DSE-1005F2 Section-II	40	10 (Test)		50
	DSE-1005E1, 1005E2, 1005F1, and DSE-1005DF2			200 (Annually)	200
	SEC 3 & SEC 4			50 (Annually)	50

Distribution of Marks for Practical Examination (LAB): Total Marks: 200

Exam. types	Experiment Groups				Project			Journal	Industrial Visit/Study Tour	Seminar	Total
	A	B	C	D	Circuit Built	Report	Vivo				
Max. Marks	35	35	35	35	20	10	10	08	04	08	200