JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OFELECTRONICS AND INSTRUMENTATION ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

B. TECH ELECTRONICS AND INSTRUMENTATION ENGINEERING

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India



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III Year - I Semester

S.No.	Subjects	Category	L	T	P	Credits
1	Signal Conditioning Circuits	PC	3	0	0	3
2	Integrated Circuits and applications	PC	3	0	0	3
3	Microprocessor and Microcontrollers	PC	3	0	0	3
4	Process Control Instrumentation	PC	3	0	0	3
5	Professional Elective (PE1)	PE	3	0	0	3
6	Process control Instrumentation Lab	LC	0	0	3	1.5
7	Integrated Circuits and applications - Lab	LC	0	0	3	1.5
8	Microprocessor and Microcontrollers Lab	LC	0	0	3	1.5
9	Professional Ethics & Human Values	MC	3	0	0	0
10	Mini Project with Hardware Development	PR	0	0	3	1.5
	Total Credits					**21**

III Year -II Semester

S.No.	Subjects	Category	L	T	P	Credits
1	Digital Signal Processing	PC	3	0	0	3
2	VLSI Design	PC	3	0	0	3
3	Industrial Instrumentation	PC	3	0	0	3
4	Professional Elective (PE-II)	PE	3	0	0	3
5	Open Elective (OE-I)	OE	3	0	0	3
6	Data Acquisition System	PC	3	0	0	3
7	Digital Signal Processing Lab	LC	0	0	3	1.5
8	Industrial Instrumentation Lab	LC	0	0	3	1.5
9	Intellectual Property Rights (IPR) & Patents	MC	3	0	0	0
	Total Credits					**21**

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III Year- I Semester		L	T	P	C
		3	0	0	3
SIGNAL CONDITIONING CIRCUITS					

OBJECTIVES:

The main objectives of this course are:

- Learn and understand signal conditioning for Resistive, Inductive and Capacitive variations sensors.
- Identify different elements of signal conditioning circuits.
- Able to identify various signal conditioning circuits for self-generating and other Sensors.

UNIT-I:

SIGNAL CONDITIONING FOR RESISTIVE SENSORS: Measurement of resistance, Voltage dividers - amplifiers for voltage dividers, wheat stone bridge- balance measurements-deflection measurements- sensitivity, linearity, analog linearization of resistive sensor bridges. Grounding and Isolation, sensor bridge calibration and compensation. Kelvin Bridge.

UNIT-II:

SIGNAL CONDITIONING FOR INDUCTIVE VARIATION SENSORS: Problems and alternatives, ac bridges - measurement of inductance – Hey Bridge, Maxwell's bridge, Anderson Bridge. carrier amplifiers and coherent detection – fundamentals and structure, application to the LVDT, variable oscillators, resolver - to - digital and digital – to - resolver converters.

UNIT-III:

SIGNALCONDITIONING FOR CAPACITIVE VARIATIONSENSORS: Measurement of Capacitance - Schering Bridge, DeSautyBridge. Specific signal conditioners for capacitive sensors. Phase sensitive detectors for capacitive sensors, sensitivity, linearity, capacitive bridge analog linearization.

UNIT-IV:

ELEMENTS OF SIGNAL CONDITIONING CIRCUITS:

Inverting and non-inverting amplifiers, difference amplifier, integrator and differentiator circuits, V-to-I and I-to-V converters, instrumentation amplifier, Log and Anti log amplifiers, Schmitt Trigger, Comparators, Multivibrators, 555 timer, Precision rectifiers. Active filters, interference types and reduction.

UNIT-V:

SIGNAL CONDITIONING CIRCUITS FOR SELF-GENERATING AND OTHER SENSORS:

Chopper and low-drift amplifiers, offset and drifts amplifiers, electrometer amplifiers, charge amplifiers, noise in amplifiers.

Signal Conditioning Circuits for Thermometers based on semiconductor junctions- Magneto diodes – Photodiodes-Sensors based on MOSFET Transistors-Charge-Coupled and CMOS Image Sensors-Fiber Optic Sensors and Ultrasonic based sensors.

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TEXT BOOKS:

1. Sensors and Signal Conditioning: Ramon PallásAreny, John G. Webster; 2nd edition, John Wiley and Sons,2000.
2. Sensors and Transducers – D. Patranabis, TMH 2003

REFERENCES:

1. Instrument Transducers – An Introduction to Their Performance and Design – by Herman K.P. Neubrat, Oxford University Press.
2. Measurement System: Applications and Design – by E.O. Doeblin, McGraw Hill Publications.
3. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987

OUTCOMES:

At the end of this course the student will be able to:

- Measure Resistance of a circuits using different methods.
- Apply different methods for measurement of Inductance and Capacitance.
- Analyze formulate and select suitable sensor for a given application.
- Apply knowledge of signal conditioning circuits to design optical and other transducers signal conditioning.

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III Year- I Semester		L	T	P	C
		3	0	0	3
INTEGRATED CIRCUITS AND APPLICATIONS					

OBJECTIVES:
The main objectives of this course are given below:

- To understand the basic operation &performance parameters of differential amplifiers.
- To understand & learn the measuring techniques of performance parameters of Op-Amp
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using op-amps
- To learn the internal structure, operation and applications of different analog ICs
- To Acquire skills required for designing and testing integrated circuits

UNIT-I:
Introduction: Internal Block Diagram of various stages of Op-Amp and Roll of each Stage. Differential Amplifier using BJTs and With R_E DC and AC Analysis, Basic Current Mirror Circuit, Improved Version of current mirror circuit, current repeated circuit, Wilson current source.
OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slow rate, CMRR, PSRR.etc, Measurements of Op-Amp Parameters.
Three-Terminal Voltage Regulators 78xx& 79xx Series, current Booster, adjustable voltage, Dual Power Supply with 78xx &79xx.

UNIT-II:
LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

UNIT-III:
ACTIVE FILTERS, ANALOG MULTIPLIERS AND MODULATORS: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.
Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

UNIT-IV:
TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

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UNIT-V:

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12 bit ADC).

TEXT BOOKS:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3. Linear Integrated Circuits by Salivahan-3rd-Edition, McGraw Hill,2018

REFERENCES:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma;SK Kataria& Sons; 2nd Edition,2010
2. Operational Amplifiers & Linear Integrated Circuits–R.F. Coughlin& Fredrick Driscoll, PHI, 6th Edition, 2000.
3. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition,2011.
4. Linear Integrated Circuits, by Ganesh Babu T.R and Suseela B. Scitech, 5th -Edition, 2014.

OUTCOMES:

At the end of this course the student will be able to:

- Design circuits using operational amplifiers for various applications.
- Analyze and design amplifiers and active filters using Op-amp.
- Diagnose and trouble-shoot linear electronic circuits.
- Understand the gain-bandwidth concept and frequency response of the amplifier configurations.
- Understand thoroughly the operational amplifiers with linear integrated circuits.

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		3	0	0	3
MICROPROCESSOR AND MICROCONTROLLERS					

OBJECTIVES:
The main objectives of this course are

- To acquire knowledge on microprocessors and microcontrollers.
- To select processors based on requirements.
- To acquire the knowledge on interfacing various peripherals, configure and develop programs to interface peripherals/sensors.
- To develop programs efficiently on ARM Cortex processors and debug.

UNIT–I
Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISC architectures.
8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT–II
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT-IV
Intel 8051 MICROCONTROLLER
Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts.
Assembly language programming: Instructions, addressing modes, simple programs.
Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light control.

UNIT–V
ARM Architectures and Processors: ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces.
Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions.
ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

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TEXTBOOKS:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition.
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2011 2-Edition.
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You

REFERENCES:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr.Alexander G. Dean, Published by Arm Education Media.
2. Cortex -M3 Technical Reference Manual

OUTCOMES:

At the end of this course the student will be able to:

- Understand the architecture of microprocessor/ microcontroller and their operation.
- Demonstrate programming skills in assembly language for processors and Controllers.
- Analyze various interfacing techniques and apply them for the design of processor/Controller based systems.

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		3	**0**	**0**	**3**
PROCESS CONTROL INSTRUMENTATION					

OBJECTIVES:

The main objectives of this course are:

- Identify and monitor process parameters of various processes.
- Understand the principles of controllers, degrees of freedom, and control valves.
- Recognize these principles written in form of mathematical equations for various control applications.
- Apply these equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical process control problems.

UNIT-I:

PROCESS DYNAMICS: Process variables – Load variables – Dynamics of simple pressure, flow, level and temperature process – interacting and non-interacting systems – continuous and batch process – self-regulation – Servo and Regulator operation - problems.

UNIT-II:

CONTROL ACTIONS AND CONTROLLERS AND TYPES OF CONTROLLERS: BASIC control actions -characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative control modes – PI, PD, PID control modes – Problems -types of controllers - Pneumatic, Hydraulic and Electronic Controllers to realize various control actions.

UNIT- III:

CONTROLLER SETTINGS AND TUNING OF CONTROLLERS: Evaluation criteria – 1/4th decay ratio, IAE, ISE, ITSE, ITAE - determination of optimum settings for mathematically described process using time response and frequency response-tuning of controllers- process curve reaction method – continuous oscillation method – damped oscillation method –problems.

UNIT-IV:

FINAL CONTROL ELEMENTS AND CONTROL VALVES: I/P Converter, P/I converter - pneumatic, electric and hydraulic actuators – valve Positioned - Control valves – characteristic of control valves – valve body – Globe, Butterfly, diaphragm, Ball valves – Control valve sizing – Cavitation, flashing - problems.

UNIT-V:

MULTILOOP CONTROL SYSTEM: Feed forward control – Feed Forward Feedback Controller (FFFBC) – Ratio control – Cascade control – Split range – Multivariable control and examples from distillation column, Boiler system and heat exchanger.

TEXT BOOKS:

1. Automatic Process Control – by Eckman D.P. Wiley Eastern Ltd., New Delhi, 1993.

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2. Process Control Instrumentation technology by CurtisD.Johnson, 8th-Edition PHI Publishers.

REFERENCES:

1. Chemical Process Control: An introduction to Theory and Practice – by Stephanopoulos, Prentice Hall, New Delhi,1999
2. Process Control, Third Edition – Liptak B.G., Chilton Book Company, Pennsylvania, 1995
3. Process control – by Pollard A., Heinemann Educational Books, London,1971.
4. Process Control – Harriott P., TMH,1991.

OUTCOMES:

At the end of this course the student will be able to:

- Apply fundamental knowledge of mathematics to modeling and analysis of fluid flow, level, pressure, temperature problems.
- Conduct experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases. Documenting them in engineering reports.
- Understand the possible disasters caused by an incorrect Design/Analysis in hydraulic, pneumatic engineering system.
- Apply multiloop control systems in various process industries.

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		3	0	0	3
QUALITY AND RELIABILITY ENGINEERING (PROFESSIONAL ELECTIVE – I)					

OBJECTIVES:

The main objectives of this course are:

- The aim of this course is to provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
- The objectives are to introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring.
- To understand techniques of modern reliability engineering tools.

UNIT-I:

QUALITY VALUE AND ENGINEERING– quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.

UNIT-II:

Statistical process control $\overline{X}$, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination).

UNIT-III:

Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.

UNIT-IV:

Loss function, tolerance design – N type, L type, S type; determination of tolerance for these types.
Online quality control – variable characteristics, attribute characteristics, parameter design.
Quality function deployment – house of quality, QFD matrix, total quality management concepts.
Quality information systems, quality circles, introduction to ISO 9000 standards.

UNIT-V:

Reliability – Evaluation of design by tests - Hazard Models, Linear, Rayleigh, Weibull. Failure Data Analysis, reliability prediction based on Weibull distribution, Reliability improvement.
Reliability of series, parallel, standby systems & complex systems, Reliability prediction and system effectiveness.
Maintainability, availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXT BOOKS:

1. Statistical Quality Control: A Modern Introduction Montgomery Wiley 7th Edition.
2. 'Reliability Engineering', E. Bala Guruswamy, Tata McGraw Hill.
3. Quality Engineering in Production SystemsG Taguchi, - McGraw Hill.

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REFERENCES:

1. Quality planning & Analysis, Frank.M. GrynaJr. Jurans McGraw Hill.
2. Reliability Engineering, LS Srinath Affiliated East West Pvt. Ltd.,
3. Quality and Performance Excellence: James R Evans, Cengage learning

OUTCOMES:

At the end of this course, students should be able to:

- Understand quality and reliability concept, beware of some basic techniques for quality improvement, and acquire fundamental knowledge of statistics and probability.
- Apply control charts to analyze and improve the process quality.
- Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process

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		3	**0**	**0**	**3**
EMI / EMC (PROFESSIONAL ELECTIVE – I)					

OBJECTIVES:

The main objectives of this course are:

- Student shall be able to understand the root causes for Electromagnetic Noise (EMI), its sources.
- Shall be able to understand the effects of EMI and the required precautions to be taken/to be discussed with his peer group.
- Shall be able to understand the different measurement techniques of EMI (for conducted and normal) and their influences in detail.

UNIT-I:

NATURAL AND NUCLEAR SOURCES OF EMI / EMC: Introduction, Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT-II:

EMI FROM APPARATUS, CIRCUITS AND OPEN AREA TEST SITES: Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive inter modulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT-III:

RADIATED AND CONDUCTED INTERFERENCE MEASUREMENTS: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements.

UNIT-IV:

ESD, GROUNDING, SHIELDING, BONDING AND EMI FILTERS: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.

Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, opto-isolators, Transient and Surge Suppression Devices.

UNIT-V:

EMC STANDARDS- NATIONAL / INTERNATIONAL: Introduction, Standards for EMI and EMC, MIL-Standards, IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, Euro norms, British Standards, EMI/EMC standards in JAPAN, Conclusions.

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1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9.

REFERENCES:

1. Introduction to Electromagnetic Compatibility, NY, John Wiley, 1992, by C.R. Pal.

OUTCOMES:

At the end of this course the student will be able to:

- Distinguish effects of EMI and counter measures by EMC-techniques.
- Apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC-norms specified by regulating authorities.
- Choose career in the fields of EMI/EMC as an Engineer/Researcher/Entrepreneur in India/abroad.

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		3	**0**	**0**	**3**
CALIBRATION AND STANDARD (PROFESSIONAL ELECTIVE I)					

OBJECTIVES:

The main objectives of this course are:

- Learn and understand structure and use of a measurement system.
- Able to learn and understand various components of a calibration system.
- Able to describe the basic attributes of making good measurements.
- Able to learn and understand the units of measure and various instruments used in parameters measurements.

UNIT-I:

STANDARDS: Standards, Definition of standard units. International standards. Primary standards. Secondary standards. Working standards. Voltage standard-primary standard-saturated Weston cell, secondary standard-unsaturated Weston cell, Zener diode laboratory standard. Resistance standard. Current standard. Capacitance standard-primary-vacuum and gas filled, secondary-solid dielectric, ceramic capacitor. Inductance standard-mutual inductance-Campbell primary standard, self-inductance standard. Time and frequency standards- atomic standards-caesium beam standard, hydrogen maser standard, Rubidium vapour standard, quartz crystal standard.

UNIT-II:

CALIBRATION: Define calibration, Principle of calibration, control of calibration environment, calibration chain and traceability, calibration records. Calibration accuracy versus installed accuracy.
Testing and calibration. Measurement reliability. Primary calibration, Secondary calibration. Direct calibration. Indirect calibration. Routine calibration. Calibration curve, Static calibration. Dynamic calibration, Self-calibration requirements.

UNIT-III:

CALIBRATION EXPERIMENT AND EVALUATION OF RESULTS: Calibration of a DC voltmeter, DC ammeter, Ohm meter and an Oscilloscope.

UNIT-IV:

CALIBRATION OF PRESSURE, FLOW, TEMPERATURE AND TRANSDUCERS:
Calibration of transducers- pressure- calibration and testing by dead weight tester, frequency response tester, shock tube. Temperature- international practical temperature scales.
Liquid Flowmeters-In-situ method-insertion point velocity, dilution gauging, Laboratory method-master meter, volumetric method, gravimetric method, pipe prover method.

UNIT-V:

CALIBRATION OF MOTION, ACCELERATION, FORCE, VIBRATION, MASS AND TORQUE TRANSDUCERS: Calibration of motion measuring devices: sinusoidal motion method, transient motion method and comparison method. Force – dynamic force calibration. Acceleration-reciprocity method, optical interferometry.

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1.Measurement and Instrumentation: Theory and Application by Alan S. Morris, Reza Langar.
2.Measurement, Instrumentation, and Sensors Handbook, Second Edition: Spatial ... edited by John G. Webster, HalitEren

REFERENCES:

1. Jone's Instrument Technology Volume1 Mechanical measurements, fourth edition, BH,2003.
2. A course in Electrical and Electronic measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co.2011.
3. Electronic Instruments and Instrumentation technology, M.M.S. Anand, PHI, 2005.
4. Instrumentation, Measurement and Analysis, second edition, B.C. Nakra, K.K. Chaudhry, TMH, 2004.

OUTCOMES:

At the end of this course the student will be able to:

- Possess the knowledge about various parameters standards and calibration methodology.
- Demonstrate the necessity skills for calibration and testing of different instruments.
- Classify different calibration methods for liquid flow meters.

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		3	**0**	**0**	**3**
DIGITAL SYSTEM DESIGN USING HDL (PROFESSIONAL ELECTIVE-I)					

OBJECTIVES:

The main objectives of this course are:

- Learn and understand the architectures of Field-programmable Gate Arrays.
- Translate a software application into hardware logic for FPGA architectures.
- Design synthesizable systems based on industry-standard coding methods.
- Build testbenches and create data models to verify bit-true accurate designs.

UNIT-I:

INTRODUCTION: Hardware Description Languages, FPGA Boards and Software Tools.

Field-Programmable Gate Arrays: Transistor as a Switch, Logic Gates from Switches, FPGA Building Blocks, Layout of the Xilinx Artix-7 XC7A35T FPGA, Input/output Blocks, Configurable Logic Blocks, Interconnect Resources, Block RAM, DSP Slices, Clock Management, The XADC Block, High-Speed Serial I/O Transceivers, Peripheral Component Interconnect Express Interface, FPGA-Based Digital System Design Philosophy, How to Think While Using FPGAs, Advantages and Disadvantages of FPGAs, Usage Areas of FPGAs

Introduction to Verilog: Verilog Fundamentals, Module Representation, Timing and Delays in Modelling, Hierarchical Module Representation, Testbench Formation in Verilog, Structure of a Verilog Testbench File, Displaying Test Results.

UNIT-II:

VERILOG DATA TYPES AND OPERATORS: Data Types in Verilog, Net and Variable Data Types, Data Values, Naming a Net or Variable, Defining Constants and Parameters, Defining Vectors, Operators in Verilog, Arithmetic Operators, Concatenation and Replication Operators, Application on Data Types and Operators, FPGA Building Blocks Used in Data Types and Operators, Implementation Details of Vector Operations, Implementation Details of Arithmetic Operations.

UNIT-III:

COMBINATIONAL CIRCUITS: Combinational Circuit Analysis, Logic Function Formation between Input and Output, Boolean Algebra, Gate-Level Minimization, Combinational Circuit Implementation, Truth Table-Based Implementation, Combinational Circuit Design.

COMBINATIONAL CIRCUIT BLOCKS: Adders in Verilog, Comparators in Verilog, Decoders in Verilog, Encoders in Verilog, Multiplexers in Verilog, Parity Generators and Checkers in Verilog, Applications on Combinational Circuits, Implementing the Home Alarm System, Implementing the Digital Safe System, Implementing the Car Park Occupied Slot Counting System, FPGA Building Blocks Used in Combinational Circuits.

DATA STORAGE ELEMENTS: Latches in Verilog, Flip-Flops in Verilog, Register, Memory, Read-Only Memory, ROM in Verilog, ROM Formation Using IP Blocks, Random Access Memory, Application on Data Storage Elements, FPGA Building Blocks Used in Data Storage Elements.

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UNIT-IV:

SEQUENTIAL CIRCUITS: Sequential Circuit Analysis, State Table, State Diagram, State Representation in Verilog, Timing in Sequential Circuits, Synchronous Operation, Asynchronous Operation, Shift Register as a Sequential Circuit, Shift Registers in Verilog, Multiplication and Division Using Shift Registers, Counter as a Sequential Circuit, Synchronous Counter, Asynchronous Counter, Counters in Verilog, Frequency Division Using Counters, Sequential Circuit Design, Applications on Sequential Circuits.

UNIT-V:

DIGITAL INTERFACING: Universal Asynchronous Receiver/Transmitter(UART) in Verilog, UART Applications, Serial Peripheral Interface (SPI) in Verilog, , SPI Application, Inter-Integrated Circuit (I^2C) in Verilog, , I2C Application, Video Graphics Array (VGA) in Verilog, VGA Application, Universal Serial Bus (USB) Receiving Module in Verilog, USB Keyboard Application, Ethernet, FPGA Building Blocks Used in Digital Interfacing.

ADVANCED APPLICATIONS: Vending Machine, Digital Clock, Moving Wave via LEDs, Translator, Air Freshener Dispenser, Obstacle-Avoiding Tank, Intelligent Washing Machine, Non-Touch Paper Towel Dispenser, Car Parking Sensor System, Digital Table Tennis Game.

TEXT BOOKS:

1. CemUnsalan, Bora Tar "Digital System Design with FPGA Implementation Using Verilog and VHDL" McGraw-Hill Education, 2017
2. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.

REFERENCES:

1. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI, 2005.
2. Fundamentals of Logic Design with Verilog – Stephen. Brown and ZvonkoVranesic, TMH, 2005.
3. A Verilog Primer – J. Bhasker, BSP, 2003.

OUTCOMES:

At the end of this course the student will be able to:

- Understand the architecture of FPGAs, tools used in modelling of digital design
- Analyze and design basic digital circuits with combinatorial and sequential logic circuits using Verilog HDL.
- Model complex digital systems at several levels of abstractions.
- Design real time applications such as vending machine and washing machines etc.

III Year- I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
PROCESS CONTROL INSTRUMENTATION LAB					

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Process control lab contains 10 experiments; the overall course objective is to provide knowledge on controllers on different processes, final control elements, multi loops and process tuning.

(Minimum 10 experiments should be conducted)

1. Flow level control unit.
2. Temperature level control unit.
3. Servo and regulator operation.
4. Realization of control actions: Pneumatic controllers. Hydraulic controllers.
5. Electronic controllers.
6. Process tuning – Process reaction curve method.
7. Process tuning – continuous and damped oscillation method.
8. Operation of flow loop in plant.
9. Input convertor – Pneumatic actuator.
10. Input convertor – Hydraulic actuator.
11. Control valve characteristics (Different types).
12. Multi loop control systems – Ratio Control.
13. Multi loop control systems – Cascade Control.

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III Year- I Semester		L	T	P	C
		0	0	3	1.5
INTEGRATED CIRCUITS AND APPLICATIONS -LAB					

PART A: Digital IC Applications:

1. Verification of truth tables of Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR.
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit
3. Verification of functional table of 3 to 8line Decoder / De-multiplexer
4. Verification of functional tables of
   (i) J K Edge triggered Flip – Flop
   (ii) J K Master Slave Flip – Flop
   (iii)D Flip – Flop
5. Design a four-bit ring counter using D Flip – Flops / JK Flip Flop and verify Output.
6. Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

PART-B: Linear IC Applications

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits
2. Integrator and Differentiator Circuits.
3. Waveform Generator using single OP-AMP with variable duty cycle
4. IC 555 Timer – Monostable Operation Circuit, A stable Operation Circuit
5. IC 566 – VCO Applications.
6. Design of Dual Power Supply using 78XX and 79XX (use full wave Bridge Rectifier with shunt capacitance filters).

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III Year- I Semester		L	T	P	C
		0	0	3	1.5
MICROPROCESSOR AND MICROCONTROLLERS LAB					

LIST OF EXPERIMENTS:

PART- A: (Minimum of 5 Experiments has to be performed)

8086 Assembly Language Programming and Interfacing

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   a. Addition of n-BCDnumbers.
   b. Multiplication and Divisionoperations.
2. Program for sorting an array.
3. Program for Factorial of given-numbers.
4. Interfacing ADC to 8086
5. Interfacing DAC to 8086.
6. Interfacing stepper motor to 8086.

PART-B (Minimum of 5 Experiments has to be performed)

8051 Assembly Language Programming and Interfacing

7. Finding number of 1's and number of 0's in a given 8-bitnumber
8. Average of numbers.
9. Program and verify Timer/ Counter in 8051.
10. Interfacing Traffic Light Controller to 8051
11. UART operation in 8051
12. Interfacing LCD to 8051.

PART-C (Minimum of 2 Experiments has to be performed)

Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL MDK ARM

13. Write anassembly program to multiply of 2 16-bit binary numbers.
14. Write an assembly program to find the sum of first 10 integer numbers.
15. Write a program to toggle LED every second using timer interrupt.

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III Year- I Semester		L	T	P	C
		3	0	0	0
PROFESSIONAL ETHICS & HUMAN VALUES					

OBJECTIVES
The main objectives of this course are

- To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human being with proper personality.
- Professional Ethics instils the student to maintain ethical conduct and discharge their professional duties.

UNIT- I
HUMAN VALUES:Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty – Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT-II
PRINCIPLES FOR HARMONY: Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT- III
ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION: History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry – Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments – – Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT-IV
ENGINEERS' RESPONSIBILITIES TOWARDS SAFETY AND RISK:
Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer Designing for Safety – Risk-Benefit Analysis-Accidents.

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UNIT-V

ENGINEERS' DUTIES AND RIGHTS: Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem Solving-Occupational Crimes-Industrial Espionage- Price Fixing-Whistle Blowing.

Global Issues:

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

REFERENCES:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications.

OUTCOMES

At the end of this course the student will be able to

- It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.
- It provides the student the sensitivity and global outlook in the contemporary world to fulfil the professional obligations effectively**.**

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III Year- I Semester		L	T	P	C
		0	0	3	1.5
MINI PROJECT WITH HARDWARE DEVELOPMENT					

Mini Project Evaluation Procedure for EIE

Mini Project is introduced during V semester. The student may execute the mini project during summer vacation for a period of 6 weeks i.e. between IV and V Semesters. The student shall submit a diary and a technical report for evaluation. This shall be evaluated in the V semester for 50 marks by a committee consisting of external examiner, Head of the Department along with supervisor and two senior faculty members of the Department. Mini Project work may involve carrying out a detailed feasibility study, literature survey along with the implementation results and preparing a work plan for major project. A student shall acquire 1.5 credits assigned, when he/she secures 40% or more marks for the total of 50 marks. In case, if a student fails, he/she shall reappear as and when the VII semester supplementary examinations are conducted.