M. E. Electronics (Specialization in Digital Instrumentation) (FULL TIME)
Curriculum & Syllabus
Batch 2015– 2016 and onwards

S. No.	Category	No. of Credits			
		SEM I	SEM II	SEM III	SEM IV
1.	Course Compulsory	15	15	-	-
2.	Generic Elective	4	4	-	-
3.	Programme Elective	5	5	-	-
4.	Skill development	2	2	-	-
5.	Seminar/ Workshop	2	2	-	-
6.	Dissertation Phase	-	-	12	12
Actual Credits per Semester		**28**	**28**	**12**	**12**
Total actual Programme Credits					**80**
7.	Virtual Credit Comprehensive Viva	4	4	4	4
Total Credits per Semester		**32**	**32**	**16**	**16**
Total (Actual + Virtual) Credits					**96**

M.E Electronics (Specialization in Digital Instrumentation) (Full Time)
Proposed Scheme for CBCS

SEM I				
S.NO	Sub Code	Sub Name	Number of Credit L-T-I	Sub Type
1.	DIR1C1	Industrial Transducers & Smart Sensors	3-1-1	PC1
2.	DIR1C2	Embedded System using ARM Micro controller	3-1-1	PC2
3.	DIR1C3	Modern Control Systems	3-1-1	PC3
4.	DIR1GX	Generic Elective I	3-1-0	GE1
5.	DIR1EX	Elective I	3-1-1	PE1
6.	ASR1S1	Soft Skills -1	2-0-0	
7.	DIR1W1	Seminar / Workshop / Research Tool	0-2-0	
8.	DIR1V1	Comprehensive Viva I	0-0-4	
Total Credit for SEM I			**28 actual + 4 Virtual credits**	
		List of Generic Elective I		
1.	DIR1G1	Advance System Design	3-1-0	
2.	DIR1G2	Wireless Sensor Network	3-1-0	
3.	DIR1G3	Advanced Communication Networks	3-1-0	
4.	DIR1G4	Medical Instrumentation	3-1-0	
		List of Elective I		
1.	DIR1E1	Fuzzy Logic & Neural Network	3-1-1	
2.	DIR1E2	Object Oriented Programming	3-1-1	
3.	DIR1E3	Nano Devices and Nano sensors	3-1-1	
4.	DIR1E4	Advance Digital Signal Processing	3-1-1	
SEM II				
1.	DIR2C1	Digital Image Processing	3-1-1	PC4
2.	DIR2C2	Process Instrumentation & Industrial Control	3-1-1	PC5
3.	DIR2C3	System Design Using Verilog	3-1-1	PC6
4.	DIR2GX	Generic Elective II	3-1-0	GE2
5.	DIR2EX	Elective II	3-1-1	PE2
6.	ASR2S2	Soft Skills -2	2-0-0	
7.	DIR2W2	Seminar / Workshop / Research Tools	0-2-0	
8.	DIR2V2	Comprehensive Viva I	0-0-4	
Total Credit for SEM II			**28 actual + 4 Virtual credits**	
		List of Generic Elective II		
1.	DIR2G1	Software Engineering	3-1-0	
2.	DIR2G2	Embedded RTOS	3-1-0	
3.	DIR2G3	Modeling and Simulation	3-1-0	
4.	DIR2G4	Industrial Communication	3-1-0	
		List of Elective II		
1.	DIR2E1	Analog and Digital VLSI Circuit Design	3-1-1	
2.	DIR2E2	Analytical Instrumentation	3-1-1	
3.	DIR2E3	Optical and Laser Instrumentation	3-1-1	
4.	DIR2E4	Advanced Industrial Drives and Control	3-1-1	
SEM III	DIR3D1	Dissertation Phase I	0-0-12	
	DIR3V3	Comprehensive Viva III	0-0-4	
Total Credit for SEM III			**12 actual + 4 Virtual credits**	
SEM IV	DIR4D2	Dissertation Phase II	0-0-12	
	DIR4V4	Comprehensive Viva IV	0-0-4	
Total Credit for SEM IV			**12 actual + 4 Virtual credits**	
Total Credit			**80 actual + 16 Virtual credits**	

Sem I

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1C1: Industrial Transducers and smart Sensors	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objective:
Acquire the knowledge of basic principles of sensing various parameters. Learn comparative methods of selection of sensors for typical applications

COURSE CONTENT

Unit I

Temperature Measurement: Classification of temperature sensors, working principle, types, materials, Non electrical sensors (thermometer, thermostat), electrical sensors (RTD, thermocouple, thermistors), radiation sensors (pyrometers), temperature switch.

Pressure Measurement: Definition, working principle, types, materials, manometers, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, force balance type, motion balance type, capacitive (delta cell), ring balance, vibrating cylinder type, high-pressure sensors, low-pressure sensors, pressure switch.

Unit II

Level Measurement: Working principle, types, materials, float, displacers, bubbler, and DP- cell, ultrasonic, capacitive, microwave, radar, radioactive type, laser type transducers, level gages, resistance, thermal, TDR/ PDS type, solid level detectors, fiber optic level detectors, level switch.

Flow Measurement: Working principle, types, materials, primary or quantity meters (positive displacement flow meter), secondary or rate meter (obstruction type, variable area type), electrical flow sensors (turbine type, electromagnetic type, and ultrasonic type), Flow switch.

Unit III

Force and Torque Measurement: Basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, strain gauge torque meter, Inductive torque meter, magneto-strictive transducers, torsion bar dynamometer, etc. Dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement.

Unit IV

Allied Sensors: Standards, working principle, types, materials, design criterion: Lleak detector, flame detector, smoke detector, humidity, density, viscosity sensors, and digital transducers, sound sensors, and proximity sensors.

Advanced sensors: Working Principle, types, materials: Smart sensors, MEMS, nano sensors IC sensors, optical fiber sensors.

Unit V

Industrial Communication Systems: Introduction to interface, fieldbus, PROFIBUS-PA, foundation fieldbus.

Text and Reference books:

[1] B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis”, Tata McGraw Hill Education, Second ed., 2004.

[2] Sabrie Soloman, “Sensors Handbook”, McGraw Hill Publication, First ed., 1998.

[3] A. K. Sawhney, “Electrical & Electronic Instruments & Measurement”, Dhanpat Rai and Sons, Eleventh ed., 2000.

[4] Dr. D. S. Kumar, “Mechanical Measurements and Control”, 3/e, Reprint-2004, Metropolitan Book Co. Private Ltd., 2004.

[5] B. E. Noltingk, “Instrumentation Reference Book”, 2nd Edition, Butterworth Heinemann, 1995.

[6] B. G. Liptak, “Process software and digital networks”, 3rd Edition, CRC press, Florida.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1C2: Embedded System using ARM Microcontroller	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Objectives: The objective of this course is to teach students design and interfacing of ARM microcontroller-based embedded systems. High-level languages are used to interface the ARM microcontrollers to various applications. There are extensive hands-on labs/projects.

Prerequisite: Knowledge of Microprocessor and C++ Programming

COURSE CONTENTS

Unit I

Introduction: Definition of embedded system, embedded systems vs general computing systems, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems, core of the embedded system: general purpose and domain specific processors, embedded system architecture: RISC and CISC, RISC: Introduction of ARM processors, evolution of ARM, ARM design philosophy, ARM processor fundamentals: data flow model, registers, program status register, pipeline, interrupts and vector table, ARM processor families and nomenclature.

Unit II

ARM Basic Instruction Set: Introduction to 32 bit programming, instruction set, architecture of ARM, addressing modes, data processing instructions, branch instructions, load and store instructions, conditional instructions, PSR instructions, stack instructions.

Unit III

ARM Thumb Instruction Set: Overview, branch instructions, data processing instructions, status register access instructions, single register load and store instructions, multiple register load and store instructions, semaphore instructions, coprocessor instructions, stack instructions, interrupt instructions.

UNIT IV

ARM Programming: Assembly language programming: Directives-AREA, ENTRY, END etc., Assembly code using instruction scheduling, register allocation, conditional execution and loops. C programming for ARM: Simple C program using function, pointers, structures, etc, exception handling, interrupts, interrupt handling schemes.

Unit V

Interfacing and Applications: Programs for LCD display, PWM, ADC, DAC application, measurement and control of physical parameter as temperature, stepper motor control, DC motor control etc.

Text and Reference Books:

[1] Andrew N. Sloss , "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier publication, 2004.

[2] Par Furber, "Arm System-On-Chip Architecture", 2/E , Pearson Education Limited, 2000.

[3] Par Santanu Chatttopadhyay, "EMBEDDED SYSTEM DESIGN", PHI Learning Private Ltd., 2013.

[4] Jonathan W. Valvano, "Embedded Microcomputer Systems, Real Time Interfacing, Brookes /Cole, 1999, Thomas Learning.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1C3: Modern Control Systems	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objective: The objective is to give students a clear understanding on characteristics of digital control systems from both frequency and time domain viewpoints. Also to give students the basic knowledge of nonlinear, optimal and adaptive control systems.

Prerequisite: Knowledge of classical control methods, Z-tansform, mapping of s-plane to z-plane, & MATLAB control system toolbox

COURSE CONTENTS

Unit I

Data conversion & quantization, Sampling process, mathematical analysis of sampling process, Reconstruction of sampled signal, zero order, first order hold pulse transfer function, Block diagram reduction for systems interconnected through samplers, Sampled Signal flow graphs, Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems, steady state error analysis.

Unit II

Root Loci, Frequency domain analysis, Bode plots, Nyquist plots, Gain margin & phase margin, Digital implementation of analog controllers: Digital controller Design: Classical methods, digital PID's, digital lead-lags, dead-beat controller.

Unit III

State space representation of discrete time systems, Solution of state equation, Pulse transfer function from state equation, Response between sampling instant using state model, observability, controllability, useful transformation in state space, pole placement methods, controller implementations, State observers.

Unit IV

Non Linear Control Design: Introduction, General properties of linear and nonlinear systems, describing function analysis: Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hystersis, dead zone, saturation, coulomb friction and backlash, Phase Plane Analysis, phase portrait of second order nonlinear systems, limit cycle, Equilibrium finding, Stability of Nonlinear Systems: Liapunov Theorems, An Overview of Kalman Filter Theory.

Unit V

Adaptive control: Model reference control. Identification, convergence and stability. Adaptive control of linear systems via state feedback and via output feedback. Adaptive control of nonlinear systems.

Optimal Control Design : Quadratic Optimal Control and Quadratic performance index, Optimal state regulator through the matrix riccati equations, Steady State Quadratic Optimal Control, Calculus of Variations: An Overview, Optimal Control forrmulation using Calculus of Variations, Classical Numerical Methods for Optimal Control, Linear Quadratic Regulator (LQR) Design – I, Linear Quadratic Regulator (LQR) Design – II

Text and Reference Books:

[1] Kuo, Digital Control System, 2/e Oxford Press, 1992.
[2] Ogata, Discrete – Time Control System, 2/e PHI, 1995.
[3] M Gopal, Digital Control System, TMH, 1997.
[4] H. K. Khalil, Nonlinear Systems, 3/e, Prentice Hall, 2002.
[5] Jasbir Arrora, Introduction to Optimum Design, third edition, Elsevier. 2003
[6] N Andreasson , A Evgrafov , M Patriksson , An Introduction to Continuous Optimization, Overseas Press, India Pvt. Ltd. 2006
[7] D. S. Naidu, Optimal Control System, CRC Press, 2003
[8] Arturo Locatelli, Optimal control: An introduction ,Birkhauser Verlag, 2001.
[9] K.S. Narendra and A.M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989.
[10] P. A. Ioannou and J. Sun, Robust Adaptive Control, Prentice-Hall, 1995 (available now at http://www.rcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust_Adaptive_Control.pdf)

List of Generic Elective I

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
	L	**T**	**P**	**L**	**T**	**P**	**Total**
DIR1G1: Advance System Design	**3**	**1**	**0**	**3**	**1**	**0**	**4**
Duration of Theory Paper: 3 Hours							

Course Objective:

To provide an in-depth knowledge regarding designing of advance digital system. To emphasizeon system design for timing and performance trade off.

Prerequisite:

Knowledge of basic digital electronics, state diagrams and graph theory.

COURSE CONTENTS

Unit I

Introduction to digital IC design – full Custom and semi-custom design flow and comparison,

Combinational Logic Design, Synchronous State Machine Design and Analysis, Asynchronous State Machine Design and Analysis, Synthesis and Optimization of Digital Circuit (AREA, POWER AND DELAY). LOW and High Level Synthesis process, optimization of hardware. combinational logic synthesis – Technology independent and technology dependent optimization –Logic synthesis

Unit II

High level synthesis- Scheduling and allocation-ASAP and ALAP scheduling-Register allocation-Functional Unit allocation-Interconnect path allocation-Hardware description languages-synthesis-register transfer design-Event driven simulation. Low power issues in high level synthesis and logic synthesis.

Unit III

Resource Sharing and Binding, Sharing and Binding for Resource-Dominated Circuits, Resource Sharing in Non-Hierarchical Sequencing Graphs, Resource Sharing in Hierarchical Sequencing Graphs, Register Sharing, Multi-Port Memory Binding, Bus Sharing and Binding, Sharing and Binding for General Circuits, Unconstrained Minimum-Area Binding.

Unit IV

Subsystem design principles pipelining - Data paths in processor architecture – Standard cell design considerations of adder and multiplier- Timing -Slack delay model – Effect of skew and jitter on timing, Sources of skew and jitter- Clocking disciplines -Wire model- Technology scaling effect on interconnect and - Noise in interconnects.

Unit V

FPGAs Introduction to FPGA, FPGA Programming technologies, Static SRAM, Anti Fuse, EPROM, EEPROM, Xilinx FPGA (XC2000, XC3000, XC4000 and XC5000), Logic block Architecture. Field Programmable Logic Sequencer, application of FPLS Devices. Programmable Array Logic Series 20, Combinational PAL Devices, Sequential PAL Devices, Arithmetic PAL Devices.

Text and Reference Books:

[1] John M Yarbrough, “Digital Logic Applications and Design”, Thomson learning

[2] Synthesis and optimization of Digital Circuits , Giovanni De Micheli , Tata Mc Graw Hill Edition

[3] Jan M Rabaey, Digital Integrated Circuits - A Design Perspective, Prentice Hall, Second Edition, 2005.

[4] Naveed A. Sherwani, Algorithms for VLSI Physical Design Automation, Springer,Third edition,1999.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1G2: Wireless Sensor Networks	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Course Objectives: To list various applications of wireless sensor networks, describe the concepts, protocols, and differences underlying the design, implementation, and use of wireless sensor networks, and propose, implement, and evaluate new ideas for solving wireless sensor network design issues.

Prerequisite(s): Computer Networks

COURSE CONTENTS

Unit I

Introduction and Overview of Wireless Sensor Networks: Introduction, Brief Historical Survey of Sensor Networks, and Background of SensorNetwork Technology, AhHoc Networks, Applications of Wireless Sensor Networks:Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, MilitaryApplications,Civil and Environmental Engineering Applications, WildfireInstrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, AnotherTaxonomy of WSN Technology, Basic Sensor Network Architectural Elements, HomeControl, Medical Applications, Basic Wireless Sensor Technology : Introduction,Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends,Wireless Network Standards: IEEE 802.15.4, ZigBee, IEE 1451

Unit II

Medium Access Control Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs:Schedule-Based Protocols, Random Access-Based Protocols, Coordination, ScheduleSynchronization, Adaptive Listening, Access Control and Data Exchange (B - MAC,Box-MAC, Bit-MAC,H-MAC, I-MAC, O-MAC, S-MAC. Ri-MAC, T-MAC, Q-MAC (Querry MAC), Q-MAC (QoS MAC), X-MAC

Unit III

Routing Protocols for Wireless Sensor Networks: Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issuesin Wireless Sensor Networks Network Scale and Time-Varying Characteristics,Resource Constraints, Sensor Applications Data Models, Routing Strategies in WirelessSensor Networks: WSN Routing Techniques, Flooding and Its Variants, SensorProtocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy,Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion,Geographical Routing

Unit IV

Transport Control Protocols and Middle wares for Wireless Sensor Networks: Traditional Transport Control Protocols: TCP (RFC 793), UDP (RFC 768), MobileIP, Introduction, WSN Middleware Principles, Middleware Architecture: ExistingMiddleware: MiLAN (Middleware Linking Applications and Networks), IrisNet(Internet-Scale Resource-Intensive Sensor Networks Services)

Unit V

OperatingSystems for Wireless Sensor Networks: Introduction, Examples of Operating Systems: TinyOS,Mate, MagnetOS

Text and Reference Books:

[1] Wireless Sensor Network by KazemSohraby, Daniel Minoli, TaiebZnati Pub: Wiley.

[2] Wireless Sensor Networks Signal Processing andCommunications by Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong Pub: John Wiley & Sons.

[3] Ad Hoc Wireless Networks: Architectures And Protocols By Murthy Pub: Pearson Education

[4] Wireless sensor networks Edited by C. S. Raghavendra Pub: Springer

[5] Fundamentals of Sensor Network Programming: Applications and Technology By Sridhar S.Iyengar, NandanParameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1G3: Advanced Communication Networks	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

COURSE CONTENTS

Unit I

Fundamentals of communication Networks: Basics of optical communication and computer networking: services, switching, multiplexing schemes, telecom network overview and architecture, optical networks, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, Challenges of optical WDM network.

Unit II

Optical network Components: Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodectors, tunable and fixed optical filters, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, various switching elements, OADM, OXC, architecture, MEMS, wavelength convertors, Couplers, isolators, circulators, optical line terminals, all optical cross connect configurations.

Unit III

Optical network architecture: Synchronous optical network/ synchronous digital heirarchy- elements, multiplexing, layers, SONET physical layer, frame structure, WDM network architectures, QoS parameters for optical networks, wavelength routed networks, routing and wavelength assignment (RWA), optical multicast routing, access networks.

Unit IV

Wavelength routing and Survivability: Classification of RWA algorithms, Problem formulation, routing sub-problem: fixed routing, fixed alternate routing, adaptive routing, fault tolerant routing, wavelength assignment sub-problem, wavelength reuse and conversion criterions, algorithms: flow deviation algorithm, fairness and admission control, restoration schemes, multiplexing schemes, provisioning restorable single fiber networks.

Unit V

Wireless adhoc networks: Introduction to ad-hoc networks, MAC Protocols for ad hoc networks, routing protocols, Transport layer, Cross layer design for ad hoc networks. Wireless sensor networks (WSN), MAC protocol for WSN, routing protocol, data management and security, applications

Text and Reference Books:

[1] Optical networks – Apractical prespective : Rajiv Ramaswami and K N Sivarajan, Morgan Kaufmann Publishers, 2002.

[2] WDM optical Networks: Concepts, Design and algorithms , C. Siva Ram Murthy and Mohan Gurusamy, PHI, 2011.

[3] Mukherjee, B- Optical communication networks", Mc-Graw Hill, New York,1997.

[4] C. Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education, 2007.

[5] C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, "Wireless Sensor Networks", Springer publication, 2004.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1G4: Medical Instrumentation	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Course Objective: To understand the advanced biomedical instruments used in hospitals. To review the basic concept of medical Imaging systems. To understand the concept of various biomedical instruments and technologies.

COURSE CONTENT

Unit I

Basic Medical Instrumentation system, General Constraints in design of medical instrumentation system, Patient Safety, Automated Drug Delivery Systems, Blood and its composition and function, Blood Cell Counters, Pulse Oximetry, Introduction to telemetry & Telemedicine .

Unit II

X-ray machines, Dental X-ray machines, Digital Radiography, Principles and, System components of Tomography, Principles of NMR, its components and biological effects. Ultrasonic & Thermal imaging systems. CT Scanning, basic CT scanning system, Types of gantries, image reconstruction techniques in tomography, image artefacts, EEG and ECG

Unit III

Pacemaker – general description and instrumentation details,Types of pacemakers: External & Internal, Defibrillators: AC &DC Defibrillator, Heart Lung Machine. Diathermy: Electro surgical diathermy (ESU), Short wave, Microwave. Artificial Kidney, Dialyzers, Haemodialysis machine. Stone disease problem, lithotriptor systems, Anesthesia machine, Mechanism of artificial ventilation, Types of Ventilator

Unit IV

Interaction of Lasers with Tissues -Thermal and Non thermal, Basic Endoscopes system & its characteristics, Laser Applications in ophthalmology- Diabetic Retinopathy , Glaucoma and Retinal hole and detachment treatment , Dermatology- Tattoo, port wine treatment.

Unit V

Orthrotics & Prosthetic devices, overview of various orthrotics & prosthetic devices along with its materials. Wheelchair Types, Materials used in wheelchair.

Text and Reference Books:

[1] Medicine and Clinical Engineering By Jacobsons & Webster, PHI
[2] Introduction to Biomedical Equipment Technology By Carr & Brown
[3] Biomedical Instrumentation and Measurements By Cromwell, PHI
[4] Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH
[5] The Biomedical Engineering Handbook, Bronzino, IEEE Press
[6] Applied Chemical Engineering Feenberg,
[7] Principles of Medical Imaging.-By: K. Kirk Shung, Michael B. Smith, Benjamin Tsui.-Pub: Academic Press.
[8] Medical Laser Applications -By Carruth
[9] Medical Lasers & their safe Use By Sliney & Trokal

List of Elective I

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1E1:Fuzzy Logic and Neural Network	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

COURSE CONTENT

Unit I

Introduction to Neural Networks: Mathematical models of a Neuron, Network Architectures, Perceptron and MLP, Back-Propagation Algorithm, Characterizing Neural Network Architectures, Learning in Artificial Neural Networks; Supervised, Unsupervised and Competitive Learning paradigms; Learning rules and Functions, Hebbian Learning, Associative Memories, Self Organizing Maps, Computing with Artificial Neural Networks, Applications of Artificial Neural Networks, RBF and RCE neural networks LVQ, Solving optimization problems using neural networks. Stochastic neural networks, Boltzmann machine

Unit II

Fuzzy sets, fuzzy logic and fuzzy inference, Rough sets.

Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicatelogic, fuzzy If – Then rules, fuzzy mapping rules and fuzzy implication functions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic

Unit III

Fuzzy neural networks Integration of fuzzy logic and neural networks, Fuzzy Hybrid neural, Computation of fuzzy logic inferences by hybrid neural net, Tuning fuzzy control parameters by neural nets, Fuzzy rule extraction from numerical data, Neuro-fuzzy classifiers, ANFIS, Applications of fuzzy neural systems, MATLAB based problems

Unit IV

Genetic algorithm : Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method

Unit V

Fuzzy controllers, Fuzzification and Defuzzification Methods , Fuzzy Inference Techniques, Computer vision, applications of fuzzy logic in pattern recognition and image processing. Applications of Neural networks in pattern recognition problems

Text Books and References

[1] G J Klir and B Yuan, "Fuzzy Sets and Fuzzy Logic - Theory and Applications", Prentice-Hall, 1995.
[2] Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications by S. Rajsekharan, Vijayalaxmi Pai
[3] C. Bishop, “Neural Networks for Pattern Recognition”, Oxford University Press, 1995.
[4] D. Driankov, H. Hellendoorn and M Reinfrank, "An introduction to fuzzy control", Springer-Verlag, 1993
[5] S. Haykin, “Neural Networks: A Comprehensive Foundation”, Prentice Hall, 1999

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1E2:Object Oriented Programming	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objectives: The aim of the course is to give a thorough grounding in object-oriented techniques for Java, as well as to examine the major uses of Java – internet programming, design pattern, user interfaces and Networking.

Prerequisite(s): Knowledge Object Oriented Programming concept using object oriented languages such as C++, Objective C.

COURSE CONTENTS

Unit I

Introduction: The History of Java, Java's Key Features, The Java Virtual Machine, The First Application. Basic Syntax - Identifiers, Comments, Keywords, The Eight Primitives, Using Objects. Expression and Arrays : Using Operators, The 'If-Else' Statements, Using 'While' Loop, Selecting with 'Switch' statement, Dealing with Primitive Casts. Using Arrays - Creating an Array, Array Initialization, Working with Arrays, Using Multi-dimensional Arrays.Classpath&JARs: The 'Classpath' in Java, Java Archives.

Unit II

Classes: Classes & Packages, The 'import' Statement, The Importance of Encapsulation, Java Constructors, Access Modifiers (private, default and public), Method Overloading. Polymorphism and Inheritance: The 'Protected' Modifier, Using 'this' and 'super', The 'final' keyword, Static Members & Methods. Interfaces & Abstract Classes, The Complete Construction Process, The Class 'Object', Nested Classes, Enums in Java.

Unit III

Basic Design Patterns:

Basic Concepts of Design Patterns, Iterators, The Pattern Concept, The OBSERVER Pattern, Layout Managers and the STRATEGY Pattern, components, Containers, and the COMPOSITE Pattern, Scroll Bars and the DECORATOR Pattern. The Java Object Model: The Java Type System, Type Inquiry, the Object Class, Shallow and Deep Copy, Serialization, Reflection

Unit IV

Exception, Collections and IO

Exceptions & Assertions: Types of Program Errors, The Exception Model, Checked and Unchecked Exceptions, Defining Custom Exceptions, Assertions. Working with Common Classes: java.lang.String, java.lang.System, java.util.Calendar. The Java Collection Framework & Generics: List Basics, Using Lists Wisely, Other Collection Classes. Java IO: Input Stream/Output Stream, JavaSerialization, Readers & Writers, Working with Files.

Unit V

Thread and Applet

Threads: The Java Thread Model, Thread Priorities, Synchronization, Messaging, Thread Class, Runnable Interface. Applet Architecture – Skeleton- Simple Applet Display Methods- HTML APPLET tag – Passing Parameters to the Applet- AudioClip and AppletStub Interface - Delegation Event Model – Event Classes. Networking: Overview, TCP/IP Sockets, Writing Your Own Web Server.

Text Books and References:

[1] Herbert Schildt, "Java The Complete Reference", Eighth Edition, Tata McGraw-Hill Edition India, 2011.
[2] Cay Horstmann, "Object Oriented Design & Patterns", John Wiley & Sons, 2004.
[3] Bruce Eckel, "Thinking in Java", 4th edition, Pearson Education, 2006.
[4] Ramesh Vasappanavara et al, "Object-oriented Programming Using C++ and Java", First Impression, Pearson, 2011.
[5] Cay Horstmann, "Big Java 4e for Java 7 and 8", John Wiley & Sons, 2010.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1E3: Nanodevices & Nanosensors	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objectives: this course will focus on understanding of the basic structure principals of Nano-devices and sensors.

Prerequisite(s): Introduce the quantum mechanical concepts needed to understand the operation

COURSE CONTENTS

Unit I

Quantum Devices: Quantum Electronic devices – Electrons in mesocopic structures – Short channel, MOS Transistor – split Gate Transistor – Electron wave transistor – Electron spin transistor – Quantum Dot array – Quantum computer- Bit and Qubit. Carbon Nanotube based logic gates, optical devices. . Connection with quantum dots, quantum wires, and quantum wells

Unit II

Tunneling Devices: Tunnelling element – Tunnel Effect and Tunneling Elements-Tunnelling Diode – Resonant Tunnelling Diode – Three -Terminal Resonate Tunnelling Devices-Technology of RTD-Digital circuits design based on RTDs - Basics Logic Circuits – Single Electron Transistor(SET) – Principle – Coulomb Blockade-Performance – Technology- Circuit Design- Logic and Memory Circuits – SET adder as an Example of a Distributed Circuit.

Unit III

Nanosensors I: Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Method of packaging at zero level, dye level and first level. Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry,

Unit IV

Nanosensors II: Sensor for bio-medical applications: Cardiology, Neurology and as diagnostic tool, For other civil applications: metrology, bridges etc. Biosensors. Clinical Diagnostics, generation of biosensors, immobilization, characteristics, applications, conducting Polymer based sensor, DNA Biosensors, optical sensors. Biochips. Metal Insulator Semiconductor devices, molecular electronics, information storage, molecular switching, Schottky devices,

Unit V

NEMS: Inertial sensors – accelerometer – gyroscope - micromechanical pressure sensors – pizoresistive – capacitive - microrobotics – micro channel heat sinks – optical MEMS – visual display – precision optical platform – optical data switching – RF MEMS – MEMS variable capacitors – MEMS switches – Resonators.

Test Books and Reference Books:

[1] K. Goser, P. Glosekotter and J. Dienstuhl, "Nanoelectronics and Nanosystems-From Transistors to Molecular Quantum Devices" , Springer, 2004.

[2] HerveRigneault, Jean-Michel Lourtioz, Claude Delalande, Ariel Levenson, "Nanophotonics", ISTE.

[3] W.R.Fahrner, "Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques" Springer, 2006 13

[4] Sensors: Micro &Nanosensors, Sensor Market trends (Part 1&2) by H. Meixner.

[5] Nanoscience& Technology: Novel structure and phenomena by Ping Sheng (Editor)

[6] Nano Engineering in Science &Technology : An introduction to the world of nano design by Michael Rieth.

[7] Tai –Ran Hsu, "MEMS & Microsystems Design and Manufacture", Tata McGraw-Hill publication, 2001.

[8] P. Rai-Choudhury, "MEMS and MOEMS technology and applications", PHI learning private Ltd, 2009.

[9] Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press, 2002.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- A			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR1E4: Advance Digital Signal Processing	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objective:
To provide clear conceptual knowledge of different DSP algorithms and to introduce speech, multimedia and other signal processing applications.
Prerequisite(s): A basic course in Digital signal processing.

COURSE CONTENTS

Unit I
Overview of DSP,FIR filters, IIR filters, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, Linear prediction & optimum linear filters stationary random process, forward-backward filters linear prediction, solution of normal equation.

Unit II
Multi rate DSP, Sampling rate conversion, poly phase filters, multistage decimator & interpolator, QMF, digital filter banks, DFT in spectral estimation, Adaptive filters & spectral estimation.

Unit III
Minimum mean square criterion, , LMS algorithm, Recursive least square algorithm, Application of DSP& Multi rate DSP Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications.

Unit IV
Image representation: Gray scale and color images , image sampling a nd quantization. Image enhancement: Filter in spatial and frequency domains , histogram based processing and homomorphic filtering. Edge Detection edge linking, boundary descriptors. Image Segmantation :Thresholding, region based segmentation Image Compression: lossy and lossless compression techniques.

Unit V
Entropy coding, lossy and lossless predictive coding, uniform and non uniformquantizers, transform based compression, JPEG, Image reconstruction from projections: Principles, mathematical basis of tomography. Projections, The Fourier Slice Theorem, Reconstruction Algorithms for Parallel Projections, Three dimensional projections. Computer visualization of 3D data :Rendering techniques: Surface based and volume based techniques. Direct Volume rendering: Ray casting, opacity function. Maximum Intensity Projection

Text and Reference Books:

[1] Gonzalez and Woods :Digital Image Processing, Pearson Education 3rd Edition
[2] A.K.Jain : Fundamentals of Digital image processing , PHI
[3] J.G. Proakis and D.G .Manolakis Digital signal processing: Principles, algorithm and applications, Macmillan publishing
[4] Ifeachor E.C., Jervis B.W. Digital signal processing, a Practical approach, 2nd ed. Pearson edu. 2003.
[5] Salivahanan, Vallavaraj&Gnanpriya Digital signal processing:: Tata Mcgraw Hill
[6] S.W.Smith Digital signal processing: A practical guide for engineers and scientists, Elsevier
[7] S.K.Mitra , Digital signal processing: Tata Mcgraw Hill.

Sem II

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2C1: Digital Image Processing	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

COURSE CINTENTS

Unit I

Introduction: Background, Digital Image Representation, Elements of a Digital Image Processing System. Data Acquisition Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, machband effect, Color image fundamentals RGB, HSI models, Image sampling, Quantization, dither.

Image Transforms: Geometric and spatial transforms Introduction to the Fourier Transform, The Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Other Separable Image Transforms.

Unit II

Morphological Image Processing: Dilation and Erosion, Labelling connected components, Morphological reconstruction, Gray-scale morphology, Image descriptors: Region and boundary extraction, Image representation: Chain code, boundary, skeletons, signature descriptors: shape numbers, Fourier descriptors, statistical moments, corner, Regional descriptors, PCA

Unit III

Image Enhancement and segmentation: Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing, Image Subtraction, Image Averaging, Background, Smoothing Filters, Sharpening Filters, Low-pass Filtering, High-pass Filtering, Generation of Spatial Masks from Frequency Domain Specifications. point, line, Edge detection, line detection using Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and Merging, Segmentation by morphological watersheds.

Unit IV

Image Restoring: Degradations Model - Definitions, Noise Models, Diagonalization of Circulant and Block-Circulant Matrices, Circulant Matrices, Block Circulant Matrices, Effects of Diagonalization on the Degradation Model, Restoration approach, Unconstrained Restoration, Constrained Restoration, Inverse Filtering – Formulation, Removal of Blur Caused by Uniform Linear Motion, Restoration in the Spatial Domain, Geometric Transformation.

Unit V

Image Compression: Fundamentals, Types of Redundancy, Fidelity Criteria. Image Compression Models, The Source Encoder and Decoder, The Channel Encoder and Decoder. Elements of Information Theory Error-Free Compression, Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding. Lossy Compression, Lossy Predictive Coding, Transform Coding.

Text and Reference Books:

[1] Rafael. C. Gonzalez & Richard E.Woods.- Digital Image Processing, 2/e Pearson Education, New Delhi - 2006

[2] W.K.Pratt.-Digital Image Processing ,3/e Edn., John Wiley & sons, Inc. 2006

[3] A.K. Jain-Fundamentals of Digital Image processing- PHI, New Delhi(1995)

[4] M. Sonka et.al Image Processing, Analysis and Machine Vision, 2/e, Thomson, Learning, India Edition, 2007.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester-B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2C2: Process Instrumentation and Industrial Control	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objective: To enable students to understand the basic concept of process instrumentation applicable in various industries. It will also give in depth knowledge regarding different type of control strategies instrumentation and controller used in processing industries.

COURSE CONTENT

Unit I

Fundamentals of Process Control

Elements of process control loop, concept of process variables, set point, controlled variable, manipulated variable, load variable. Need for standardization of signals, current, voltage and pneumatic signal standards, concept of live & dead zero, Difference between converter & transmitter, Pneumatic to current converter, Current to pneumatic converter .

Unit II

Types of Control Actions:

Discontinuous:ON/OFF, Continuous: Proportional, integral, derivative, proportional-Integral, Proportional-Derivative, Proportional-Derivative-Integral

Tuning of Controller:

Quarter Amplitude Decay Ratio, Loop disturbance, optimum control, Measure of quality, stability criteria, Tuning methods: Process Reaction Curve (open loop), Ziegler Nichols (closed loop), set point tuning Vs load disturbance tuning.

Unit III

Programmable Logic Controller (PLC):

Continuous versus Discrete Process Control, ladder diagram using standard symbols, Architecture of PLC, PLC ladder diagram and instructions, PLC Programming for process applications.

Complex Control Systems:

Introduction, cascade, feed forward, Ratio Control, Anti Reset, Selector & Multivariable control scanners.

Unit IV

Control Valve:

Classification of control valves based on: Valve body. Construction, type of actuation, application etc. Control valve terminology: Range ability, turndown, valve capacity, Air to open, Air to close, valve gain etc. Control valve characteristics: Inherent & installed Control valve accessories. Types of actuators. Positioners: Application/Need, Types, Effect on performance of control valves.

Unit V

Safety and Hazards:

Explosion Proof Housing, Encapsulation, Sealing, & Immersion, intrinsic safety, Concept of safety cycle.

DCS and SCADA:

DCS architecture, system elements of DCS. Definition of SCADA, Application area of SCADA, Major elements of SCADA, Advantages and disadvantages of SCADA, Comparison of SCADA, DCS, PLC and Smart Instrumentation.

Text Books and References:

[1] Curtis Johnson, "Process Control and Instrumentation Technology", Prentice-Hall of India Seventh ed., 2005.

[2] B. G. Liptak, "Process Control, Instrument Engineering Hand book", Chilton Book Company, Third ed., 1995

[3] Patranabies , "Principles of Process control", Tata Mc Graw Hill Pub, 2006

[4] P. Harriott , "Process control", McGraw-Hill: New York, 1964

[5] Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition System " , ISA publication 3rd Edition)

[6] Dobrivoje Popovic and Vijay Bhatkar, "Distributed Computer Control for Industrial ",Marcel Dekker Inc.,1990

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2C3: System Design using Verilog	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objectives:

To enable the students to translate a functional system description into appropriate digital blocks coded in Verilog. Perform synthesis, place, and route of a digital design into a target FPGA

Prerequisite(s):

Digital Design, Microprocessor architecture, C++ language.

COURSE CONTENTS

Unit I

Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-based design flow, why Verilog HDL?, trends in HDLs.

Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

Basic Concepts: Lexical conventions, data types, system tasks, compiler directives.

Unit II

Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing.

Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of andlor and buflnottype gates, rise, fall and turn-off delays, min, max, and typical delays.

Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types.

Unit III

Behavioral Modeling: Structured procedures, initial and always,blocking'and nonblocking statements, delay control, event control, conditional statements, multiway branching, loops, sequential and parallel blocks.

Tasks and Functions -Differences between tasks and functions, declaration, invocation.

Useful Modeling Techniques: Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks.

Unit IV

Timing and Delays: Distributed, lumped and pin-to-pin delays, specify blocks, parallel and full connection, timing checks, delay back-annotation.

Switch-Level Modeling: MOS and CMOS switches, bidirectional switches, modeling of power and ground, resistive switches, delay specification on switches.

Unit-V

Logic Synthesis with Verilog HDL: Introduction to logic synthesis, impact of logic synthesis, Verilog HDL constructs and operators for logic synthesis, synthesis design flow, verification of synthesized circuits, modeling tips, design partitioning.

Text Books and References:

[1] Samir Palnitkar , “Verilog HDL-A guige to Digital Design and Synthesis “ 2nd Edition, Pearson , 2006.

[2] J. Bhaskar, “A Verilog HDL Primer”, B.S Publications,

[3]Douglas J. Smith, “Hdl Chip Design : A Practical Guide for Designing, Synthesizing & Simulating ASICs &FPGAs Using VHDL or Verilog”.Doone Pubns ,1998.

[4] Blaine Readler , “Verilog by Example: A Concise Introduction for FPGA Design”, Full Arc Press, 2011

List of Generic Elective II

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2G1: Software Engineering	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Course Objectives: The main purpose of this course is to impart knowledge on the basic principles of software development life cycle.

Prerequisites: Knowledge of Basic Data Types - Lists, Stacks, Queues, Hash Tables ,Trees - Binary Trees, Tree Traversal, Memory Management - Storage Allocation, Garbage Collection, Algorithms - Divide and Conquer, Backtracking, Iterative Techniques, Searching and Sorting, Complexity - O-Notation

COURSE CONTENTS

Unit I - Introduction

Software Engineering-Software Process- Generic process model-Prescriptive process model-specialized, unified process-Agile development-Agile Process- Extreme Programming- Other agile Process models-Software engineering Knowledge-core Principles-Principles that guide each framework Activity.

Unit II-Requirements

Requirements Engineering-Establishing the Groundwork-Eliciting Requirements- Developing use cases-Building the requirements model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling Strategies.

Unit III-Design modeling with UML

Modeling Concepts and Diagrams - Use Case Diagrams - Class Diagrams - Interaction Diagrams - State chart Diagrams – Activity Diagrams - Package Diagrams - Component Diagrams – Deployment Diagrams - Diagram Organization- Diagram Extensions. Design Process- Design concepts: Abstraction, Architecture, patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object Oriented Design Concepts, Design Classes- Design Model: Data, Architectural, Interface, Component, Deployment Level Design Elements .

Unit IV-Software implementation

Structured coding Techniques-Coding Styles-Standards and Guidelines- Documentation Guidelines-Modern Programming Language Features: Type checking-User defined data types-Data Abstraction-Exception Handling- Concurrency Mechanism.

Unit V-Testing and Maintenance

Testing: Software Quality- Software Quality Dilemma- Achieving Software Quality- Testing: Strategic Approach to software Testing- Strategic Issues- Testing: Strategies for Conventional Software, Object oriented software, Web Apps-Validating Testing- System Testing- Art of Debugging.

Maintenance: Software Maintenance-Software Supportability- Reengineering- Business Process Reengineering- Software Reengineering- Reverse Engineering- Restructuring- Forward Engineering-Economics of Reengineering

Text and Reference Books:

[1] Roger S, "Software Engineering – A Practitioner's Approach", seventh edition, Pressman, 2010.
[2] Pearson Edu, "Software Engineering by Ian sommerville", 9th edition, 2010.
[3] Hans Van Vliet, "Software Engineering: Principles and Practices", 2008.
[4] Richard Fairley, "Software Engineering Concepts", 2008.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2G2:Embedded Real Time Operating Systems (RTOS)	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Objective: provide an understanding of general embedded system concept, Embedded Software development, RTOS essentials, advantages and trade-offs. It will provide practical experience necessary to use an RTOS in an embedded system development

Prerequisites: Operating system, Microcontrollers and C Programming

COURSE CONTENTS

Unit I

Introduction

Introduction to UNIX/LINUX, Overview of Commands, File I/O (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

Unit II

Real Time Operating Systems

Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Tasks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

Unit III

Objects, Services and I/O

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

Unit IV

Exceptions, Interrupts and Timers

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

Embedded Firmware:

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Unit V

Case Studies of RTOS

RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, Tiny OS, and Basic Concepts of Android OS.

Text Books and References

[1] Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011
[2] Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
[3] Advanced UNIX Programming, Richard Stevens
[4] Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaug

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2G3:Modelling and Simulation	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Course Objectives:

To give exposure of stochastic processes and to show their importance in engineering education and research. To develop skills to identify a process, its inputs and outputs. Then to develop a model and quantify the results. To give hands on experience in MATLAB to be used as a simulation tool for the stochastic processes. To develop an orientation towards research in electronics and computer engineering.

Prerequisite(s):

Fundamental knowledge of probability theory.

COURSE CONTENTS

Unit I

Introduction to Probability Theory -Relative Frequency and Classical Definitions, Sample Space and Events, Conditional Probabilities, Independent Events, Bayes Formula, Bernoulli Trials.

Unit II

Random Variables- Definition, Discrete Random Variables, Probability mass Function , Distrribution Functions: Bernouli pmf, Bionomial pmf, Geometric pmf, Poisson pmf, ContinuousRandom Variables, Cumulative Distribution Function(CDF), Probability Density Function (PDF), Exponential Distribution, Reliability and failure rate, Normal Distribution, Uniform Distribution. Mean, Variance and Moments of Random Variables, Function of a Random Variable and it's Expectation, Jointly Distributed Random Variable.

Unit III

Markov Chains- Classification of stochastic process, Introductionto Markov chains, Classification of States, Transition Probabilities, Limiting State Probabilities, HigherTransition Probabilities, Concept of Transient States and Absorption Probabilities, Solution of Problems Based on Markov Chains.

Unit IV

Markov Processes -Introduction to Continues Time Markov Chains, Birthand Death Processes, The Transition Probability Function, Limiting Probabilities, Exponential Distribution & Poison Process. Solution of Problems Based on Continuous Time Markov Chains, Introduction to Queuing Theory and M/M/1 Queuing Systems.

Unit V

Simulation- Simulation of Queues, Statistical Inference and FewExamples on Simulation

Estimation of Mean and Variance, Confidence Interval, Regression and Correlation analysis

Text and Reference Books:

[1] S.M. Ross, "Introduction to Probability Models, 9th Edition, Elsevier Publication", 2007.

[2] K.S.Trivedi, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition , A Wiley-Interscience Publication.

[3] Averill M. Law,W. David Kelton, "Simulation Modeling and Analysis", 3rd Edition, Tata McGraw-Hill Publication.

[4] A Papoulis, S.V Pillai, "Probability Random Variables and Stochastic Processes", 4th Edition, TMH Publication, 2002.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2G4: Industrial Communication	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**0**	**3**	**1**	**0**	**4**

Prerequisites: Programming ability and an understanding of basic networking, OS, and architecture issues.
Objective: The focus of the course is on the protocols, algorithms and tools needed to support the development and delivery of advanced Industrial network for Control and communication

COURSE CONTENTS

Unit I

Historical Overview of Industrial Automation and Communication Networks, Hierarchical Levels in Industrial, Communication Networks, Transmission Methods, Industrial Network Components, Network Topology.

Serial Communication Standards: Standards organizations, Serial data communication interface standards, Balanced and unbalanced transmission lines, Synchronous & asynchronous communication, RS 232,422,485 interface standards and Troubleshooting.

Parallel Communication Standards : Parallel data communications interface standards - General purpose interface bus (GPIB) or IEEE - 488, The Centronics interface standard, The universal serial bus (USB), Different configuration modes - two wire & four wire point - to -point & multidrop connections.

Unit II

HART Communication protocol - Evolution of signal standards, features of HART protocol, Communication modes, HART networks, HART Data format or telegram structure, field device & Control system interface to HART bus, HART cabling considerations, HART commands and types, HART field controller implementation, 3 layers of HART-OSI model, DDL and compatibility, Advantages and applications of HART protocol.

Unit III

Field Bus: Basics, Architecture, OSI -model, FF/Foundation FB segments, interconnection type -distributed and Chicken foot, FFB types -H1 & HSE, Network design and system configuration, General considerations, advantages of FB & Foundation FB and their comparison.

Unit-IV

Controller Area Network DeviceNet, CANopen, Interbus, Actuator Sensor Interface (AS-I), ControlNet.

Unit-V

An Introduction to Industrial Ethernet Ethernet's Roots',Ethernet Physical Layer, Data Link Layer, The Ethernet Frame, Hubs and Switches, Higher Level Network Functions, Ethernet and Industrial Systems, Industrial Ethernet communication protocols

Text Books and References:

[1] Steve Mackay, John Park and Edwin Wright, "Practical Data Communication for Instrumentation and Control", Newnes Elsevier, 2002.
[2] David Bailey and Edwin wright , "Practical SCADA for industry", Newnes Elsevier.
[3] Romilly Bowden, 'HART application Guide', HART Communication Foundation, 1999.

List of Elective II

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2E1: Analog and Digital VLSI Circuit Design	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objectives: This course presents the fundamental of CMOS VLSI design with different VLSI design methodologies and combinational, sequential and semiconductor memory circuit design. It also covers the limitations of CMOS in NANO technology with introduction to the NANO Technology

Prerequisite(s): Knowledge of semiconductor devices is required.

COURSE CONTENTS

UNIT I

Introduction: VLSI design flow, VLSI design style, Fabrication process Flow: basic Steps, the CMOS n-well Process. Metal oxide semiconductor (MOS) structure, Types of MOSFET: Enhancement and Depletion. Structure and operation of MOS transistor. MOSFET process simulation.

UNIT II

MOS Transistor: threshold voltage of MOSFET, controlling of threshold voltage, MOSFET current – Voltage Characteristics. Transconductance, Drain conduction. Aspect ratio, process parameters, second order effects, MOS small signal and Large signal model, MOS capacitances.

UNIT III

CMOS Inverter: Analysis of different types of inverter circuit, CMOS inverter, transfer characteristic, calculation of propagation delay, rise time, fall time, noise margin and power dissipation for CMOS Inverter. Effect of threshold voltage and supply voltage on delay and power dissipation.

UNIT IV

CMOS Circuit Design: CMOS logic**,** pseudo NMOS logic, pass transistor logic, Transmission Gate logic and Dynamic logic circuit design. Designing of Combinational logic circuit, sequential logic circuit design and semiconductor memory circuit.

Unit V

CMOS Analog Circuit Design: Large signal models, small signal models, current sources, single stage amplifiers, differential amplifiers, operational amplifiers, frequency response, frequency response of amplifiers, frequency response of operational amplifiers, stability and frequency compensation, frequency compensation

Text and Reference Books:

[1] Sung-mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuit analysis and Design, 3rd Edition, Tata McGraw-Hill.

[2] Neil H.E. Weste and Kamran Esharhian, Principal of CMOS VLSI design,2nd Edition, PHI,.anded), AW/Pearson, 2001.

[3] CMOS mixed-signal circuit design by R. Jacob BakerWiley India, IEEE press, reprint 2008.

[4] Design of analog CMOS integrated circuits by Behad RazaviMcGraw-Hill, 2003.

List of Experiment:

Note : Use the BSIM3v3 (T-SPICE Level 49) model to characterize a 0.18µm CMOS process (TSMC).

1. Determine the threshold voltage $V_{TH,}$ for the NMOS and PMOS devices (for V_{BS}=0, L=0.18µm and W= 1µm), by extrapolating from the I_D-V_{GS} curve at low V_{DS}. Explain your circuit setup. How does this result compare to values reported in the model file? Also, determine the body-effect parameter.

2. Determine the subthreshold slope factor S for the NMOS and PMOS devices (at V_{DS} =1.8V, room temperature). Determine the leakage currents at V_{GS} =0 V. Repeatit at a lower temperature T=77k.

3. Determine the effects of channel length L on the threshold voltage V_{Th} between 0.18 µm to 2.0 µm. Draw V_{Th} of the NMOS and PMOS as a function of L (for V_{DS}=1.8 and 1.2V).
4. Determine the effects of drain-source voltage $V_{DS,}$ on the threshold voltage V_{Th} between and 1.8V.Draw V_{Th} as a function of V_{DS} (for L=0.18µm). What is the measured DIBL factor?

5. With the given CMOS inverter Circuit calculate and estimate the static Characteristics
   Determine the VTC of CMOS Inverter
   Obtain the $NM_{H,}$ NM_{L}, and V_{M} for the inverter
   Dynamic Characteristics
   Measure the t_{pHL}, t_{pLH}, $t_{P,}$ $t_{r,}$ t_{f}
   Power Consumption with varying load capacitances from 100fF to 500fF. And compute the powe Delay Product (PDP) foe the 0.18 Micron technologies.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2E2: Analytical Instrumentation	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Course Objective: This course exposes the students to various instruments and techniques used in the analysis andIdentification of elements and compounds

Prerequisite: Knowledge of basic Electronics and Fundamentals of Chemistry

COURSE CONTENTS

Unit I

Colorimeters, Visible-Ultraviolet Spectrometers (single beam, Direct reading), **Infrared Spectrometers**: Basic components, Types of IR spectroscopy, **Atomic Absorption Spectrometers:** Flame photometer (principal and constructional details), principle of AAS, radiation sources, Burners and Flames, Plasma Excitation sources.

Unit II

Flourimeters: Principle of Fluorescence, Measurement of florescence,Phosphorimeters, **Raman Spectrometer:** TheRaman effect**,** Source, sample chamber, spectrometer and detector, Photo Acoustic, Photo thermal Spectrometers **MassSpectrometers:** Principle of operation, Types of MS, Components of MS, ICP-MS

Unit III

Nuclear Magnetic Resonance Spectrometers: Principle of NMR**,** Types of NMR, Constructional details of NMR, **Electron Spin Resonance Spectrometers:** Basis ESR spectrometer and constructional details**,** Electron and Ion Spectroscopy, Basic X-ray Spectrometers

Unit IV

Gas Chromatographs, Liquid Chromatography, Thermo Analytical Methods

Unit V

PH Meters, Blood Gas Analyzer, Industrial Gas Analyzers, Environmental Pollution Monitoring Instruments

Text and Reference Books:

[1] H. H. Williard, L. L. Merrit, J. A. Dean, and F. A. Settle, Instrumental Methods of Analysis, 7/e, CBS Publishers and Distributors, India, 1988

[2] D. A. Skoog, F. J. Holler, and T. A. Nieman, Principles of Instrumental Analysis, 6/e., Thomson Learning, 1998

[3] R. S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill, New Delhi

[4] R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1985

[5] G. W. Ewing, Instrumental Methods of Chemical Analysis, 5/e., McGraw Hill, Singapore, 1992.

[6] R. E. Sherman and L. J. Rhodes (Eds), Analytical Instrumentation, ISA Press, New York, 1996.

[7] B. G. Liptak, Process Measurement and Analysis, 3rd ed., Chilton Book Company, Pennsylvania, 1995

[8] Behrouz A.Forouzan , Data Communications and Networking ,4/E Tata McGraw-Hill, 2000.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2E3: Optical and Laser Instrumentation	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

CONTENTS

Unit I

Laser Fundamentals: coherence; Spatial and Temporal, Laser theory; absorption, Spontaneous and Stimulated emission, Population inversion, pumping, Einstein coefficient, Resonators, mirrors and modes, Laser output, Q switching, modulation of output by different techniques.

Unit II

Laser Systems & Instrumentation: Principle and construction of different Laser sources-solid state, gas, He-Ne Gas laser, Ruby Laser, CO2 laser, semiconductor and free electron lasers. Tunable lasers etc., Lengths, displacement and shape measurement; laser heterodyne, Laser Doppler and particle image velocimetry

Unit III

Laser applications: LIDARs (Light Detection And Ranging), Laser alignment, gauging inspection and Laser machine vision, laser material processing, Laser applications to chemical and environmental Analysis, Laser-induced fluorescence, Temperature measurement techniques, Laser Tweezers: Single-dual-and multiple-beam tweezers, and applications.

Unit IV

Holography and Speckle based NDT: Principle of Holography, Holographic Interferometry; Double exposure, Time averaged, Real time H.I., Laser speckle techniques; speckle photography/ interferometry, and digital speckle pattern interferometry and applications of laser speckles, Lengths, displacement, Velocity, slope and shape measurement etc., Optical coherence tomography: biomedical applications.

Unit V

Fiber Optic Sensors: Basics of Optical fiber as sensing device, classification of fiber sensors, intensity, phase, frequency, wavelength modulated sensors, measurement of temperature, pressure, liquid level, displacement, flow, electric and magnetic fields.

Books Recommended:

[1] Optical Electronics : Ghatak & Thygarajan, Cambridge University Press
[2] Basics of Holography : P. Hariharan, Cambridge University Press
[3] Optical Metrology: Kjell J. Gåsvik, John Wiley & Sons, Ltd, 2013
[4] Optics: Eugene Hecht, Pearson Education Ltd., 2014
[5] Fiber Optic Sensors, Second Edition, Shizhuo Yin, Paul B. Ruffin, Francis T.S. Yu, CRC Press, 2008

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
DIR2E4: Advanced Industrial Drives and Control	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hours	**3**	**1**	**2**	**3**	**1**	**1**	**5**

Objective: To study the different motors used in industry and their driving circuits.

COURSE CONTENTS

Unit I

Introduction to Power Devices: Construction, Working, Characteristics, Specifications and applications of SCR, TRIAC, DIAC, Power MOSFET, IGBT and UJT. SCR gate triggering and commutation circuits. Series and parallel connection of SCR and its triggering arrangement. Choppers: Principle, Working, Classification, Thyristorised Choppers- Jones Chopper, Morgan Chopper ,Single Phase and Three Phase Controlled rectifiers, (Half wave, full wave and bridge configuration with resistive and Inductive Load. Inverters and choppers, Single-phase rectifiers and single phase controlled Inverters: Classification, Single Phase half bridge and full bridge Inverters, PWM Inverters

Unit II

Motors Fundamentals and Mechanical Systems: DC motor - Types, induced emf, speed-torque relations; Speed control – Armature and field control; Ward Leonard control – Constant torque and constant horse power operations. Review of Induction Motor operation – Equivalent circuit – Performance of the machine with variable voltage, rotor resistance variation, pole changing and cascaded induction machines, slip power recovery – Static Kramer Drive. Synchronous, Brush less DC and Switched Reluctance Drives

Unit III

Converter and Chopper Control: Principle of phase control – Series and separately excited DC motor with single phase and three phase converters – waveforms, performance parameters, performance characteristics - Operation with free wheeling diode schemes; Drive employing dual converter. Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control.

Unit IV

VSI and CSI Fed Induction Motor Control: AC voltage controller fed induction machine operation – Energy conservation issues – V/f operation theory – requirement for slip and stator voltage compensation. CSI fed induction machine – Operation and characteristics - PWM controls. Field oriented control of induction machines – Theory – DC drive analogy – Direct or Feed back vector control - Indirect or Feed forward vector control – Flux vector estimation - Space Vector Modulation control, Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy – optimum switching vector selection – reduction of torque ripple methods

Unit V

Special purpose Machines and control: Stepper motor: Working principle, construction, types, application and characteristics. Half and full step sequence, driving circuit using L297, L298Servo motor: Working principle, construction, types, application and characteristics, Universal Motor: Working principle, construction, types, application and characteristics

Text and Reference Books:

[1] Gopal K Dubey, "Power Semiconductor controlled Drives", Prentice Hall Inc., New Jersey, 1989.

[2] Bimal K Bose, "Modern Power Electronics and AC Drives", Pearson Education Asia 2002.

[3] Vedam Subramanyam, "Electric Drives – Concepts and Applications", Tata McGraw Hill, 2000.

[4] R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice- Hall of India Pvt. Ltd., New Delhi, 2003.

[5] Austin Hughes, "Electric Motors and Drives – Fundamentals, Types and Applications", Elsevier – a division of Reed Elsevier India private Limited, New Delhi, 2006.