Dr Ambedkar Institute of Technology, Bangalore-560056

(An Autonomous Institutions Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics and Instrumentation Engineering

Seventh and eighth semester syllabus

(2017-2018 Batch Students)

2020-2021

Scheme of Teaching & Examination
Electronics &Instrumentation Engineering
VII Semester

Academic Year of Admission 2017-18

Subject Code	Title	Teaching Department	Teaching hours/week				Examination			
			L	T	P	Credits	Duration (hrs)	CIE	Theory/ Practical SEE	Total Marks
EI 71	VLSI Design	EI	04	00	00	04	03	50	50	100
EI 72	DCS and Industrial safety systems	EI	04	00	00	04	03	50	50	100
HS 04	IPR	EI	02	00	00	02	03	50	50	100
EI 73x	Elective-4 (Group-D)	EI	04	00	00	04	03	50	50	100
EI 74x	Elective-5 (Group-E)	EI	03	00	00	03	03	50	50	100
	Elective-6 (Group-F)*		04	00	00	04	03	50	50	100
EI L75	Process Control Lab	EI	-	-	03	1.5	03	50	50	100
EI L76	VLSI Lab	EI	-	-	03	1.5	03	50	50	100
EI P77	Project Work Phase 1				04	00	04	-	-	-
Total			21	00	10	24	28	400	400	800

Electives-4 (Group- D)			Electives-5 (Group- E)		
Sl. No	Subject Code	Title of the Subject	Sl. No	Subject Code	Title of the Subject
1	EI 731	Robotics and Automation	1	EI 741	Embedded Systems & RTOS
2	EI 732	Neural Networks & Fuzzy Logic	2	EI 742	Micro Systems and Nanotechnology
3	EI 733	Medical Imaging Systems	3	EI 743	Digital System Design Using Verilog HDL
4	EI 734	Industrial Process Control	4	EI 744	Remote Sensing and Telemetry

Scheme of Teaching & Examination
Electronics &Instrumentation Engineering
VIII Semester

Academic Year of Admission 2017-18

Subject Code	Title	Teaching Department	Teaching hours/week				Examination			
			L	T	P	Credits	Duration (hrs)	CIE	Theory/ Practical SEE	Total Marks
EI 81X	Elective-6(Group-F)	EI	03	00	00	03	03	50	50	100
EI 82X	Elective-7(Group-G)	EI	03	00	00	03	03	50	50	100
	Elective- 8(Group-H)*		04	00	00	04	03	50	50	100
EI P83	Project Work Phase -2	EI	-	-	20	12	-	100	100	200
EI S84	Seminar	EI	00	00	-	02	03	50	-	50
Total			10	00	20	24	12	300	250	550

Electives-6 (Group- F)			Elective-7(Group-G)		
Sl. No	Subject Code	Title of the Subject	Sl. No	Subject Code	Title of the Subject
1	EI 811	Smart Sensors	1	EI 821	Biomedical DSP
2	EI 812	Low Power VLSI	2	EI 822	Lasers & Optical Instrumentation
3	EI 813	Wireless Communication	3	EI 823	Computer Networks
4	EI 814	Industrial Instrumentation	4	EI 824	Speech Signal Processing

***Interdepartmental Elective**

Subject Title : **VLSI Design**		
Sub Code : **EI71**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objectives:

The objectives of the course is to-

1. To know fundamentals of VLSI design and Need, Advantages & Applications of VLSI technology.
2. Analyze the performance of MOS/CMOS transistors ,using mathematical methods and circuit models, including logic components and their interconnect
3. To implement MOS (CMOS,BICMOS) logic schematic , Stick diagram, specific layout rules in the placement and Routing of transistors and interconnect, and to verify the functionality, power, and parasitic effects.
4. To Design , combinational, sequential logic , Memory cell at the transistor level, functional units including adders, multipliers

Unit No	Syllabus	No of Teaching hours
1	**INTRODUCTION TO MOS TECHNOLOGY:** Moores law, speed –power performance, nMOS fabrication, CMOS fabrication: nwell, pwell processes, BiCMOS, comparison of bipolar & CMOS. **BASIC ELECTRICAL PROPERTIES OF MOS & BICMOS CIRCUITS:** Drain to source current versus voltage characteristics, threshold voltage, transconductance, nMOS inverter, Determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull-up, CMOS inverter, latch up.	**10 Hours**
2	**BASIC CIRCUIT CONCEPTS:** Sheet resistance, area capacitance calculation. Delay unit, inverter delay, estimation of CMOS inverter delay, driving of large capacitance loads, super buffers, BiCMOS drivers, propagation delays & wiring capacitances. **MOS AND BICMOS CIRCUIT DESIGN PROCESSES:** MOS layers stick diagrams, nMOS design style; CMOS design style, Design rules and layout, lambda based design.	**10 Hours**
3	**Scaling of MOS circuits:** Scaling factors for device parameters, limitations of scaling**.** **SUBSYSTEM DESIGN & LAYOUT:** Switch logic pass transistor, gate logic inverter, Nand gates, Nor gates, pseudo nMOS, dynamic CMOS example of structured design, parity generator, Bus arbitration, Multiplexers, logic function block.	**10 Hours**
4	Clocked sequential circuits, dynamic shift registers, bus lines. Subsystem design processes General considerations, 4 bit arithmetic processor, 4-bit shifter, a further consideration of adders, multipliers. **DESIGN PROCESS- COMPUTATIONAL ELEMENTS:** Regularity, design of ALU subsystem, ALU using adders, Carry look ahead adders	**12 Hours**
5	**MEMORY, REGISTER & ASPECTS OF TIMING:** 3 transistor dynamic RAM cell, dynamic memory cell, pseudo-static RAM, JK FF, D FF circuits, RAM arrays. Practical aspects and testability, CAD tools for design & Simulation.	**10 Hours**

Course Learning Outcomes:
Students completing this course successfully will be able to:

1. Explain the fundamental of VLSI technology and design
2. Analyze the performance of MOS/CMOS transistors ,using mathematical methods and circuit models, including logic components and their interconnect
3. Implementing MOS (CMOS,BICMOS) logic schematic , Stick diagram, layout , Routing of transistors and interconnect, and verify the functionality, power, are
4. Design, combinational, sequential logic, adders, multipliers and at the transistor level,
5. Developing CMOS circuits with own design using modern tool and specification and verify the functionality.

TEXT BOOK:

1. **Basic VLSI design**- Douglas A Pucknell, Kamaran Eshraghian, Prentice Hall of India publication, 3rd Edition, 2005.

REFERENCE BOOKS:

1. **CMOS Digital Integrated Circuits, Analysis and design**, 3rd Edition, Sung-Mo (steve) Kang, Yusuf Leblbici, Tata Mcgraw Hill.
2. **VLSI Technology,** 2nd Edition, S.M .Size, Tata Mcgraw Hill.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	1	1	2	2	-	-	-	-	-	-	2	-
CO2	1	3	2	3	2	-	2	-	1	-	-	2	1
CO3	3	3	3	3	3	2	-		1	2	2	2	3
CO4	2	3	3	3	3	1	1		1	2	2	3	3
CO5	3	2	3	2	3	1							1

Subject Title : **DCS and Industrial safety systems**		
Sub Code : **EI72**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

The main objective of the course is to

1. Understand the concept of automation
2. Provide basic knowledge on architecture and components of DCS
3. Provide knowledge on different algorithms and applications in DCS
4. Provide knowledge on different applications in DCS
5. Understand safety management system

Unit No	Syllabus	No of Teaching hours
1	**Introduction and Overview**: aims of plant automation, classical approach to plant automation, computer based plant automation concepts, distributed computer control **System Architecture :** evolution of hierarchical system structure, functional levels, data base organization, system implementation concepts, human interface	**10 Hours**
2	**System Elements :** field stations, intermediate stations, central computer station, monitoring and command facilities, Real time operating system, communication system, communication software, process oriented languages , application software, software configuration and parametrisation, knowledge based software	**10 Hours**
3	**Algorithms :**data acquisition and signal processing algorithms, closed loop and sequential control, optimal and adaptive control, implementation examples, algorithms available within DCCS	**10 Hours**
4	**Applications:** power plants, iron and steel plants, chemical plants, cement plants, pulp and paper plants, glass making plants. Water and waste water treatment plants, oil and gas fields **State-of-the-Art and Future Trends**: mstate of the art in DCCS, state of the art in programmmble controllers, factors impacting technology development, artificial intelligence in process control	**12 Hours**
5	**Safety Instrumentation and Machinery:** Introduction, Introduction to IEC 61511 and the safety lifecycle, SIS configurations for safety and availability targets, Selection of sensors and actuators for safety duties, Selection of safety controllers, System integration and application, software Programming, tools Machinery safety, Guide to Regulations and Standards **Hazardous Areas and Intrinsic Safety:** Introduction, Zonal Classification, Area classification, Methods of explosion protection, Flameproof concept Ex d, Intrinsic safety, Increased safety, Certification (components) . Principles of testing, Non Sparking concept, Concept Ex p, Other protection concepts, Earthing & Bonding, Standards and codes of practice, Fault finding and repairs.	**10 Hours**

Course Learning Outcomes:
At the end of this course the students is able to

1. Explain the concept of automation
2. Apply the concept of DCS in automation
3. Explain the architecture and components of DCS
4. Analyze the different algorithms used in DCS
5. Explain different applications
6. Explain safety management system

TEXT BOOK:

1. **Distributed computer control for industrial automation** popovic and bhatkar Publication by Marcel Dekker, Inc. New York, NY, USA ©1990
2. **Pocket Guide on Industrial Automation For Engineers and Technicians** Rev 1.04 Edited by Srinivas Medida

REFERENCE BOOKS:

1. **Computer Aided Process Control-** S K Singh, Prentice Hall of India, 2008
2. **Understanding Distributed Processor Systems for Control.** Samuel M. Herb ISA Publication, 1999
3. **Computer control of processes** - M.Chidambaram, Narosa publishing, Reprint 2010
4. **Computer Based Industrial control**- Krishna Kant, Prentice Hall of India. 6th Edition, 2004

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	-	-	-	1	1	1	2
CO2	1	1	2	1	3	1	-	1	1	1	1	2
CO3	2	2	2	2	2	-	-	1	1	1	1	2
CO4	1	1	2	1	3	-	-	-	1	1	1	2
CO5	1	1	2	2	1	2			1	1	1	1
CO6	1	1	2	1	3	-	-	-	1	1	1	2

Subject Title : **Robotics and Automation**		
Sub Code : **EI731**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

The main objective of the course is to

1. Understand the generic technology and principles associated with robotics and automation systems
2. Understand the principles and operations of different sensors used for robotic applications
3. Understand the kinematics and dynamics aspects of robotic system

Unit No	Syllabus	No of Teaching hours
1	**Introduction :** robot definition, classification of robot, history, robot components, robot degrees of freedom, robot joints, coordinates, reference frames, asimov's laws of robotics, robot programming modes, characteristics, applications	**08 Hours**
2	**Robot drivers, sensors and vision:** drives for robots: electrical, hydraulic and pneumatic. Sensors: proximity and range, tactile force and torque End effectors, position and velocity measurement **Robot vision:** introduction to techniques, image acquisition and processing.	**12 Hours**
3	**Robot kinematics :** rotation matrix, homogenous transformation matrix, Denavit- Hartenberg convention, Euler angles RPY representation, Direct and inverse kinematics for industrial robots for position and orientation	**12 Hours**
4	**Robot dynamics:** Langrangian formulation newton Euler formulation.	**10 Hours**
5	Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory.	**10 Hours**

Course outcomes:

At the end of this course the students is able to

CO1: Identify components, advantages, disadvantages, applications of robots.
CO2: Develop mathematical equations related to robot kinematics, dynamics and path planning
CO3: Solve direct and inverse kinematics of simple robot manipulators.
CO4: Select a suitable transducers and sensor for measurement of parameters used in robot manipulator
CO5: Analyze the operation of robot in development of homogeneous transformation matrix

Text Books:

1. **Robotics control sensing Vision and Intelligence**- K.S.Fu, R.C.Gonzalez, C.S.G. Lee, McGraw Hill, 1987.
2. **Introduction to robotics** Saeed B Niku Prentice Hall of India 2005

Reference Books:

1. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learning Publishers, 1998
2. **Introduction to robotics** John J Craig third Edition pearson Education Inc., 2005
3. **Introduction to robotics** SK Saha Tata Mc Graw Hill **,** 2008

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	2	-	2
CO2	3	3	2	1	-	-	-	-	-	2	-	2
CO3	2	2	2	1	-	-	-	-	-	2	-	2
CO4	2	2	2	1	-	-	-	-	-	2	-	2
CO5	2	2	2	1	-	-	-	-	-	2	-	2

Subject Title : **Neural Networks & Fuzzy Logic**		
Sub Code : **EI732**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

1. To understand the basic need of artificial neural network to engineering applications with emphasis on it use for process control applications.
2. To understand the various neural network and the Applications of these models to solve engineering problems.
3. To understand the basics of fuzzy logic and relations

Unit No	Syllabus	No of Teaching hours
1	**INTRODUCTION:** What is neural network? Human Brain, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.	**10 Hours**
2	**LEARNING PROCESSES:** Introduction, Error correction algorithm, Memory based learning, Hebbian Learning, Competitive learning, Boltzmann learning, learning with a teacher, learning without a teacher, Learning tasks, Memory, adaptation.	**10Hours**
3	**SINGLE LAYER PERCEPTIONS:** Introduction, Perceptron, and perception convergence theorem, Examples, Multilayer perceptron, Introduction, Some preliminaries	**08 Hours**
4	**BACK PROPAGATION ALGORITHM**: Summary of the Back Propagation Algorithm, XOR Problem, and Heuristics for making the Back propagation algorithm to perform better. **RADIAL BASIS FUNCTION NETWORKS:** Architecture, learning algorithms, Applications. Hopfield Networks – Architecture, Capacity of Hopfield models, Energy analysis of Hopfield networks	**12 Hours**
5	**INTRODUCTION:** Uncertainty and Imprecision, state and random processes, Uncertainty in information, fuzzy sets and classical sets, properties, mapping of classical sets to function, fuzzy set operation, properties of Fuzzy sets, **CLASSICAL RELATIONS AND FUZZY RELATIONS:** Cartesian product, crisp relations, fuzzy relations, tolerance and equivalence relations.	**12 Hours**

aweCourse Outcomes:

After completion of this course the student is able to:

1. Understand and explain the basic neural networks paradigms
2. Understand and explain the basic concepts of training methods in neural networks
3. Explain the ANN applications
4. Understand and explain the techniques for identification and control of the nonlinear processes
5. Understand and explain the techniques for designing successful applications
6. Explain the basics of fuzzy logic and relations

TEXT BOOKS:

1. Simon Haykin, Neural Networks A comprehensive foundation- McMillan College public company, Newyork 1994.
2. Artificial neural networks-B. Yegnanarayana Prentice Hall of India 1999.

3.**Fuzzy logic with engineering applications**-Timothy. J. Ross, McGraw Hill International Edition, 1997.

REFERENCE BOOKS:

1. Introduction to Artificial Neural Systems- Jacek M. Zurada JaicoPublishing House,1994
2. Neural Network Fundamentals with Graphs, Algorithms, and applications-N.K. Bose, P.Liang, Tata McGraw Hill Edition.1998
3. Artificial Neural networks-Robert J Schalkoff, McGraw Hill international Edition,1997
4. Neural networks and Fuzzy Systems, A Dynamical systems approach to machine intelligence-Bart Kosko, Prentice Hall of India Publications, 200

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2
CO4	3	2	3	2	2	3	2	1	2	2	1	2

Subject Title : **Medical Imaging Systems**		
Sub Code : **EI733**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

1. The aim of the course is to show how to extract, model, and analyze information from medical data and Applications In order to help diagnosis, treatment and monitoring g of diseases through computer science.
2. Biomedical Engineering undergraduates integrate the knowledge core of traditional engineering disciplines and modern biology to solve problems encountered in living systems.
3. To analyze a problem from both an engineering and biological perspective; to anticipate the special difficulties in working with living systems and to evaluate a wide range of possible approaches to solutions.

Unit No	Syllabus	No of Teaching hours
1	**X-Rays:** Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers. X-Ray detectors, Conventional X-Ray radiography, Fluoroscopy, Angiography, Digital radiography, Dynamic spatial reconstruction	**12 Hours**
2	**Computed Tomography:** Conventional tomography, Computed tomography principle, Projection function Generations of CT machines, Electron beam CT, Reconstruction algorithms, Helical CT. **Ultrasound Imaging: Ultrasound properties** Ultrasonic transducers, Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging.	**10 Hours**
3	**Fundamental Of Imaging Systems:** Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences. Introduction to functional MRI.	**10 Hours**
4	**Magnetic Resonance Imaging Systems:** Slice selection, Frequency encoding, Phase encoding, Spin-Echo imaging, Gradient-Echo imaging, Imaging safety. **Thermal Imaging:** Medical thermography, Infrared detectors, Thermographic equipment, Pyroelectric vidicon camera.	**10 Hours**
5	**Radionuclide Imaging:** Interaction of nuclear particles and matter, Nuclear sources, Radionuclide generators, Nuclear radiation detectors, Rectilinear	**10 Hours**

	scanner, scintillation camera, SPECT, PET.	

Course Outcomes:

After completion of this course the student is able to:

1. Analyze information from medical data and Applications In order to help diagnosis, treatment and monitoring of diseases through computer science.
2. Integrate the knowledge core of traditional engineering disciplines and modern biology to solve problems encountered in living systems.
3. To analyze a problem from both an engineering and biological perspective; to anticipate the special difficulties in working with living systems and to evaluate a wide range of possible approaches to solutions.

Text Books:

1. **Medical Imaging Signals and Systems**- Jerry L Prince and Jonathan M Links, Prentice Hall of India/Pearson Education 2009.
2. **Principles of Medical Imaging**- Kirk shung, Academic Press. Inc, 1992
3. **Handbook of Biomedical Instrumentation**-R. S. Khandpur, Tata McGraw-Hill. 2nd Edition, 2008,

Reference Books:

1. **Fundamentals of medical Imaging**- Zhong Hicho and Manbir singh, John Wiley 1993

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	2	-	2
CO2	3	3	2	1	-	-	-	-	-	2	-	2
CO3	2	2	2	1	-	-	-	-	-	2	-	2

Subject Title : **Industrial Process Control**		
Sub Code : **EI734**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

1. Impart knowledge on practices in process industry
2. Explain steel production instrumentation
3. To draw and Illustrate the Food industry and in paper and pulp industry instrumentation system
4. Analyze the various operations in Electric Power Generation &Distribution
5. Distinguishing Nuclear Reactor Instrumentation and Air space Instrumentation.

UNITS		**Hours**
1	**Instrumentation Practices In Process Industries:** Department functions and responsibilities, development, process analysis, maintenance, standardization, economics of process instrumentation. **Steel production instrumentation** : Selection of instruments, black furnace instrumentation, open-hearth process instrument, End product measurement, continuous casting of steel	08 Hours
2	**Food industry instrumentation** (Block diagram approach): Instrumentation in brewing, canning industry, baking, dairy industries. Steam power plant instrumentation, Instrument selection, primary and secondary plant measurement.	07 Hours
3	**Paper And Pulp Instrumentation** (Block Diagram Approach): Different types of pulping, pulp bleaching, pulp blending, wet end and drier instrumentation	08 Hours
4	**Electric Power Generation & Distribution Control**: General characteristics of interconnected systems, classification of economy dispatch control systems, Digital computer for economy dispatch applications.	08 Hours
5	**Nuclear Reactor Instrumentation:** Nuclear reactor dynamics, reactor instrumentation, reliability aspects of protective systems **Air Space Instrumentation:** Air craft's and aerospace vehicle instrumentation, air flight simulation instrumentation.	08 Hours

TEXT BOOK:

1. Hand book of applied instrumentation-CONSIDINE and ROSS,Publisher McGraw-Hill.

REFERENCE BOOKS:

1. Industrial instrumentation- by DONALD P. ECKMAN, Wiley 10 th reprint
2. Industrial Instruments- by K.Krishnaswamy, S.Vijayachitra, New age International publishers.
3. Food Processing Principles & Applications- J.S.Smith, University press (US) 2004.
4. Process Control Fundamentals for the pulpe-paper Industry.Nancy Jean Sell, Tappi(June 1997) ISBN-978-0898522945.

COURSE OUTCOMES

After completion of this course the student is able to

1. To identify the practical challenges in process industry
2. Explaining instrumentation in Steel production
3. Illustrate the instrumentation in Food industry and in paper and pulp with block diagram
4. Analyze the various operations in Electric Power Generation &Distribution
5. Distinguishing Nuclear Reactor and Air space Instrumentation system.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2
CO4	3	2	3	2	2	3	2	1	2	2	1	2
CO5	3	2	3	2	3	2	3	1	2	2	2	3

Subject Title : **Embedded Systems & RTOS**		
Sub Code : **EI741**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

It is designed to achieve the following objectives:

1. To Introduce the basic concepts of Embedded Systems and the various techniques used For Embedded Systems with real time example.
2. To Understand & Analyse the purpose of Processor and Software architecture
3. To partition a system to hardware and software parts efficiently.
4. To get exposed to Real-Time Operating System.

Unit No	Syllabus	No of Teaching hours
1	**INTRODUCTION:** Overview of embedded systems, embedded system design challenges, common design metrics and optimizing them. Survey of different embedded system design technologies, trade-offs. Custom Single-Purpose Processors, Design of custom single purpose processors **SINGLE-PURPOSE PROCESSORS:** Hardware, Combinational Logic, Sequential Logic, RT level Combinational and Sequential Components, Optimizing single-purpose processors. Single-Purpose Processors: Software, Basic Architecture, Operation, Programmer's View, Development Environment, ASIPS.	**08 Hours**
2	Standard Single-Purpose Peripherals, Timers, Counters, UART, PWM, LCD Controllers, Keypad controllers, Stepper Motor Controller, A to D Converters, Examples. **MEMORY:** Introduction, Common memory Types, Compulsory memory, Memory Hierarchy and Cache, Advanced RAM. Interfacing, Communication Basics, Microprocessor Interfacing, Arbitration, Advanced Communication Principles, Protocols - Serial, Parallel and Wireless.	**08Hours**
3	**INTERRUPTS:** Basics - Shared Data Problem - Interrupt latency. Survey of Software Architecture, Round Robin, Round Robin with Interrupts - Function Queues - scheduling - RTOS architecture.	**07 Hours**
4	**INTRODUCTION TO RTOS:** Tasks - states - Data - Semaphores and shared data. More operating systems services - Massage Queues - Mail Boxes-Timers–Events-Memory Management.	**08 Hours**

5	**Basic Design Using RTOS, Principles-** An example, Encapsulating semaphores and Queues. **Hard real-time scheduling considerations –** Saving Memory space and power. Hardware software co-design aspects in embedded systems.	**08 Hours**

Course Outcomes:

After completion of this course the student is able to:

1. Design embedded system architectures for various applications and to learn the different techniques on embedded systems.
2. Identify, formulate, and solve engineering problems
3. Function on multidisciplinary teams
4. To discuss the basics embedded systems and the interface issues related to it.
5. To discuss the real time models, languages and operating systems and to analyze real time examples

TEXT BOOKS:

1. Embedded System Design: A Unified Hardware/Software Introduction - Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.2002

2.An Embedded software Primer - David E. Simon: Pearson Education, 1999

REFERENCE BOOKS:

1. **Embedded Systems: Architecture and Programming,** Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Embedded C programming**, Barnett, Cox & O'cull, Thomson (2005)
3. **Programmers**, Tammy Noergaard, Elsevier Publication, 2005

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	1	1	2	2	-	-	2	2	1
CO2	2	2	3	2	2	1	-	-	-	2	2	1
CO3	2	2	3	3	1	2	2	-	2	2	2	2
CO4	3	2	2	1	3	-	-	-	1	2	2	2
CO5	2	3	3	2	2	2	-	-	2	2	2	2

Subject Title : **Micro Systems and Nanotechnology**		
Sub Code : **EI742**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

The objective of this course is to make the students to

1. To impart fundamental knowledge of Microsystems and their manufacturing.
2. To provide knowledge of fabrication process.
3. To know the basics of Nanotechnology and its properties.
4. To impart basic knowledge on various synthesis and characterization techniques involved in Nanotechnology.

Unit No	**Syllabus**	**No of Teaching hours**
1	**Overview of MEMS and Microsystems and working principles of microsystems:** MEMS and Microsystems, Typical MEMs and Microsystems products, Evolution of microfabrication, microsystems and microelectronics, Multidisciplinary nature of microsystems design and manufacture, Applications of microsystems in Automotive, Healthcare Aerospace and other industries.	**07 Hours**
2	**Microsensors, Actuator systems:** **Microsensors**: Silicon Capacitive Accelerometer, Piezoresistive pressure sensor, Portable blood Analyzer **Microactuation:** using thermal forces, SMA, Piezoelectric crystals, Electrostatic forces **MEMS with Microactuators**- Microgrippers, Micromotors, Microvalves, Micropumps, Microaccelerometers	**08Hours**
3	**Miniaturization and Micromachining technologies:** Introduction to scaling, scaling in rigid body dynamics, electrostatic forces, electromagnetic forces, electricity.Silicon as a material for micromachining, Thinfilm deposition, Lithography, etching, Silicon micromachining- surface, Bulk, LIGA. Advanced process for Microfabrication- Wafer bonding techniques, Special Microfabrication Techniques. Special Materials for Microsystems	**07 Hours**
4	**Introduction to nanotechnology: Nanotechnology**-definition, classification based on the dimension, Effects of the Nano-metre Length Scale, Fabrication methods Top-down processes-Milling, Lithograophy, Bottom-up processes-Vapour phase deposition methods, Plasma-assisted deposition processes.	**09 Hours**
5	**Methodologies for nanotechnology characterization**: Electron microscopy-Scanning electron microscopy, Transmission electron microscopy, Scanning probe	**07 Hours**

	techniques- Scanning tunnelling microscopy , Atomic force microscopy, **Applications of nanotechnology-** electronics and Medical field.	

Course Outcomes:

At the end of the course the student is able to

CO1: Understand the fundamental knowledge of Microsystems for varied applications

CO2: Understand the working principles of sensors and actuators at micro level

CO3: Integration of various functions into a very small space from submicrometrs to some millimeters and also the fabrication aspects.

CO4: Understand the fundamentals of Nanotechnology.

CO5: Gain knowledge on various synthesis and characterization techniques involved in nanotechnology.

Text Books:

1.**MEMS and Microsystems**: design and manufacture-Tai-Ran Tsu, Tata McGraw-Hill, 6th reprint 2012

2. **Micro and Smart systems**: G.K Ananhasuresh, K.J.Vinoy, S. Gopalakrishan, K.N Baht, Wiley India Publishers 1st edition 2010.

3.**Nanoscale Science And Technology**: Robert W. Kelsall, Ian W. Hamley,GeogheganJohn Wiley& Sons, Ltd publishers 2005

Reference Books:

1. **MEMS**- Nitaigour Premchand Mahalik, Tata McGraw-Hill, 2007

2. **Nanotechnology**: Principles and practices-SulabhaK. Kulakarani, 3rd edition 2014 Capital Publishing company co-published by Springer.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**2**
CO2	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**-**	**1**	**2**	**-**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**	**2**	**-**	**1**	**2**	**1**	**2**
CO4	**3**	**2**	**3**	**1**	**1**	**2**	**-**	**-**	**1**	**2**	**-**	**2**
CO5	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**-**	**1**	**2**	**1**	**2**

Subject Title : **Digital System Design using Verilog HDL**		
Sub Code : **EI743**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objective:-
The objectives of this subject are:

1. To make the student understands advanced digital system design.
2. To understand HDL based IC design.
3. To understand Verilog programming.
4. Focus on high level synthesis and timing issues.
5. To understand verification using Verilog HDL

Unit No	Syllabus	No of Teaching hours
1	**Verilog HDL:** Introduction to Verilog HDL, Abstraction levels, basic concepts, Verilog primitives, keywords, data types, nets and registers, Verilog MODULEs and ports; Lab Practice: Xilinx tool flow: simulation and synthesis	**08 Hours**
2	**Verilog Operators:** Logical operators, Bitwise and reduction operators, Concatenation and conditional operators, Relational and arithmetic, Shift and equality operators, Operator execution order, Assignments: Types of assignments, Continuous assignment, Procedural assignments, Blocking and non-blocking assignments, Tasks and functions,	**07 Hours**
3	**Verilog modeling:** gate type, design hierarchy, gate delay, propagation delay, logic simulation Dataflow-level modeling: assignments, Behavioral modeling: Always block, Flow Control, If-else, case, case, while loop, for loop, repeat,	**08 Hours**
4	**Verilog for verification:** Design verification and testing, Test bench writing, Initial statement, Verilog system tasks: $finish, $stop, $display, $monitor, $time, $real time, $random, $save, $readmemh/$writememh, $fopen, $fclose, Compiler directives, ifdef, Array, multi-dimensional array. Memory modelling	**08 Hours**
5	**High-level synthesis:** Basic concepts of high-level synthesis, Partitioning, scheduling, Allocation and binding, Technology mapping, **Static Timing Analysis:** Introduction to Static Timing Analysis, Timing path and constraints, Types of clock, Clock domain and variation, Clock distribution networks, How to fix timing failure Synthesis Coding Styles: Registers in Verilog, Unwanted latches ,RTL coding styles	**08 Hours**

Course Outcomes:
Upon successful completion of this subject, students should be able to:

1. Design advanced digital system using Verilog HDL.
2. Design FSM based system.
3. Explain STA and high-level synthesis.

Text Books:

1. Verilog HDL: A Guide to Digital Design and Synthesis; Samir Palnitkar; 2nd edition, Pearson Education, 2011.
2. Verilog Digital System Design; ZainalabedinNavabi; 2nd edition, TMH,2012. 3. Advanced Chip Design: Practical Examples in Verilog, Kishore Kumar MisHoursa, CreateSpace Independent Publishing Platform

Reference Books:

1. Verilog HDL Synthesis: A Practical Primer; J. Bhasker, BSP Publishers, 2008.
2. FPGA-Based System Design, Wayne Wolf, 1st edition, Pearson

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**2**
CO2	**1**	**2**	**2**	**3**	**1**	**1**	**2**	**-**	**1**	**2**	**-**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**	**2**	**-**	**1**	**2**	**1**	**2**

Subject Title : **Remote Sensing and Telemetry**		
Sub Code : **EI744**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

The main objective of the course is to

1. Understand the concept on Electromagnetic radiation, Aerial Photography & Sensor
2. Understand the advance techniques such as Airborne Radar, Satellite Sensor Imagery
3. Understand the basics of Telemetry Systems

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** Introduction to Remote Sensing, Energy sources and Radiation Principles, Remote Sensing Terminology And Units, Ideal Remote sensing system, Characteristics of Real remote sensing system, Electromagnetic spectrum, Earth Surface Interaction With Electromagnetic Radiation, Atmospheric Interactions With Electromagnetic Radiation.	**08 Hours**
2	**Aerial Photography & Sensor :** Introduction, Film exposure, Aerial film cameras, Interpretation Aerial Photo- General procedure for photo interpretation, Basic elements of Image interpretation, Application of Aerial Photo interpretation, Sideways Look Airborne Radar (SLAR), Synthetic Aperture Radar (SAR).	**07 Hours**
3	**Satellite Sensor Imagery:** Introduction, Earth Resources Satellites: Landsat satellite program, SPOT satellite program, Indian Remote Sensing Satellite(IRS) Meteorological Satellites: NOAA Satellites, GOES Satellite, NIMBUS Satellite.	**08 Hours**
4	**Geographic Information System**: Introduction, Contribution Disciplines, GIS Definitions and Terminology, GIS architecture, Components of a GIS, GIS work flow, Theoretical models of GIS, Theoretical framework for GIS.	**08 Hours**
5	**Introduction to Telemetry Systems:** Introduction, Telemetry Basics, Components of a typical wireless telemetry System, Radio propagation, Antenna system design, telemetry radio range.	**08 Hours**

Textbooks:

1. Remote sensing and image interpretation- Thomas M.Lillesand, Ralph W kiefer, Jonathan W chipman Fifth edition WILEY student edition

2. Remote sensing and Geographical information systems – M.Anji Reddy Third Edition BS publications.

Course outcome:

1. Differentiate between electro-magnetic radiation
2. Analyse the concepts of aerial photography and applying the concept in Applications of aerial photography.
3. Analyze the concept of images obtained from Earth resource satellites and Meteorological satellites.
4. By using the basic concepts of GIS, analyze theoretical model and framework of GIS.
5. Apply the concepts of Telemetry systems in different applications.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**
CO2	**3**	**1**	**2**	**1**	**1**	**1**	**-**	**-**	**2**	**3**	**2**	**3**
CO3	3	**2**	2	**-**	**1**	**1**	**-**	**-**	**2**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**3**	**2**	**3**
CO5	3	1	1	-	2	2	1	-	2	3	2	3

Subject Title : **Process Control Lab**		
Sub Code : **EIL75**	No of credits : 1.5=0:0:1.5 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 13

Course objectives:

1. To design a suitable signal conditioning circuit for the given physical parameter measured using transducer/sensor
2. Calibrate, configure, and tune various real-world instrumentation and control loops on the physical parameters like pressure, temperature, and level training stations.
3. Design and develop a ladder diagram using PLC for simple automation application

Expt No	**Syllabus**
1	Rig up and test the circuit to display the temperature using RTD with suitable signal conditioning circuit.
2	Rig up and test the circuit to display the temperature using Thermocouple with suitable signal conditioning circuit
3	Rig up and test the circuit to display the temperature using AD590 with suitable signal conditioning circuit.
4	Rig up and test the circuit to display the load using load cell with suitable signal conditioning circuits.
5	Closed loop response of flow control loop with and without disturbance
6	Closed loop response of Level control loop with and without disturbance
7	Closed loop response of Temperature control loop
8	Closed loop response of Cascade control loop
9	Response of flow/level/temperature control using DCS and SCADA
10	Bottle filling process using PLC. The logic should be solved using ladder diagram technique.
11	Elevator using PLC. The logic should be solved using ladder diagram technique
12	Conduct experiment to plot the control valve characteristics
13	Demonstration of open ended project using the concept of Experiments 1-12

Course Outcomes:

After completion of this course the student is able to:

1. Design a suitable signal conditioning circuit for the given physical parameter measured using transducer/sensor

2. Calibrate, configure, and tune various real-world instrumentation and control loops on the physical parameters like pressure, temperature, and level training stations.
3. Design and develop a ladder diagram using PLC for simple automation application

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**1**	**1**	**1**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**2**
CO2	**1**	**1**	**2**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**1**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**1**	**1**	**1**

Subject Title : **VLSI Lab**		
Sub Code : **EIL76**	No of credits : 1.5=0:0:1.5 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 13

Analog experiments

Design the schematic and layout of following with the given specification, and verify Transient, DC and AC analysis

a) Inverter
b) NOR gate
c) NAND gate
d) Common source amplifier
e) Common drain amplifier
f) Differential amplifier

ii) Digital experiments

Write RTL and test bench code to realize and synthesis the following logic circuits

a) Inverter
b) Universal gates
c) D flipflop
d) SR flipflop
e) JK flipflop
f) T-flipflop
g) Half adder
h) Fulladder

Subject Title : **Smart Sensors**		
Sub Code : **EI811**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

1. Students will be studying The overview of how smart sensors have the capabilities beyond simple signal conditioning
2. New capabilities being extended with term smart power referring to semiconductor power technologies that combine an output power device with control circuitry on the same silicon chip
3. Students will be aware of Communication network protocols for smart sensor using automotive and CAN protocols and other aspects of network communication
4. Students will get to know about the Reliability implications, testing of smart sensor and also the packaging techniques.

Unit No	Syllabus	No of Teaching hours
1	**Basics Of Smart Sensors & Micromachining:** Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining, other micromachining techniques.	**08 Hours**
2	**Sensor Information To Mcu:** Introduction, amplification and signal conditioning, separate versus integrated signal conditioning, digital conversion. **Mcus And Dsps To Increase Sensor Iq:** Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration.	**08 Hours**
3	**Communications For Smart Sensors :** Introduction, definitions and background, sources and standards, automotive protocols, industrial networks, office & building automation, home automation, protocols in silicon, other aspects of network communications. **Control Techniques:** Introduction, state machines, fuzzy logic, neural networks, combined fuzzy logic and neural networks, adaptive control, other control areas.	**08 Hours**
4	**Packaging, Testing And Reliability Of Smart Sensors:** Introduction,	**07 Hours**

	Semiconductor packaging applied to sensors, hybrid packaging, packaging for monolithic sensors, reliability implications, testing smart sensors. Unit Standards for Smart Sensors: Introduction, setting the standards for smart sensors and systems, IEEE 1451.1, IEEE 1451.2, IEEE P1451.3, IEEE 1451.4, extending the systems to network**.**	
5	**Implications Of Smart Sensor Standards And Recent Trends:** Introduction, sensor plug-and-play, communicating sensor data via existing wiring, automated/remote sensing and web, process control over the internet, alternative standards, HVAC sensor chip, MCU with integrated pressure sensors, alternative views of smart sensing, smart loop.	**08 Hours**

Course Outcomes:

After completion of this course the student is able to:

1. A good knowledge of alternate views of smart sensor will allow the engineers to explore the new capabilities of using smart senor replacing the existing sensor
2. Students will able to acknowledge recent industry efforts on definition functionality and communication standards
3. Engineers could know how a smart sensor with appropriate local decision making capability, can act as a standalone sensor, communicate in peer-to-peer relationship to other sensors or actuators, or act as an intelligent node in the network
4. Students will be equipped with the basics of how industry standards for smart sensors including IEEE1451 family and others that have been initiated for control applications

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2
CO4	3	2	3	2	2	3	2	1	2	2	1	2

Text Book:

1. **Understanding Smart Sensors**- Randy Frank, Artech House Publications, 2nd Edition 2000.

Reference Book:

1. Smart Sensors- Paul W. Chapman, ISA Press.1996

Subject Title : **Low Power VLSI**		
Sub Code : **EI 812**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

The main objective of the course is to

1. To study the concepts on different levels of power estimation and optimization techniques
2. Understand the Impact of Scaling technology and transistor sizing in chip design
3. To provide the knowledge to analyze and estimate the power conception in the Architectural level

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices. **Device & Technology Impact On Low Power:** Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation	**08 Hours**
2	**Power Estimation, Simulation Power Analysis:** SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.	**08 Hours**
3	**Low Power Architecture & Systems:** Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.	**07 Hours**
4	**Low Power Clock Distribution:** Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co-design of clock network	**08 Hours**
5	**Algorithm & Architectural Level Methodologies:** Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis	**08 Hours**

Course outcomes:

At the end of the course, the student is able to

1. Understand the concepts on different levels of power estimation and optimization techniques
2. Understand and apply the knowledge on Scaling technology in chip design

3. Apply the knowledge to analyze and estimate the power conception in the Architectural level

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2

Text Books:

1. **Practical Low Power Digital VLSI Design**-Gary K. Yeap, KAP, 2002
2. **Low power design methodologies Rabaey, Pedram**-Kluwer Academic, 1997.

Reference Book:

1. **Low-Power CMOS VLSI Circuit Design**-Kaushik Roy, Sharat Prasad, Wiley, 2000.

Subject Title : **Wireless Communication**		
Sub Code : **EI 813**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. Is to introduce the student to the concepts of cellular communication. Various modulation techniques, Propagation methods, coding and multiple access techniques used in wireless Communication.
2. Study the second generation digital cellular networks in detail.

Unit No	Syllabus	No of Teaching hours
1	**Introduction**: Application and requirements of wireless services, History, types of services, requirements for services, Economical and social aspects. Spectrum limitations, limited energy, user mobility	**08 Hours**
2	**The Cellular concept**: System design fundamentals: Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trucking and Grade of service, Improving coverage and capacity in cellular system	**07 Hours**
3	**Mobile radio propagation**: Large scale path loss – Introduction to Radio wave propagation, free space propagation model, relating power to electric field, Reflection, Ground Reflection model, Diffraction, scattering. Small scale fading- small-scale multipath propagation, Impulse response model of a multipath channel, small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading	**08 Hours**
4	**Equalization and Diversity**: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in communication receiver, Survey of Equalization Techniques, Linear and non-linear equalization, Algorithms for Adaptive Equalization, Fractionally Spaced equalizers, Diversity techniques, RAKE receivers.	**08 Hours**
5	**Global System for Mobile communication**: System overview, The air interface, Logical and physical channels, synchronization, coding , circuit switched data transmission, Establishing a communication and handoff, Services and billing.	**08 Hours**

Course Outcomes:

After completion of this course the student is able to

1. Understand and explain the concepts of cellular communication techniques.
2. Understand and explain the various modulation techniques,

3. Explain the various propagation methods, coding and multiple access techniques used in wireless communication.
4. Analyze concept of second generation digital cellular networks in detail.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**2**
CO2	**1**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**1**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**1**	**2**
CO4	**1**	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**1**	**2**
CO5	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**2**

Text Books:

1. Wireless Communication- Andreas F Molish, Wiley Student, 2nd Edition (Units 1&5)
2. Wireless Communication- Principles and Practice, Theodre S Rapp port 2nd edition, Second Edition (Units 2, 3&4)

Reference Books:

1. **Mobile Communications engineering, Theory and applications**-2nd Edition, WILLIM C.Y. LEE, McGraw-Hill, 1997, Singapore.
2. **Introduction to Wireless and Mobile Systems**-Second edition, Dharma Prakash Agarwal, Qing An Zeng, 2nd Edition, THOMSON, 2007.
3. **Electronic Communications systems Fundamentals through advanced**-5th Edition, Wayne Tomasi, Pearson education 2007.

Subject Title : **Industrial Instrumentation**		
Sub Code : **EI 814**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. Impart knowledge on practices in process industry
2. Explain steel production instrumentation
3. To draw and Illustrate the Food industry and in paper and pulp industry instrumentation system
4. Analyze the various operations in Electric Power Generation &Distribution
5. Distinguishing Nuclear Reactor Instrumentation and Air space Instrumentation.

UNITS		**Hours**
1	**Instrumentation Practices In Process Industries:** Department functions and responsibilities, development, process analysis, maintenance, standardization, economics of process instrumentation. **Steel production instrumentation** : Selection of instruments, black furnace instrumentation, open-hearth process instrument, End product measurement, continuous casting of steel	08 Hours
2	**Food industry instrumentation** (Block diagram approach): Instrumentation in brewing, canning industry, baking, dairy industries. Steam power plant instrumentation, Instrument selection, primary and secondary plant measurement.	07 Hours
3	**Paper And Pulp Instrumentation** (Block Diagram Approach): Different types of pulping, pulp bleaching, pulp blending, wet end and drier instrumentation	08 Hours
4	**Electric Power Generation & Distribution Control**: General characteristics of interconnected systems, classification of economy dispatch control systems, Digital computer for economy dispatch applications.	08 Hours
5	**Nuclear Reactor Instrumentation:** Nuclear reactor dynamics, reactor instrumentation, reliability aspects of protective systems **Air Space Instrumentation:** Air craft's and aerospace vehicle instrumentation, air flight simulation instrumentation.	08 Hours

TEXT BOOK:

1. Hand book of applied instrumentation-CONSIDINE and ROSS,Publisher McGraw-Hill.

REFERENCE BOOKS:

1. Industrial instrumentation- by DONALD P. ECKMAN, Wiley 10 th reprint
2. Industrial Instruments- by K.Krishnaswamy, S.Vijayachitra, New age International publishers.
3. Food Processing Principles & Applications- J.S.Smith, University press (US) 2004.
4. Process Control Fundamentals for the pulpe-paper Industry.Nancy Jean Sell, Tappi(June 1997) ISBN-978-0898522945.

COURSE OUTCOMES

After completion of this course the student is able to

CO1: To identify the practical challenges in process industry

CO2: Explaining instrumentation in Steel production

CO3: Illustrate the instrumentation in Food industry and in paper and pulp with block diagram
CO4: Analyze the various operations in Electric Power Generation &Distribution
CO5: Distinguishing Nuclear Reactor and Air space Instrumentation system.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2
CO4	3	2	3	2	2	3	2	1	2	2	1	2
CO5	3	2	3	2	3	2	3	1	2	2	2	3

Subject Title : **Biomedical DSP**		
Sub Code : **EI 821**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. To understand the fundamental concept of biomedical signal detection and estimation.
2. To understand the concept of various noise sources and the filtering techniques.
3. To understand and analyse the various ECG Data Réduction Techniques

Unit No	Syllabus	No of Teaching hours
1	**Introduction to Biomedical Signals:** The nature of biomedical signals, The action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis. **Neurological Signal Processing**: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis	**08 Hours**
2	**Linear Prediction Theory**: The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- the case of epileptic patients, overall performance. **Sleep Eeg**: Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modeling sleep	**08 Hours**
3	**Adaptive Interference/Noise Cancellation** : A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the	**08 Hours**

	Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, Canceling Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery	
4	**Cardiological Signal Processing:** Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording.	**08 Hours**
5	**ECG Data Reduction Techniques:** Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Transformation compression techniques, other data compression techniques, Data compression techniques comparaison.	**07 Hours**

Course Outcomes:

After successful completion the student is able to:

1. To understand and explain the fundamental concept of biomedical signal detection and estimation.
2. To understand and explain the concept of various noise sources and the filtering techniques.
3. To understand and analyse the various ECG Data Réduction Techniques

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2

Text Books:

1. **Biomedical Signal Processing Principles and Techniques**- by D C Reddy, The McGraw-Hill publications 2006.
2. **Biomedical Signal Analysis a case study approaches**- by Rangaraj M. Rangayyan The John Wiley publications 2002.

Reference Book:

1. **Biomedical Digital Signal Processing-**by Willis J. Tompkins, The Prentice Hall of India publications 1995

Subject Title : **Lasers & Optical Instrumentation**		
Sub Code : **EI 822**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

1. To introduce the basic concepts of Lasers, Laser Instruments, optical Fibers and their applications in the field of Instrumentation.
2. To understand the basic principles of opto electronic devices like photo transistor, photodiodes etc
3. To understand the concepts of different optical fiber sensors like optic gyroscope, rotation sensors, polarimetric sensors

Unit No	Syllabus	No of Teaching hours
1	**Lasers:** Principles, classification, construction of Ruby, He-Ne, Nd-YAG, semiconductor, Argon and Carbon dioxide lasers. Characteristics of stabilization, Q-switching and mode locking, frequency stabilization, Line shape function, lasing threshold, application of lasers in engineering and medicine, safety with lasers.	**08 Hours**
2	**Laser Instruments:** Laser interferometry, laser strain gauges, velocimetry, pulse echo technique, beam modulation telemetry and holography, application of holography, laser welding, laser machining and laser spectroscopy	**08 Hours**
3	**Optoelectronic Devices And Components:** Photo diodes, PIN diodes, solar cells, LED's phototransistors, opto-isolators, photocouplers.	**07 Hours**
4	**Fiber Optics:** Light Modulation schemes, optical fibers, intermodal dispersion, graded index fiber, low dispersive fibers Fiber losses, fiber materials, integrated optics, optical bistability, laser printing, optical multiplexers	**08 Hours**
5	**Optical Fiber Sensors:** Multimode passive and active fiber sensors, Phase modulated sensors, fiber optic gyroscope, Polarization: polarimetric sensors, polarization, and rotation sensors	**08 Hours**

Course Outcome:

At the end of the course, the student is able to

1. Distinguish the different types of Lasers and laser instruments
2. To apply laser in Instrumentation and Biomedical applications

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	

Text Books:

1. **Optoelectronics**-Wilson & Hawkes, Prentice Hall of India 2003
2. **Laser principles and applications**-Wilson and Hawkes, Prentice Hall of India 1983

Reference Books:

1**. Essentials of Opto Electronics with Applications-** A.J.Rogers, CRC Press.
2. **"Optical Fiber Communications Principles and Systems"** A. Selvarajan, S Kar and T Srinivas. Tata Mcgraw Hill, 2006
3. Solar Energyî, by S. P. Sukhatme, Tata McGraw Hill, New Delhi,1996

Subject Title : **Computer Networks**		
Sub Code : **EI 823**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

The main objective of this course is to:

1. Build an understanding of the fundamental concepts of computer networking
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.
4. To detect the network errors and corrections

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** Uses of Computer Networks, Network Hardware-LAN,MAN,WAN, Wireless, Network Software- protocol hierarchies, design issues for the layers, connection oriented and connectionless services, Reference Models-OSI, TCP/IP, comparison of the OSI and TCP/IP **The Physical Layer**: The Theoretical Basis for Data Communication-fourier analysis, band limited signals, maximum data rate of a channel, Guided Transmission Media- magnetic media, Twisted pair, Coaxial cable, Fibre optics, Wireless Transmission-electromagnetic spectrum, radio transmission, microwave transmission, Communication Satellites- geostationary, medium earth orbit, low earth orbit, satellite versus fiber, The Public Switched Telephone Network-structure ,polices, local loop.	**08 Hours**
2	**The Data Link Layer:** Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols-an unrestricted simplex protocol, A simplex stop – and – wait Protocol, Sliding Window Protocols, Protocol Verification	**08 Hours**
3	**The Medium Access Control Sub Layer:** The Channel Allocation Problem, Multiple Access Protocols-ALOHA, carrier sense multiple access , Collision free, Ethernet-cabling, Manchester coding, The Ethernet MAC Sublayer Protocol, Wireless LANS-802.11 Protocol Stack, physical layer	**07 Hours**
4	**The Network Layer:** Network Layer Design Issues-store-and- Forward Package Switching, services provided to transport layer, Routing Algorithms-the optimality principle, shortest path routing, flooding, distance vector routing, Congestion	**08 Hours**

	Control Algorithms-general principles, prevention polices, virtual circuit subnets,datagram subnets, jitter control	
5	**The Transport Layer:** The Transport Service-services provided to the upper layers, transport service primitives, A Simple Transport Protocol-addressing, connection establishment, connection release, flow control and buffering, The Internet Transport Protocols -TCP and UDP. **The Application Layer:** Domain Name System (DNS)-name space, resource records, electronic mail-services, the user agent, message format, worldwide web-static and dynamic web documents.	**08 Hours**

Course Outcomes:

After completion of this course the student is able to:

1. understand basic computer network technology
2. Identify the different types of network topologies and protocols
3. Identify the different types of network devices and their functions within a network

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2

Text Books:

1. Computer Networks: Andrews S. Tanenbaum, 4th Edition, Pearson Education,2010.

Reference Books:

1. ATM Networks concepts and Protocols - Sumit Kasera Tata Mc Graw Hill 2nd edition, 2008

2. **Data and computer networks**- W STALLINGS 5th Edition, Prentice Hall of India 1998.

Subject Title : **Speech Signal Processing**		
Sub Code : **EI 824**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. The objective of the course is to develop an understanding of how speech signals are processed in three general areas: Analysis, Synthesis, and Recognition.
2. To understand and analyze the representations of the speech waveform
3. To understand and analyze the linear predictive coding of speech and its applications

Unit No	**Syllabus**	**No of Teaching hours**
1	**Digital Models For Speech Signals:** Process of Speech Production, Lossless tube models, Digital models for Speech signals. Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function	**08Hours**
2	**Time Domain Models For Speech Processing:** Time Dependent processing of speech, Short time Energy and average magnitude, Short time average zero crossing rate, Speech Vs silence discrimination using energy and zero crossing.	**08Hours**
3	**Digital Representations Of The Speech Waveform:** Sampling speech signals, Review of the statistical model for speech, Instantaneous quantization, Adaptive Quantization, General theory of differential quantization, Delta modulation	**07 Hours**
4	**Linear Predictive Coding Of Speech:** Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Applications of LPC parameters**.** **Speech Synthesis:** Principles of Speech synthesis, Synthesis based on waveform coding, analysis synthesis method, speech production mechanism, Synthesis by rule, Text to speech conversion.	**08 Hours**
5	**Speech Recognition:** Principles of Speech recognition, Speech period detection, Spectral distance measures, Structure of word recognition systems, Dynamic time warping (DTW), Word recognition using phoneme	**08 Hours**

Course Outcomes:

After completion of this course the student is able to:

1. Develop an understanding of speech signals are processing in three general areas: Analysis, Synthesis, and Recognition.
2. understand and analyze the representations of the speech waveform
3. understand and analyze the linear predictive coding of speech and its applications

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	2	3	2	3	1		1
CO2	2	1	2	1		3	2	1	3	1	1	
CO3	3	1	2	3	1	2	2					2

Text Books:

1. **Digital Processing of Speech Signals**- L R Rabiner and R W Schafer, Pearson Education 2004.
2. **Digital Speech Processing**- Synthesis and Recognition, Sadoaki Furui Mercel Dekker, 2nd Edition, 2002.

Reference Books:

1. **Introduction to Data Compression**- Khalid Sayood, Elsivier Publications, 3rd Edition, 2006.
2. **Digital Speech**-A M Kondoz, Wiley Publications 2nd Edition, 2004