UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VII SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING

SCHEME -2013

VII SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING (A)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.701	Nanoelectronics (AT)	3	2	1	-	50	3	100	150
13.702	CMOS Circuits Design (A)	4	3	1	-	50	3	100	150
13.703	Discrete-Time Control Systems (A)	4	3	1	-	50	3	100	150
13.704	Industrial Instrumentation (A)	4	3	1	-	50	3	100	150
13.705	Elective III	3	2	1	-	50	3	100	150
13.706	Elective IV	3	2	1	-	50	3	100	150
13.707	Power Electronics & Drives Lab (A)	3	-	-	3	50	3	100	150
13.708	Process Control Lab (A)	3	-	-	3	50	3	100	150
13.709	Seminar (AT)	1	-	-	1	50	-	-	50
13.710	Project Design (AT)	1	-	-	1	50	-	-	50
	Total	**29**	**15**	**6**	**8**	**500**		**800**	**1300**

13.705 Elective III

13.705.1	Pattern Recognition (AT)
13.705.2	Automotive Electronics (A)
13.705.3	Industrial Safety and Management (A)
13.705.4	Power Plant Instrumentation (A)
13.705.5	Biomedical Imaging Techniques (A)

13. 706 Elective IV

13.706.1	Intellectual Property Rights (AT)
13.706.2	MEMS (AT)
13.706.3	Embedded Systems (AT)
13.706.4	Control of Power Converters(A)
13.706.5	Instrumentation & Control in Petrochemical Industries (A)
13.706.6	Instrumentation System Design(A)

13.701 NANOELECTRONICS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *Explain the fundamental science and quantum mechanical effects associated with low dimensional semiconductors.*
- *Identify the significance of nanolevel fabrication of particles and layers and their characterization.*
- *Correlate the concept of quantum level transport and tunnelling in similar structured nano devices.*
- *Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.*

Module – I

Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics.

Mesoscopic Physics and Nanotechnologies - trends in Microelectronics and Optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence, Quantum wells ,wires and dots, Density of states and dimensionality The physics of low dimensional structures - basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots.

Module – II

Introduction to methods of fabrication of nanonaterials-different approaches. fabrication of nano-layers -Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxy- Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide.

Fabrication of nanoparticle- grinding with iron balls, laser ablation, reduction methods, sol gel, self assembly, precipitation of quantum dots.

Introduction to characterization tools of nano materials-principle of operation of STM, AFM, SEM, TEM, XRD, PL & UV instruments.

Module – III

Semiconductor quantum nanostructures and super lattices, MOSFET structures, Heterojunctions, modulation doped quantum wells, multiple quantum wells. The concept of super lattices Kronig - Penney model of super lattice.

Transport of charge in Nanostructures under Electric field - parallel transport, perpendicular transport, quantum transport in nanostructures Transport of charge in magnetic field and

quantum Hall effect - Effect of magnetic field on a crystal, the Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect.

Module – IV

Nanoelectonic devices and systems , MODFETS, heterojunction bipolar transistors, resonant tunnel effect, RTD, RTT, hot electron transistors, Coulomb blockade effect and single electron transistor, CNT transistors, heterostructure semiconductor laser, quantum well laser, quantum dot LED, quantum dot laser, quantum well optical modulator, quantum well sub band photo detectors, Infrared detector, nanoswitches, principle of NEMS.

References:

1. Martinez-Duart J. M., R. J. Martin Palma and F. Agulle Rueda, *Nanotechnology for Microelectronics and Optoelectronics*, Elsevier, 2006.
2. Fahrner W. R., *Nanotechnology and Nanoelctronics*, Springer, 2005
3. Chattopadhyay and Banerjee, *Introduction to Nanoscience & Technology*, PHI, 2012.
4. Poole, *Introduction to Nanotechnology*, John Wiley 2006.
5. George W. Hanson, *Fundamentals of Nanoelectronics*, Pearson Education, 2009.
6. Goser K., P. Glosekotter, J. Dienstuhl, *Nanoelectronics and Nanosystems*, Springer 2004.
7. Supriyo Dutta, *Quantum Transport- Atom to Transistor*, Cambridge, 2013.
8. Murty,Shankar ,*Text book of Nanoscience and Nanotechnology*, Universities Press, 2012.
9. Pradeep, *Nano the Essentials*, McGraw Hill, 2007.
10. Ramsden, *Nanotechnology*, Elsevier, 2011.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain 20 % Analysis/Numerical Problems.*

Course Outcome:

After the successful completion of the course the student will be able to

- *Explain the fundamental science of low dimensional semiconductors.*
- *Know the fabrication of nanoparticles and their characterization.*
- *Correlate the concept of quantum level transport and tunneling in nano devices.*
- *Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.*

13.702 CMOS CIRCUIT DESIGN (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn about the concepts of CMOS based Circuit Design*
- *To learn about various CMOS structures.*

Module – I

Basic CMOS device physics, CMOS I/V characteristics. CMOS processing, CMOS device layout and design rules, device capacitance. MOS amplifiers –CS, CD, CG and cascode amplifiers, gain and frequency response. MOS Differential Amplifiers, MOS load, Current source, Current mirror, cascode load.

Module – II

MOS Sample-and-Hold Circuits, Current and Voltage reference, Bandgap Voltage reference, Proportional-to-absolute-temperature (PTAT) current generation and constant Gm biasing. Translinear gain cell, Trans linear multiplier.

Module – III

MOS Operational Amplifiers, single stage-cascode and folded cascode CMOS op-amp. Advanced current mirrors – Wide swing current mirror, wide swing constant trans conductance bias circuit, enhanced output impedance current mirror.

Module – IV

CMOS oscillators – ring oscillators, LC oscillators, CMOS VCO, CMOS PLL, non-ideal effects in PLL, delay locked loops and application. CMOS data converters -Medium and High-speed CMOS data converters- Over sampling converters. CMOS comparators, multipliers and wave shaping circuits. CMOS inverters – static and dynamic characteristics. Domino and NORA logic, combinational and sequential circuits.

References:

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, TMH, 2002.
2. Jacob Baker R, Harry W. Li, David E. Boyce, *CMOS Circuit Design, Lay out and Simulation*, IEEE Press, 2002.
3. Paul R. Gray, Paul J. Hurst *et. al.* , *Analysis and Design of Analog Integrated Circuits*, Wiley India 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will familiar with CMOS structures and develop knowledge in CMOS based circuit design.

13.703 DISCRETE – TIME CONTROL SYSTEMS (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To learn about design aspects of discrete time control systems*
- *To learn in detail about state space analysis and optimal control.*

Module – I

Introduction to Digital control system. Z plane analysis of discrete control systems – Impulse sampling and data hold - pulse transfer function - Realization of digital controllers. Design of discrete time control systems by conventional methods - Mapping between the S plane and the Z plane. Stability analysis in the Z plane. Transient and steady state response analysis. Design based on the root locus and frequency response methods.

Module – II

State space analysis – State space representations – Solving discrete time state space equations – pulse transfer function matrix – Discretization of continuous time state space equations – Liapunov stability analysis.

Module – III

Pole placement and observer design – Introduction – controllability – observability Transformations in state space analysis and design – design via pole placement – state observers – servo systems. Polynomial equation approach to control systems design - Introduction – Diophantine equation –Design – Design of model matching control systems.

Module – IV

Optimal control – Introduction – Discrete Euler– Lagrange equation – Time optimum control with energy constraint - Design of optimal linear digital regulator – Principle of optimality and dynamic programming – Solution of the discrete Riccati equation – Sampling period sensitivity. Quadratic optimal control systems – Introduction – Steady state quadratic optimal control.

References:

1. Ogata K., *Discrete-time Control Systems*, 2/e, Pearson Education.
2. Kuo B. C, *Digital Control Systems,* 2/e, Oxford University press.
3. Phillips C. L. and Nagle H. T, *Digital Control System Analysis and Design*, 3/e, Prentice-Hall.

4. Astrom K. J and Wittenmark, *Computer Controlled Systems Theory and Design*, 2/e, Prentice-Hall.
5. Gopal M., *Digital Control and State Variable Methods*, Tata McGraw Hill, 2006.
6. Charles L. Phillips, H. Troy Nagle, *Digital Control System Analysis and Design*, ISA Press, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, the students will be familiar with discrete time control systems and various aspects of optimal control.

13.704 INDUSTRIAL INSTRUMENTATION (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To give an understanding of working of various instruments used in industrial fields.*
- *To study the recent trends in industrial instrumentation.*

Module – I

Measurement of force torque, velocity Electric balance – different types of load cells – magnets - elastics load cell - strain gauge load cell-different methods of torque measurement, strain gauge, relative regular twist-speed measurement-revaluation counter-capacitive tacho-drag up type tacho D.C and A.C tacho generators – stroboscope.

Measurement of acceleration, vibration and density Accelerometers – LVDT, piezo- electric, strain gauge and variable reluctance type accelerometers - mechanical type vibration instruments – seismic instrument as an accelerometer and vibrometer - calibration of vibration pick-ups – units of density, specific gravity and viscosity used in industries - Baume scale API scale.

Module – II

Pressure Measurement: Units of pressure – manometers – different types – elastic type pressure gauges – Bourde type bellows – diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – capacitive type pressure gauge – piezo resistive pressure sensor – resonator pressure sensor – measurement of vacuum – McLeod gauge – thermal conductivity gauges – Ionization gauge cold cathode and hot cathode types – testing and calibration of pressure gauges – dead weight tester.

Module – III

Temperature measurement: Definitions and standards – primary and secondary fixed points - calibration of thermometers different types of filled in system thermometer – sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Industrial RTDs and their characteristics –3 lead and 4 lead RTDs.

Module – IV

Measurement of viscosity, humidity and moisture: Viscosity terms – say bolt viscometer – rotameter type viscometer – industrial consistency meters – humidity terms – dry and wet bulb psychrometers - hot wire electrode type hygrometer – dew cell – electrolysis type hygrometer – commercial type dew point meter – moisture terms – different methods of

moisture measurement – moisture measurement in granular materials, solid penetrable materials like wood, web type material.

Principle and constructional details of electromagnetic flow meter – different types of excitation –schemes used – different types of ultrasonic flow meters – laser doppler anemometer systems – rortex shedding flow meter – target flow meter – solid flow rate measurement – guidelines for selection of flow meter.

References:

1. Ernest O. Doebelin, *Measurement systems Application and Design*, 4/e, McGraw Hill.
2. Patranabis D., *Principles of Industrial Instrumentation*, 2/e, TMH.
3. Sawhney A. K., *A course in Electrical and Electronic Measurement and Instrumentation* – Dhanpat Rai & Sons, 2004.
4. Nakra B. C. and K. K. Chaudary, *Instrumentation Measurement and Analysis*, TMH, 1985.
5. Willard, Merritt, Dean and Settle, *Instrumental Methods of Analysis*, 7/e, CBS Publishers, India.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, students will be familiar with terminologies used in industrial instrumentation systems and will get exposed to use and working of various instruments used in industries.

13.705.1 PATTERN RECOGNITION (AT) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *Introduce pattern classification and structural pattern recognition.*
- *Discuss topics like feature extraction, Bayesian decision theory, nearest-neighbour rules, clustering, support vector machines.*
- *Understand neural networks, classifier combination, and syntactic pattern recognition techniques such as stochastic context-free grammars.*

Module – I

Basics of pattern recognition. Bayesian decision theory- Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features. Parameter estimation methods - Maximum-Likelihood estimation.

Module – II

Gaussian mixture models, Expectation-maximization method, Bayesian estimation. Hidden Markov models for sequential pattern classification - Discrete hidden Markov models, Continuous density hidden Markov models. Dimension reduction methods, Fisher discriminant analysis.

Module – III

Principal component analysis. Non-parametric techniques for density estimation - Parzen-window method, K-Nearest Neighbour method.

Linear discriminant function based classifiers – Perceptron Support vector machines.

Module – IV

Non-metric methods for pattern classification - Non-numeric data or nominal data, Decision trees, Cluster validation. Unsupervised learning and clustering - Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods.

References:

1. Duda R. O., P.E.Hart and D.G.Stork, *Pattern Classification*, John Wiley, 2001.
2. Theodoridis S. and K. Koutroumbas, *Pattern Recognition*, 4/e, Academic Press, 2009.
3. Bishop C.M., *Pattern Recognition and Machine Learning*, Springer, 2006.
4. Castleman K. R., *Digital Image Processing*, Prentice Hall of India, 1996.
5. Chou W. and B.H. Juang, *Pattern Recognition in Speech and Language Processing*, CRC Press, 2003.
6. Tou J. I. and R. C. Gonzalez, *Pattern Recognition Principles*, Addition Wesley, 1974.

7. Schalkoff R., *Pattern Recognition -Statistical, Structural and Neural Approaches*, John Wiley, 1992.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 20%* problems, derivations, proof and algorithms.

Course Outcome:

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

- *Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.*
- *Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.*
- *Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.*
- *Apply pattern recognition techniques to real-world problems such as document analysis and recognition.*
- *Implement simple pattern classifiers, classifier combinations, and structural pattern recognition*

13.705.2 AUTOMOTIVE ELECTRONICS (A) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To learn about various electronic systems used in automobiles.*
- *To learn different embedded systems in advanced vehicle systems.*

Module – I

Automotive Mechanical Systems: Vehicle systems: Power train system {Air System, Fuel system {Carburetor & fuel injection, Ignition system, Exhaust System and other Auxiliary Systems {Cooling, Lubrications & Electrical systems}}, **Transmission System** {Front, Rear & 4-wheel drive, Manual, Automatic Transmission, Differential}. **Braking System** (Drum, Disc, Hydraulic Pneumatic), **Steering System** (Rack and Pinion, Power steering).

Need for Electronics in Automotive systems: Performance (Speed, Power and Torque), Control (Emission, Fuel Economy, Drivability and Safety) & Legislation (Environmental legislation for pollution & Safety Norms).

Module – II

Overview of Vehicle Electronic Systems: Basic electrical components and their operation in an automobile: Power train subsystem (Starting systems, charging systems – ignition systems – Electronic fuel control), Chassis subsystem (ABS, TCS and ESP) – Comfort and safety subsystems (Night Vision, Airbags, Seatbelt Tensioners, Cruise Control – Lane-departure-warning, Parking).

Embedded Systems Definition: Components of Embedded systems: **Hardware Module**: Microprocessor, Microcontrollers, On-Chip peripherals: Program Memory(PM), Data Memory (DM), Parallel Port Structures, Timer, Input Capture & Output Compare Units, ADC, PWM, Introduction to an Embedded board.

Module – III

Embedded Systems Software Module: IDE – Getting Started: Creating a new project, creating new files, adding files to project, compile, build, debug and simulation of a project. Embedded system programming: Up-loaders, ISP, ROM Emulators, In-Circuit Emulators.

Debug Interfaces: BDM and JTAG. **Introduction to Embedded RTOS:** Comparison of Conventional OS with RTOS. Tasks & Task states (Pre-emptive & Non-pre-emptive, Scheduler, Interrupt – interrupt latency and Context Switch Latency) – Task, multi-tasking, Task synchronization, Inter-task communication, Shared data problem and its prevention – Features of typical embedded RTOS (µC/OS-II).

Module – IV

Embedded System in Automotive Applications: Engine management systems – Gasoline/ Diesel systems, various sensors used in system – Electronic transmission control – **Vehicle safety system** – Electronic control of braking and traction – **Body electronics – Infotainment systems – Navigation systems – System level tests** – Software calibration using engine and vehicle dynamometers – Environmental tests for Electronic Control Unit – Application of Control elements and control methodology in Automotive system. **Embedded System Communication Protocols: Introduction to control networking – Communication protocols in embedded systems** – SPI, I^2C, USB **– Vehicle communication protocols –** CAN, LIN, FLEXRAY, MOST, KWP2000.

References:-

1. BOSCH *Automotive Handbook*, 6th Edition.
2. Jean J. Labrosse, *(µC/OS-II) Real Time Kernel.*
3. Ronald K. J., *Automotive Embedded System Handbook,* 2009.
4. Denton T., *Automobile Electrical and Electronic Systems.*
5. Knowles D., *Automotive Electronic and Computer Controlled Ignition Systems.*
6. William T.M., *Automotive Electronic Systems.*
7. Joerg Schaeuffele, Thomas Zurawka, *Automotive Software Engineering – Principles, Processes, Methods and Tools.*
8. Jorg Schauffer, *Automotive SW Engineering* SAE Publications.
9. Raj Kamal, *Embedded System Architecture, Programming and Design*, Tata McGraw Hill, First reprint, 2003.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, the students will be familiarized with various electronic systems in automobiles with emphasis on embedded systems in advanced vehicle systems..

13.705.3 INDUSTRIAL SAFETY AND MANAGEMENT (A) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To learn about the aspects of safety in industries.*
- *To learn about the management of safety in industrial environments.*

Module – I

Safety, Health and Environment Management Systems. Occupational Health and Safety Management Systems as per OHSAS-18001 Standard and OSHA. Overview of Industrial Safety Management. Security Management of Industrial Plants. Organization, Administration and Management Responsibility in the Field of Safety. Legal Aspects of Safety. Safe Working Practices Personal Protective Equipment and Protective Costumes. Storage and Handling of Material and Equipment. Safety in Transportation and Automotive Equipments.

Module – II

Electrical Safety, Electrical Shocks and Their Prevention. Mechanical Hazards. Chemical Hazards. Environmental Hazards. Radiation Hazards. Safety in Hazardous Area. Industrial Safety Analysis. Risk Analysis and Risk Management. Industrial Noise and Noise Control. Industrial Psychology, Ergonomics and Accidents. Work Permit System. Safety in Power Plants.

Module – III

Fire Prevention and Fire fighting in Plants. Portable Fire Extinguishers. Fire Detection, Fire Alarm and Fire Fighting Systems. Building Design and Fire Protection. Plant Layout and Design Material. Industrial Safety. Safety during Project Construction. Safety Management of Plants During Commissioning and Maintenance. Safety Training for Employees and Human Resource Development. Social Security in Industries. Insurance Policies for Project Construction, Operation and Maintenance.

Module – IV

Important Ingredients of Health. Occupational Health. First Aid. Health Care as per Naturopathy. Exercises for Healthy Living. Yoga for Health. General Care of Heart and Its Related Diseases. Ayurveda. Homeopathy. Other Sciences to Cure diseases. Occupational Health and Industrial Hygiene. Environment. Degradation of Environment. Major Challenges for Development. Controlling Environmental Pollution. Water Pollution. Environmental Guidelines for Power Plants and Infrastructure Development. Energy, Conservation, Efficiency and Audit. Sustainable Development. Disaster Management.

References:

1. Sunil S Rao and R K Jain, *Industrial Safety, Health and Environment*, 3rd edition, Khanna Publishers,
2. Desh Mukh L. M., *Industrial safety Management*, TMH,2005
3. Mishra R. K., *Construction Safety*, AlTBS publishers, India,2013
4. Rao S. and R. K. Jain, *Electrical Safety, Fire Safety Engineering and Safety Management*, Khanna Publishers, 2012
5. Akhil Kumar Das, *Principles of Fire Safety Engineering*, *Understanding Fire and Fire Protection*, PHI, 2014

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, the students will acquire knowledge on various aspects of safety in industrial environment and its management.

13.705.4 POWER PLANT INSTRUMENTATION (A) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To provide an overview of different methods of power generation*
- *To impart knowledge about the different types of controls and control loops.*
- *To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.*

Module – I

Overview of Power Generation: Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes UP&I diagram of boiler – cogeneration.

Module – II

Measurements in Power Plants: Electrical measurements – current, voltage, power, frequency, power – factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement - radiation detector – smoke density measurement – dust monitor.

Module – III

Control Loops in Boiler: Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – super heater control – attemperator – deaerator control – distributed control system in power plants – interlocks in boiler operation.

Module – IV

Turbine – Monitoring and Control: Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system.

References:

1. Sam G. Dukelow, *The control of Boilers*, instrument Society of America, 1991.
2. Krishna Swamy K. and M. Ponni Bala, *Power Plant Instrumentation*, 2/e., PHI, 2011.
3. *Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing*, Pergamon Press, Oxford, 1971.
4. Elonka S. M. and A. L. Kohal, *Standard Boiler Operations*, McGraw Hill, New Delhi, 1994.
5. Jain R. K., *Mechanical and industrial Measurements*, Khanna Publishers, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiar with different controls and control loops in power plants. The students will acquire knowledge to monitor different parameters like speed, vibration of turbines and their control.

13.705.5 BIOMEDICAL IMAGING TECHNIQUES (A) (Elective II)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To familiarize students with terminologies and transforms used in biomedical Imaging*
- *To impart knowledge about the different imaging techniques used in medical fields.*

Module – I

Historical Perspective, Generic Principles-Modality, Contrast, SNR, Resolution, Toxicity. Mathematical fundamentals- 2D Fourier Transform, Hankel Transform, Radon Transform, K-space. Physics of Projection Radiography.

Module – II

Computerized Tomography-Principles of sectional imaging - Scanner configuration - Data acquisition system - Image formation principles - Conversion of x-ray data in to scan image - 2D image reconstruction techniques - Iteration and Fourier Methods-Types of CT Scanners-Applications.

Module – III

Nuclear Medicine – Radio nuclides- Emission Computed Tomography- PET – SPECT imaging - Gamma Camera. Ultra Sound Imaging – Echo equation – Transducers-Capture and display - Principles of A-mode, B-mode and M-mode display – Beam forming- Pulsed Doppler and phased array systems - Applications of diagnostic ultra sound.

Module – IV

Magnetic Resonance Imaging - Physics of MRI - Pulse sequence- Image acquisition and reconstruction techniques- MRI instrumentation- Magnets-Gradient system- RF coils – Receiver System-Functional MRI -MRI Angiography- Applications of MRI.

References:

1. Albert Macovski, *Medical Imaging Systems*, Prentice Hall, 1983.
2. S Webb, *The Physics of Medical Imaging*, CRC press, 1988.
3. A C Kak, *Principle of Computed Tomography*, IEEE Press New York.
4. Joseph Hornak, *The Basics of MRI*, online at http://www.cis.rit.edu/htbooks/mri
5. G A Hay, *Medical Image Formation Perception and Measurement*, Wiley International, 1976.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, student will be familiar with terminologies used in biomedical imaging and will acquire knowledge of various imaging techniques in biomedical field.

13.706.1 INTELLECTUAL PROPERTY RIGHTS (AT) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To study general features of intellectual property rights.*
- *To study IPR acts of patents, trademarks, design ,copyright, layout design of ICs*
- *To know Indian position in the global IPR structure.*
- *To know the features of TRIPS, PCT, WIPO, EPO, WTO etc.*

Module – I

Intellectual property rights-Introduction, importance, need of IPR, forms of IPR-Trade mark, Patent, Copyright, Design, Semiconductor IC layout design, geographical indication of goods, Trade secret, Protection of plant varieties and farmers rights, biodiversity and traditional knowledge, Indian position in global IPR structure.

Module – II

Trademarks-Introduction, condition and procedure for registration, rights and limitations of registration, infringement of trade mark, remedies against infringement, offences and penalties.

Patents- Meaning and purpose of patent , advantage of patent to inventor, invention not patentable, application for patent, provision for secrecy of certain inventions, grant of patent, rights of patent holder, infringement of patent, offences and penalties, international arrangements.

Module – III

Copyrights- introduction, meaning of copyrights ownership, rights of owner, subject matter of copyrights, international copyrights, infringement, offences and penalties.

Industrial design- Introduction, registration of design, copyrights in registered design Industrial and international exhibitions, infringement, offences and penalties.

Semiconductor IC layout design- Introduction, condition and procedure for registration, Effects of registration, offences and penalties.

Module – IV

IPRs in cyber space, IT related IPR, Computer software and IPR, database and protection, domain name protection, IPRs in pharmaceutical sector, IPRs in fashion industry, IPRs in biotechnology sector.

International treaties- Introduction, TRIPS, PCT, WIPO, EPO, WTO.

References:

1 Sople*, Managing Intellectual Property*, PHI, 4th edition, 2014.

2 Acharya N. K., *Text book on Intellectual Property Rights*, Asia Law House, Hyderabad, 2002.

3 Ganguli, *Intellectual Property Rights*, TMH, Delhi, 2001.

4 Bare acts of (i)The Trademarks Act 1999 (ii) The patents acts 1970 (iii) The copyright act 1957 (iv) Design act 2000 (v)The semiconductor IC layout design act 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, students will be able to

- *Explain the importance of IPR.*
- *Practice in filing trademarks, patents, copyrights, industrial designs and semiconductor IC layout design applications.*
- *Explain the situations of infringement of rights and penalties and other legal aspects.*
- *Write the importance of IT related IPR like domain name and data base protection etc*
- *Review the role of IPR related organizations like PCT,WIPO, EPO, WTO,TRIPS etc*
- *Apply proficiency in communication and documentation.*

13.706.2 MEMS (AT) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To introduce MEMS and micro fabrication.*
- *To study the essential electrical and mechanical concepts of MEMS.*
- *To study various sensing and actuating technique.*
- *To know about the polymer and optical MEMS*

Module – I

History of MEMS Development, Characteristics of MEMS-Miniaturization ,Micro electronics integration - Mass fabrication with precision. Sensors and Actuators - Energy domain. Sensors, actuators Micro fabrication - microelectronics fabrication process- Silicon based MEMS processes- New material and fabrication processing.

Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and Surface micromachining process-structural and sacrificial material.

Module – II

Conductivity of semiconductors, crystal plane and orientation, stress and strain - definition - Relationship between tensile stress and strain- mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam-longitudinal strain under pure bending -deflection of beam- Spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

Module – III

Electrostatic sensing and actuation-Parallel plate capacitor – Application. Inertial, pressure and tactile sensor parallel plate actuator- comb drive. Thermal sensing and Actuations-Thermal sensors-Actuators- Applications. Inertial, flow and infrared sensors Piezoresistive sensors- piezoresistive sensor material.

Module – IV

Piezoresistive sensors- sensor material stress in flexural cantilever and membrane-Application-Inertial, pressure, flow and tactile sensor. Piezoelectric sensing and actuation, Application-Inertial, Acoustic, tactile, flow-surface elastic waves Magnetic actuation- Micro magnetic actuation principle, Deposition of magnetic materials-Design and fabrication of magnetic coil. Polymers in MEMS- polymide, Liquid crystal polymer(LCP)- PDMS – PMMA – Parylene - Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors.

References:-

1. Chang Liu, *Foundations of MEMS,* Pearson Indian Print, 1st Edition, 2012.
2. Gaberiel M. Rebiz, *RF MEMS Theory, Design and Technology,* John Wiley & Sons, 2003.
3. Charles P. Poole and Frank J. Owens, *Introduction to Nanotechnology*, John Wiley & Sons, 2003.
4. Julian W.Gardner and Vijay K. Varadhan, *Microsensors, MEMS and Smart Devices,* John Wiley & Sons, 2001.
5. Tai-Ran Hsu, *MEMS and Micro Systems: Design and Manufacture*, TMH, 2008.
6. Jones T. B. and N. G. Nenadic, *Electromechanics and MEMS*, Cambridge University Press, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 10* % problems, derivations and proof

Course Outcome:

At the end of the course, students will be able

- *To explain the principle of MEMS and micro fabrication.*
- *To know the essential electrical and mechanical concepts of MEMS.*
- *To study various sensing and actuating technique.*
- *To know about the polymer and optical MEMS*

13.706.3 EMBEDDED SYSTEMS (AT) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To have a thorough understanding of the basic structure and design of an Embedded System.*
- *To study the different ways of communicating with I/O devices and standard I/O interfaces.*
- *To study the basics of RTOS for Embedded systems and Micro C/OS-II and VxWorks RTOS.*
- *To study the programming concepts of Embedded Systems.*
- *To study the architecture of System-on-Chip and some design examples.*

Module – I

Introduction to Embedded Systems– Components of an embedded system hardware – Software embedded into the system –Embedded Processors - CPU architecture of PIC and ARM processors – CPU Bus Organization and Protocol.

Design and Development life cycle model - Embedded system design process – Challenges in Embedded system design.

Serial Communication Standards and Devices - UART and HDLC, SCI, SPI - Parallel Port Devices - I^2C Bus, CAN Bus, USB Bus, ISA Bus, PCI and PCI-X Bus.

Module – II

Memory devices and systems - memory map – DMA - I/O Devices – Interrupts - ISR – Device drivers for handling ISR – Memory Device Drivers – Device Drivers for on-board bus.

Real time operating systems -Process, tasks and threads – Operating System Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization.

Module – III

Interrupt Service Routines Handling in RTOS - Inter Process Communication and Synchronization –Signals – Semaphore – Message Queues – Mailboxes – Pipes –Sockets – Remote Procedure Calls (RPCs).

Micro C/OS-II RTOS - System Level Functions – Task Service Functions –Memory Allocation Related Functions – Semaphore Related Functions – VxWorks – Basic Features – System Functions and System Tasks.

Module – IV

Programming concepts of Embedded programming – Features of Embedded C++ and Embedded Java. Software Implementation, Testing, Validation and debugging, system-on-chip.

Design Examples: Mobile phones, ATM machine, Set top box.

References:

1. Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design*, Morgan Kaufman Publishers - Elsevier 3ed
2. Rajkamal, *Embedded Systems Architecture, Programming and Design*, TMH, 2003.
3. Tammy Noergaard, *Embedded Systems Architecture, A Comprehensive Guide for Engineers and Programmers*, Newnes – Elsevier 2ed
4. Steve Heath, *Embedded Systems Design*, Newnes – Elsevier 2ed
5. David E.Simon, *An Embedded Software Primer*, Pearson Education Asia, First Indian Reprint 2000.
6. Frank Vahid and Tony Givargis, *Embedded Systems Design – A Unified Hardware / Software Introduction,* John Wiley, 2002.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, problems based on MATLAB / any other software packages covering the syllabus etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 20 %* problems, derivations and proof.

Course Outcome:

At the end of the course, students will be able to

- *To have a thorough understanding of the basic structure and design of an Embedded System.*
- *To study the different ways of communicating with I/O devices and standard I/O interfaces.*
- *To study the basics of RTOS for Embedded systems and Micro C/OS-II and VxWorks RTOS.*
- *To study the programming concepts of Embedded Systems.*

13.706.4 CONTROL OF POWER CONVERTERS (A) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To learn about various types of power electronic drives*
- *To study the vector control in inverter driven motors and applications of PWM in motor control*

Module – I

Introduction to Motor Drives: Components of Power Electronic Drives, Criteria for selection of Drive components. DC Motor Drives: Equivalent circuit of DC Motor, Block diagram and transfer function.

Module – II

Principle of DC Motor control, two quadrant, three phase converter controlled DC Motor drives, Four-quadrant converter circuit.

Induction Motor Drives: Induction Motor equivalent circuit, Block diagram and transfer function, Speed control by varying stator frequency and voltage.

Module – III

Principle of vector control, Comparison of vector control and scalar control, Voltage source inverter driven induction motor. Synchronous Motor Drives: Basic principles of synchronous motor operation and its equivalent circuit, Methods of control.

Module – IV

Application of PWM in control of DC-DC converters and DC-AC, Classification of PWM, Quasi square wave PWM, Frequency spectrum of PWM signals, Sinusoidal PWM, Space vector PWM, Comparison of SPWM and SVPWM, Selective harmonic elimination PWM, Hysteresis controller.

References:

1. R. Krishnan, *Electric Motor drives – Modeling, Analysis and Control,* PHI, 2008.
2. Umanand L., *Power Electronics Essentials and Applications,* Wiley India, 2009.
3. Ned Mohan *et. al*, *Power Electronics: Converters, Applications and Design*, 2/e, John Wiley.
4. Theodore Wildi, *Electrical Machines, Drives and Power Systems,* 6/e, Pearson Education.
5. Shephered W. and L N Hulley, *Power Electronics & Control of Motor*, Cambridge University Press.

6. Bubey, *Power Electronics Drives*, Wiley Eastern.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, problems based on MATLAB / any other software packages covering the syllabus etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer two full question out of the three from each module. Each question carries 10 marks.

Course Outcome:

After successful completion of the course, the students will be familiarized with various types of power electronic drives and will acquire knowledge about the vector control in inverter driven motors and applications of PWM in motor control.

13.706.5 INSTRUMENTATION & CONTROL IN PETROCHEMICAL INDUSTRIES (A) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits:** 3

Course Objectives:

- *To expose the students to the Instrumentation applied in petrochemical industries.*
- *To expose the students to the basic processing in petroleum industry.*
- *To provide adequate knowledge about the various control loops in Petrochemical Industry.*
- *To impart knowledge pertaining to the petroleum products and the chemicals obtained from them and also various parameter measurements.*

Module – I

Introduction: Petroleum Exploration - Petroleum Refining - Refining Methods Constituents of Crude Oil - Indian and world reserve of crude oil and its processing capacity. Operations in petroleum industry: Atmospheric Distillation of Crude oil- Vacuum Distillation process - Thermal Conversion process overview - Thermal cracking processes, Catalytic cracking process overview - catalytic reforming – polymerization - alkylation - isomerisation - Octane Number, Cetane Number, Sulphur content, calorific value.

Module – II

Parameters to be measured in refinery and petrochemical industry, selection and maintenance of measuring instruments - intrinsic safety of instruments. Cascade control, Feed forward control, Distillation column control, Reactor control, Heat exchanger control, Pumps and compressors, Surge control, control system of oil & gas separators, oil &gas storage & transportation, Limit switches and alarm system.

Module – III

Automatic controls in oil well drilling operations (Top drive system), SCADA system.PID control in dynamic positioning of floating vessels in deep sea operations. Subsea control systems: subsea valves, ROV actuators, hydraulic actuators, multi phase flow meters (gamma rays), Subsea sand monitoring system.

Module – IV

Effluent and Water Treatment Control: Chemical Oxidation, chemical Reduction, Naturalization - Precipitation - Biological control. Safety: Hazardous area classification - Electrical installations in hazardous area- industry standards. Pressure relief systems, emergency shutdown system.

References:

1. Ram Prasad, *Petroleum Refining Technology*, Khanna Publishers
2. Liptak B.G., *Instrumentation in Process Industries*, Chilton Book Company, 1994
3. Arnold K (Ed.), *Facilities and Construction Engineering, Volume III, Petroleum Engineering Handbook*, SPE, 2007.
4. Andrew W G, *Applied instrumentation in the Process Industries*, Gulf Publishing Company. 2002
5. Gregory McMillan, Douglas Considine, *Process/Industrial Instruments and Controls Handbook*, McGraw Hill, 1993.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, the students will acquire knowledge about the measurement of various parameters in petrochemical industry and they will get exposed to the various control loops in Petrochemical Industry.

13.706.6 INSTRUMENTATION SYSTEM DESIGN (A) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objective:

- *To learn about the design aspects of different instrumentation systems*
- *To study signals and noise in instrumentation* systems

Module – I

Design of the bridge Circuit for RTD- Cantilever and torque elements, Pillar load cell, Strain gauge accelerometer- Capacitive level sensor - Inductive push pull displacement sensor- Design of reference junction compensation and linearizing circuit for thermocouple and thermistor- Design of charge Amplifier-Instrumentation amplifier.

Module – II

Design of 2 and 4 wire transmitters with 4-20mA output- Smart transmitters- Design of pneumatic and electronic PID Controllers-Design of ON-OFF controllers with neutral zone- Design of instrumentation servo mechanism- Design of annunciators - Low level and high level annunciators.

Module – III

Orifice meter- Design of orifice for a given flow condition- Design of rotameter- Zero and span adjustment in DP transmitter and temperature transmitter - Bourdon gauges-Factors affecting sensitivity- design of bourdon tubes- Design of square root extractors for variable head flow meters.

Module – IV

Signals and noise in instrument systems – Statistical representation – pdf – psd – Auto correlation function – Effects of noise and interference – Series and common mode – Noise sources and coupling mechanisms – Multiple earths – Methods of reduction of noise – Shielding – Screening – Filtering – Modulation – Averaging – Auto correlation.

References:-

1. Sheingold D. H.: Transducer interfacing hand book – *A Guide to Analog Signal Conditioning*, Analog Devices Inc Massachusetts, 1980.
2. Johnson C.D: *Process Control Instrumentation Technology*, 4/e, PHI, 1995.
3. John P. Bentley: *Principles of Measurement Systems*, Longman 1983.
4. Anderson N A: *Instrumentation for Process Measurement and Control*: Chilton book company 1980.
5. Barney G. C.: *Intelligent Instrumentation – Microprocessor Application in Measurement and Control*, PHI, 1992.

6. Andrew w: *Applied Instrumentation in Process Industries*; Vol. II. Gulf publications, 1990.
7. Doebelin.E.O. *Measurement Systems Applications and Design*, McGraw Hill, 1975.
8. *ISA Handbook*: ISA Publications, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, the students will be familiarized with noise and signals in instrumentation systems and will also acquire knowledge about design aspects of different instrumentation systems.

13.707 POWER ELECTRONICS AND DRIVES LAB (A)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits:** 3

Course Objectives:

- *To impart practical knowledge about various power converter circuits*
- *To learn about Design and practice of DC drives*

List of Experiments:

1. *Sine triangle PWM generation*
2. *Study of PWM IC TL 494*
3. *Power BJT and MOSFET drive circuits*
4. *Battery charger circuit*
5. *Buck DC-DC Converters*
6. *Step up DC-DC converter*
7. *Push pull DC- DC Converter*
8. *Application of opto-coupler IC MCT2E*
9. *AC phase control circuit*
10. *Linear ramp firing circuits*
11. *Simple SMPS*
12. *Half bridge and full bridge converters*
13. *Study of DC Drive*
14. *Regulation Characteristics of DC Drive*
15. *Basic Inverter Circuits*

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions for each batch should be based on the list of experiments prescribed.

25% - Circuit Design

15% - Implementation (Usage of Kits and trouble shooting, Coding for Software experiments)

35% - Result

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After the completion of this course, the students will be familiarized with design and practice of motor drives. They will also be able to design various practical power converter circuits.

13.708 PROCESS CONTROL LAB (A)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits**: 3

Course Objective :

- *To become conversant with the practical aspects of process control*
- *To characterize control elements and learn methods of controller tuning*

List of Experiments:

1. Experimental study of P, PD, PI and PID controllers on level, flow, temperature and pressure loops.
2. Experimental study of ON-OFF controller and ON- OFF controller with neutral zone on temperature control systems.
3. Controller tuning using continuous cycling method.
4. Controller tuning using process reaction curve method.
5. Control valve characteristics.
6. Experimental study of Ratio, Cascade and Feed forward control systems.
7. PLC based Water level, Bottle filling and Motor speed control systems.
8. Calibration of pressure gauge.
9. Design and testing of RTD based temperature transmitter.
10. Experimental study of Inertial control systems.
11. Experimental study of Binary distillation process.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions for each batch should be based on the list of experiments prescribed.

The following guidelines should be followed regarding award of marks

20% - Circuit Design

15% - Implementation (Usage of Kits and trouble shooting, Coding for Software experiments)

35% - Result

25% - Viva voce

5% - Record

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

- *From the practical exposure, the students will acquire a profound understanding on various practical aspects of process control.*

13.709 SEMINAR (AT)

Teaching Scheme: 0(L) - 0(T) - 1(P) **Credits**: 1

Course Objective :

- *To do a detailed study of a selected topic based on current journals or published papers and present a seminar based on the study done.*
- *The seminar provides students adequate exposure to public presentations to improve their communication skills.*

The student is expected to present a seminar in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. The student will undertake a detailed study on the chosen subject and submit a seminar report in a soft bound form at the end of the semester. While preparing the report, at least three cross references must be used. This report shall be submitted for evaluation for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Seminar coordinator and the HOD. Evaluation of presentation and report shall be conducted by a committee of the **Seminar coordinator, Guide and a senior faculty.**

Internal Continuous Assessment *(Maximum Marks-50)*

40% - 20 Marks is to be awarded for the presentation
40% - 20 marks is to be awarded for the report.
20% - 10 marks for the attendance.

Course Outcome:

At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills.

13.710 PROJECT DESIGN (AT)

Teaching Scheme: 0(L) - 1(T) - 0(P) **Credits**: 1

Course Objective :

- *To identify a problem for the final-year project, outline a solution, and prepare a preliminary design for the solution.*
- *To improve the ability to perform as an individual as well as a team member in completing a project work.*

The student is expected to select a project in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. He/She shall complete the design of the project work and submit the design phase report. This shall be in soft bound form. This report shall be submitted for evaluation in 7th semester as well as for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Project coordinator and the HOD. Evaluation of report and viva will be conducted by a committee consisting of the **Project coordinator, Guide and a senior faculty.** The number of students in a project batch shall be limited to a **maximum of four**.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - 20 Marks is to be awarded for the Viva Voce
50% - 20 Marks is to be awarded for the report.
20% - 10 marks for the attendance

Course Outcome:

At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer.