UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VII SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING
<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>C A Marks</th>
<th>Exam Duration Hrs</th>
<th>U E Max Marks</th>
<th>Total Marks</th>
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<tr>
<td>13.701</td>
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<td>CMOS Circuits Design (A)</td>
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<td>Discrete-Time Control Systems (A)</td>
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**SCHEME -2013**

**VII SEMESTER**

**APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING (A)**
### 13.705 Elective III

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### 13.706 Elective IV

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13.701 NANO ELECTRONICS (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 nanomaterials-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

Nanoelectronic 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:


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


Module – III


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:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, 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


Module – II


Module – III


Module – IV


References:


**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 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

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


References:
2. Patranabis D., Principles of Industrial Instrumentation, 2/e, TMH.
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


Module – II


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


References:


**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


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


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


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


References:-

2. Jean J. Labrosse, (µC/OS-II) Real Time Kernel.

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


Module – II


Module – III


Module – IV

References:


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)

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


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


Module – IV

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

References:

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.

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


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:


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:


**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

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

Module – IV
References:-


**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.
- To study the programming concepts of Embedded Systems.

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

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

Module – II

Memory - memory technologies – DRAM, SRAM, EPROM, EEPROM – Memory Organizations

I/O Devices – Timer / Counter, Real time clock, ADC and DAC, Keyboards and Displays

DMA – DMA Controllers

Interrupts and Exceptions– Interrupt Controller

Serial Communication Standards and Devices - UART and HDLC, SCI, SPI - Parallel Port Devices - I²C Bus, CAN Bus, USB Bus, ISA Bus, PCI and PCI-X Bus.

Module – III


LINUX OS – Basic Features – File system, Disk partitioning, Software structure.


Module – IV

Concepts of Embedded programming –Components for Embedded programs – Assembling, Linking and Loading – Compilation Techniques –Program Optimization

Software Implementation, Testing, Validation, Debugging and Emulation

References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as homework, 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 have

- Thorough understanding of the basic structure and design of an Embedded System.
- Knowledge on the different ways of communicating with I/O devices and standard I/O interfaces.
- Knowledge on the basics of RTOS for Embedded systems and on 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


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


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:


**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


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

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.
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

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

References:-

**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.