SYLLABUS FOR

INTEGRATED MASTER OF SCIENCE
IN ELECTRONICS, COMPUTER AND INSTRUMENTATION
[M.Sc.(ECI)]

A Five-year Degree Course

SAURASHTRA UNIVERSITY
RAJKOT
(Effective from June 2018)

Department of Electronics
Saurashtra University Campus
Rajkot-360005
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www.saurashtrauniversity.edu
SEMESTER V
Paper 17: Basic concepts of control system (4 Credits)
Paper 18: Fundamental of Computer Hardware (4 Credits)
Paper 19: Advance Instrumentation (4 Credits)
Paper 20: Microprocessor and Microcontroller (4 Credits)
Practicals (8 Credits)

SEMESTER VI
Paper 21: Fiber Optics (4 Credits)
Paper 22: Advance concepts of Control System (4 Credits)
Paper 23: Basic programmable controllers (4 Credits)
Paper 24: Computer Aided Designing (4 Credits)
Practicals (8 Credits)
SEMESTER V

Paper 17: Basic Concepts of Control system

Credit :4
Total marks: 100 (70 external+ 30 internal)
Total hours required: 60 Hrs.

Unit 1: Introduction to Control Systems and the Laplace Transform
Introduction, Examples of Control Systems, Closed-Loop Control Versus Open-Loop Control, Design of Control Systems.
Review of Complex Variables and Complex Functions, Laplace Transformation, Laplace Transform Theorems, Inverse Laplace Transformation, Partial-Fraction Expansion with MATLAB, Solving Linear, Time-Invariant, Differential Equations, Example Problems and Solutions

Unit 2: Mathematical Modeling of Dynamic Systems

Unit 3: Transient-Response Analysis
Introduction, First-Order Systems, Second-Order Systems, Transient-Response Analysis with MATLAB, An Example Problem Solved with MATLAB, Example Problems and Solutions, Problems

Unit 4: Basic Control Actions and Response of Control Systems
Introduction, Basic control actions, Effects of integral and derivative control actions on system performance, Higher order systems, Routh’s stability criterion, Pneumatic controllers, Hydraulic controllers, Electronic controllers, Phase lead and phase lag in sinusoidal response, Steady state errors in unity feedback control systems, Example problems and solutions

Recommended-Book:
   Publication: Prentice-Hall India.

Reference-Book:
1. “Control System Engineering” by Bhattacharya, Pearson Education.
2. “Control Systems: Principles and Design” by Madan Gopal, TMH.
4. “Control Engineering: Theory and Practice” by Bandopadhaya, PHI.
5. “Control System Design” by Goodwin, Salgado, PHI Publication
Unit 1: The Visible PC and Microprocessor

**The Visible PC**
- How the PC Works: Input, Processing, Output, Storage, The Art of the PC Technician
- Essential Tools of the Trade and ESD Avoidance: Tools of the Trade, Avoiding Electrostatic Discharge, Results of Electrostatic Discharge, Anti-static Tools
- Recognize the Major Components of a PC: CPU, RAM, Motherboard, Case, Power Supply, Floppy Drive, Hard Drive, and CD-ROM Drive
- Connectors: DBC Connectors, DIN Connectors, Centronics Connectors, RJ Connectors, BNC Connectors, Audio Connectors, USB Connectors, FireWire Connectors
- All Kinds of Connectors: Sound Cards, Video Cards, Network Cards, Keyboard, Mouse, Modem, Printer, Joystick

**Microprocessors**
- CPU Core Components: The Main in the Box, External Data Bus, Registers, Clock, Back to the External Data Bus
- Memory: Memory Storage Options, RAM: Random Access Memory, Address Bus
- Modern CPUs: Manufacturers, CPU Packages, The Pentium CPU: The Early Years, Pentium Pro, Later Pentium-Class CPUs, Pentium II, Pentium III, Early AMD Athlon CPUs, AMD "Thunderbird" Athlon CPUs, AMD Duron, Intel Pentium 4, AMD Athlon XP
- Specialty Processors: Intel Xeon Processors, 64-Bit Processing, Mobile Processors
- Installing CPUs: Why Replace a CPU?, Determining the Right CPU, Buying a CPU, Preparing to Install, Inserting a Slot I/Slot II CPU, Inserting a PGA-Type CPU, Testing Your New CPU, The Art of Cooling, Know Your CPUs, Overclocking

Unit 2: RAM, BIOS and CMOS

**RAM**
- DRAM: Organizing DRAM, You Are a Byte Victim!
- RAM Sticks, Part I: DIPs, 30-Pin SIMPs, 30-Pin SIMMs, SIMM Sticks and Parity, Access Speed
- RAM Sticks, Part II: 72-Pin SIMMs, Banking, Part I: Filling the Bus, DIMM
- Improvements in DRAM Technology: EDO, SDRAM, PC100/133 Standards, ECC, Double Pumping, RDRAM, DDR SDRAM, Banking Part II: Dual-Channel, Architecture, Double-Sided SIMMs/DIMMs
- Installing RAM: Do You Need RAM?, Getting the Right RAM, Installing SIMMs, Installing DIMMs and RIMMs, Installing SO DIMMs in Laptops, The RAM Count
- Troubleshooting RAM: Testing RAM, MRAM

**BIOS and CMOS**
- The Function of BIOS: Talking of the Keyboard, BIOS and Its Relation to Memory Addressing, All Hardware Needs BIOS
- CMOS Setup Utilities: Updating CMOS: The Setup Program, A Quick Tour Through a Typical CMOS Setup Program, And the Rest of the CMOS Settings, Modern CMOS
- BIOS and Device Drivers: Option ROM, Device Drivers, BIOS, BIOS Everywhere!
- Power-On Self-Test (POST): Before and During the Video Test: The Beep Codes, Text Errors, POST Cards, the Boot Process, Boot Configuration
Unit 3: Expansion Bus and Motherboard

Expansion Bus
Structure and Function of the Expansion Bus: PC Bus, 16-Bit ISA
System Resources, I/O Addresses, Interrupt Requests, Direct Memory Access (DMA), Memory Addresses
Modern Expansion Bus: False Starts, PCI
Installing Expansion Cards: Step 1: Knowledge, Step 2: Physical Installation, Step 3: Assigning Resources to the Card, Step 4: Device Drivers, Step 5: Verify Troubleshooting Expansion Cards: Device Manager PCI-X and PCI-Express

Motherboards
How Motherboards Work
Types of Motherboards: AT Motherboards, The Need for a New Form Factor, Enter ATX Chipset Varieties: Functions, Features, and Expandability Upgrading and Installing Motherboards: Choosing the Motherboard and Case, Installing the Motherboard, Wires, Wires, Wires Troubleshooting Motherboards: Symptoms, Techniques, Options

Unit 4: Power Supplies and Floppy Drives
Power Supplies
Understanding Electricity

Floppy Drives
Floppy Drive Basics: Formatting, Types of Disks, Drive Size Installing Floppy Drives: Inserting Ribbon Cables, Determining Drive Letters, Connectors, Power, CMOS Floppy Drive Maintenance and Troubleshooting: Repairing Floppy Drives, Other CMOS Options, Radial Misalignment, USB Floppy Drives, USB Flash Memory Drives

Recommended Book:

Reference Book:
1. “Troubleshooting, Maintaining and Repairing PCs” Stephen J. Bigelow, TMH
3. “Upgrading and Repairing PCs” Scott Mueller, PHI
PAPER 19: ADVANCE INSTRUMENTATION

Credit: 04
Total marks: 100 (70 External + 30 Internal)
Total Hours required: 60 Hrs.

Unit 1: WAVE ANALYZERS, HARMONIC DISTORTION AND MEASURING INSTRUMENTS

Unit 2: Bridges and recorders

Unit 3: Transducers and signal conditioning

Unit 4: Measurement setup and measurement of power

Recommended Book
1. Electronic instrumentation
   By: H.S. Kalsi, Tatamecrow Hill

Reference Book
1. Electronic instrumentation and measurement
   By: Anand, PHI
2. Instrumentation, measurement and analysis
   By: Nikrs BCand Chaudhary K.K., TMN

Paper 20: Microprocessor and Microcontroller
Unit 1:  
8085 Microprocessor block diagram and instruction set  
Functional Description – Interrupts – Serial Input and Output – Pin Description – Data transfer group  
– Arithmetic group – Branch group – Logic group – Stack operations, I/O and Machine control instructions  

Unit 2:  
The AVR Microcontroller: History and Features  
Microcontrollers and Embedded Processors – Overview of the AVR Family  
AVR Architecture and Assembly Language Programming  
The General Purpose Registers In The AVR – The AVR Data Memory – Using Instructions With The Data Memory – AVR Status Register – AVR Data Format And Directives – Introduction To AVR Assembly Programming – Assembling An AVR Program – The program counter and program ROM space in the AVR – RISC architecture in the AVR – Viewing Registers and Memory with AVR studio IDE  

Unit 3:  
AVR Programming in C  
Data types and time delays in C – I/O programming in C – Logic operations in C – Data conversation programs in C – Data serialization in C Memory allocation in C  
AVR Hardware connection, Hex file, and Flash Loaders  
ATmega32 pin connection – AVR fuse bits – Explaining the Hex file for AVR – AVR programming and trainer board  
AVR Timer programming in C  
Programming timer 0, 1, and 2 – Counter programming – Programming timer in C  
AVR Interrupt programming in C  
AVR interrupts – Programming timer interrupts – Programming external hardware interrupts – Interrupt priority in the AVR – Interrupt programming in C  
AVR serial port programming in C  
Basics of serial communication – Atmega32 connection to RS232 – AVR serial port programming in C – AVR serial port programming in C using interrupts  

Unit 4:  
LCD and Key-Board Interfacing  
LCD interfacing – Key-Board interfacing  
ADC, DAC and sensor interfacing  
ADC characteristics – ADC programming in the AVR – Sensor interfacing in signal conditioning – DAC interfacing  
Relay, Optoisolator and Stepper motor interfacing with AVR  
Relay and Optoisolator – Stepper motor interfacing
Recommended Books:

1. 0000 – 8085 Introduction to Microprocessors for Engineers and Scientists
   P. K. Ghosh and P. R. Sridhar
   PHI publication
2. The AVR Microcontroller and Embedded System Using Assembly and C
   Muhammad Ali Mazidi
   SarmadNaimi
   SepehrNaimi
   Pearson Publication

Reference Books:

1. “Microprocessor Architecture, Programming and Application with 8085”
   R S Gaonker.
   Whiley Easter ltd. (Unit 3, 4)
   Rafiquzzaman,
   PHI.
3. AVR Programming
   Elliot Williams
   Make publication
4. Programming and customizing the AVR microcontroller
   Dhananjay V. Gadre
   McGrow Hill Publication
SEMESTER VI

PAPER-21: FIBER OPTICS

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours required: 60 Hrs.

UNIT 1
Overview of Optical Communication Systems
This Unit provides an overview of the fiber optical system, and the lightning review of optics will cover the basics of and overview of the distinctive characteristics of the propagation of light in conducting and dielectric waveguides.

UNIT 2
Fiber Material and Fabrication
This unit covers propagation in multimode and single-mode fibers, coupling into and out of fibers, fiber material and various fabrication methods.

**Coupling into and out of fibers:** Fiber to Fiber Joints, Fiber Splicing, Optical Fiber Connectors, **Fiber material and fabrication:** Various types of Fiber Materials, Various methods of Fiber Fabrication

UNIT 3
Optical Source and Detectors
This Unit covers the physics and technology of light emission and amplification in semiconductors, light-emitting diodes, semiconductor lasers (including both edge-emitting and surface-emitting lasers). Also, covers the physics and technology of the detection and demodulation of light, including photodiodes and APDs.

**Optical Source:** Review of Semiconducting Physics, Energy Bands, Intrinsic and Extrinsic Material, The pn Junctions, Band-gaps, Light-Emitting Diodes, Modulation capability, Transient response, Semiconductor Losses, **LASER Diodes:** Structure and Threshold conditions, Temperature Effects, Source Linearity and Reliability and Quantum Efficiency, **Optical Detectors:** PIN photo detector, Avalanche photodiode, Noise consideration, Response time, Depletion layer photocurrent, Avalanche multiplication noise, materials used in APDs.

UNIT 4
Optical Fiber Measurements
This Unit covers the various measurement techniques which covers the measurement of Attenuation as well as loss occurred in fiber.

**Attenuation Measurement:** Cutback method, Optical Time Domain Reflectometer, Fiber fault location, Time Domain Dispersion Measurements, Frequency Domain Measurements. **Refractive Index Profile Measurement:**End reflection technique, Transmitted near field scanning method, Refracted near filed technique, Interferometer of optical source characteristics, Response time, Distortions.

**Recommended Book**
2. Optical Fiber Communications: Principles and Practice by John M. Senior, Pearson Education Publication

**Reference Book:**
1. Fiber Optic Communication by D. C. Agarwal, S. Chand Publication
2. Fiber Optics and Optoelectronics by R. P. Khare, Oxford Publication.
Paper 22: Advance Concepts of Control Systems

Credit: 4
Total marks: 100 (70 external + 30 internal)
Total hours required: 60 Hrs.

Unit 1: Root-Locus Analysis & Design
Introduction, Root-Locus plots, Summary of general rules for constructing root loci, Root-Locus plots with MatLab, Special cases, Root-Locus analysis of control systems, Root-Lociforsystems with transparent tag, Root-Contourplots, Example problems and solutions
Control Systems Design by the Root-Locus Method: Introduction, Preliminary design considerations, Lead compensation, Lag compensation, Example problems and solutions

Unit 2: Frequency Response Analysis & Design
Introduction, Bode diagrams, Plotting bode diagrams with MatLab, Polar plots, Drawing Nyquist plots with MatLab, Log-Magnitude versus Phase plots, Nyquist stability criterion, Stability Analysis, Relative Stability, Closed loop frequency response, Experimental determination of transfer functions, Example problems and solutions

Unit 3: Control Systems Design by Frequency Response
Introduction, Lead Compensation, Lag Compensation, Lag-Lead Compensation, Concluding Comments, Example problems and solutions

Unit 4: PID Controls and Introduction to Robust Control
Introduction, Tuning rules for PID controllers, Modifications of PID control schemes, Two-Degrees-of-Freedom control, Design considerations for robust control, Example problems and solutions

Recommended Book:
1. “Modern Control Engineering (3rd Edition)”
   Katsuhiko Ogata.
   Publication: Prentice-Hall India.

Reference Book:
1. “Industrial Instrumentation and Control”
   Singh,
   TMH
   Ghosh,
   Pearson Education.
3. “Industrial Electronics and Control:”
   Bishwanath Paul,
   PHI.
Paper 23: Basic Programmable controllers

Credit:04
Total marks:100(70 external+30 Internal)
Total Hours required: 60 Hrs.

Unit 1: Ladder diagram fundamentals, the programmable logic controller and fundamental PLC programming.

Unit 2: Advance programming techniques, mnemonic programming code, wiring techniques.

Unit 3: Analog I/O, discrete position sensors and encoders, transducer, and advanced sensors.

Unit 4: Closedloop and PID control, motor control and system integrity and safety.

Recommended Book:
1. Programmable logic controllers: programming methods and applications
   John R .Hackworth and Frederick D.Hackworth
   pearson

Reference Book:
1. Programmable logic controllers
   W.Bolton
   Newnes
2. PLC Programming for industrial automation
   Kevin collins
   Liskeard,cornwall
Paper 24: Computer Aided Designing

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours required: 60 Hrs.

Unit 1: Introduction to NX 10.0, Drawing Sketches For Solid Models:

Unit 2: Adding Geometric and Dimensional Constraints to Sketches, Editing, Extruding and Revolving Sketches, and Working with Datum Planes, Coordinate Systems, and Datum Axes:
Constraining Sketches – Concept of constrained Sketches: Under-Constrain, Fully-constrain, Over-constrain – Degree of Freedom Arrows – Dimensioning Sketches: Locking the Automatically applied dimensions, Applying dimensions by using the rapid dimension tool, Applying linear dimensions, Applying Angular dimensions, Applying perimeter dimensions, Editing the dimension value and other parameters, Animating a fully-constrained Sketches – Measuring the distance value between objects in a sketch: Measuring the distance between two objects in a sketch, Measuring the projected distance between two objects, measuring the screen distance between two objects – measuring the length of an Arc or a Line – Measuring the angle between entities: Measuring the Angle value using the by object option, Measuring the Angle value using the by 3 points option, Measuring the Angle value using the by Screen point option – Geometric constraints: Applying additional constraints individually, Applying symmetry constrain, Applying Automatic constraints to a Sketch, Controlling inferred constraints settings, Showing all constraints in a sketch, Showing/ Removing constraints, Converting a sketch entity or dimension into a reference entity or reference dimension
Editing Sketches: Trimming Sketched Entities, Extending Sketched Entities, Creating a Corner between Sketched Entities, Moving Sketched Entities by using the move curve tool, Offseting Sketched Entities by using Offset Move Curve, Modifying Entities by using the Resize curve tool, Modifying chamfer in Sketched entities by using resize chamfer curve tool, Deleting Sketched entities by using delete curve tool, Offsetting Sketches entities, Mirroring Sketched entities, Creating a linear sketch pattern, Creating a Circular sketch pattern, Creating a general sketch pattern, Transforming sketched entities, Editing sketched entities by dragging – Exiting the sketch environment – Changing the view of the sketch – Creating base features by extruding: Extrude dialog box options – Creating solid revolved bodies – Copying, moving and rotating objects – Hiding entities – Showing hidden entities – Hiding all entities using a single tool – Rotating the view of a model in 3D space – Setting display modes
Creating Fixed and Relative Datum Axes – Other Extrusion Options: Specifying the Boolean Operation, Specifying Other Extrusion Termination Options – Projecting External Elements

**Unit 3: Advanced Modeling Tools – I, Advanced Modeling Tools – II:**

**Unit 4: Editing Features and Advanced Modeling Tools – III, Assembly Modeling – I, Assembly Modelling – II:**
Editing Features: Editing a Hole Feature, Editing the Positioning of a Groove Feature, Editing the Positioning of a Slot Feature, Editing the Parameters of Features, Editing the Parameters of Features with Rollback, Editing Sketches of the Sketched-based Features – Reordering Features – Advanced Modeling Tools: Creating Boss Features, Creating Pocket Features, Creating Pad Features, Creating Drafts

The Assembly Environment – Invoking the Assembly Environment: Invoking the Assembly Environment Using the new Dialog Box, Invoking the Assembly Environment in the Current Part File, Types of Assembly Design Approaches – Creating Bottom-up Assemblies: Placing Components in the Assembly Environment, Changing the Reference Set of a Component, Applying Assembly Constraints to Components, Points to remember while Assembling Components, Creating a Pattern Component in an Assembly, Replacing a Component in an Assembly, Moving a Component in an Assembly, Mirroring a Component in an Assembly, Modifying a Component in the Assembly File

The Top-Down Assembly Design Approach: Creating Components using the Top-Down Assembly Design Approach – Creating Subassemblies – Editing Assembly Constraints – Checking the Interference between the Components of an Assembly: Checking Interference using the simple interference tool, Checking Interference between the Assembly Components, Checking Interference and Clearance and Analyzing cross-sections of components using the View-Section Tool – Creating Exploded Views of an Assembly: Exploding Views automatically, Exploding Views Manually

**Recommended Book:**
1. NX-10.0: For Engineers and Designers, 9th Edition by Prof. Sham Tickoo, Purdue University Calumet, USA Published by DreamTech Press

**Reference Books:**
1. Siemens Nx 10 Design Fundamentals
   Jaecheol Koh
   Onsia
2. Parametric modelling with NX 9
   Randi Shih
   SDC Publication