The Department of Instrumentation and Control Engineering was established in the year 2001, with a B.Tech course in Instrumentation & Control Engineering. Since 2018, the department is offering B.Tech in Electronics and Instrumentation Engineering in place of Instrumentation and Control Engineering. The course deals with Electronics, Control system and Instrumentation subjects. The department has state-of-the-art laboratories in the areas of Instrumentation, Process Control, Control Systems, Microcontrollers, Soft Computing, Industrial Automation and Space Engineering Lab. All the department programs are AICTE approved.

The Department has expertise available in the field of Sensors, Robust Control, Neural Network and Fuzzy Logic, Bio-medical Instrumentation, Digital Signal Processing, Image Processing, Adaptive Control, MEMS, Electronic Instrumentation, Embedded Systems, Hybrid Systems, Automation etc. The Department is involved in numerous active research works in the above emerging fields. The department also organizes various research workshops and conferences. Control Instrumentation System Conference (CISCON) is an annual event organized under the auspices of Instrumentation and Control Engineering Department.

Programs offered
Under Graduate Program

Post Graduate Programs

PhD

Faculty Strength
Qualification-wise

<table>
<thead>
<tr>
<th>Qualification</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>12</td>
</tr>
<tr>
<td>M.Tech/ME/M.Sc</td>
<td>18</td>
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</table>

Cadre-wise

<table>
<thead>
<tr>
<th>Cadre</th>
<th>No.</th>
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<tbody>
<tr>
<td>Professors</td>
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<tr>
<td>Associate Professors</td>
<td>5</td>
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<tr>
<td>Assistant Professors</td>
<td>21</td>
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</table>
# B TECH in ELECTRONICS AND INSTRUMENTATION ENGINEERING

## Third Semester

<table>
<thead>
<tr>
<th>Sub. Code</th>
<th>Subject Name</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
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<tbody>
<tr>
<td>MAT 2152</td>
<td>Engineering Mathematics – III</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
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<tr>
<td>ICE 2151</td>
<td>Analog Electronic Circuits</td>
<td>3</td>
<td>1</td>
<td>0</td>
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<tr>
<td>ICE 2152</td>
<td>Digital Electronic Circuits</td>
<td>2</td>
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<tr>
<td>ICE 2153</td>
<td>Electronic Measurements</td>
<td>3</td>
<td>0</td>
<td>0</td>
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<tr>
<td>ICE 2154</td>
<td>Network Analysis and Signals</td>
<td>3</td>
<td>1</td>
<td>0</td>
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<tr>
<td>ICE 2155</td>
<td>Sensors and Transducers</td>
<td>3</td>
<td>0</td>
<td>0</td>
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<tr>
<td>ICE 2161</td>
<td>Digital Circuits Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<tr>
<td>ICE 2162</td>
<td>Measurement and Transducers Lab</td>
<td>0</td>
<td>0</td>
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<tr>
<td>ICE 2163</td>
<td>Virtual Instrumentation Lab</td>
<td>0</td>
<td>1</td>
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Total contact hour (L+T+P) = 16 5 9 24

## Fourth Semester

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<tr>
<th>Sub. Code</th>
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<tr>
<td>MAT 2258</td>
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<td>Digital System Design</td>
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<td>ICE 2252</td>
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<td>ICE 2253</td>
<td>Linear control Theory</td>
<td>3</td>
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<tr>
<td>ICE 2254</td>
<td>Linear Integrated Circuits</td>
<td>3</td>
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<td>ICE 2255</td>
<td>Open elective-I</td>
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<td>ICE 2259</td>
<td>Circuit Simulation and HDL Lab</td>
<td>0</td>
<td>0</td>
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<tr>
<td>ICE 2261</td>
<td>Instrumentation Lab</td>
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</table>

Total contact hour (L+T+P) = 16 5 9 24

## Fifth Semester

<table>
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<tr>
<th>Sub. Code</th>
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<tbody>
<tr>
<td>HUM 3052</td>
<td>Essentials of Management</td>
<td>2</td>
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<td>ICE 3151</td>
<td>Control System Components</td>
<td>3</td>
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<tr>
<td>ICE 3152</td>
<td>Micro-controllers</td>
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<td>ICE 3153</td>
<td>Modern Control Theory</td>
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<tr>
<td>ICE 3154</td>
<td>Process Instrumentation and Control</td>
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<tr>
<td>ICE 3155</td>
<td>Open elective-II</td>
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<td>ICE 3161</td>
<td>Micro-controller Lab</td>
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Total contact hour (L+T+P) = 18 3 6 23

## Sixth Semester

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<th>Sub. Code</th>
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<tbody>
<tr>
<td>HUM 3051</td>
<td>Engineering Economics and Financial Management</td>
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<tr>
<td>ICE 3251</td>
<td>Digital Signal Processing</td>
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<td>ICE 3252</td>
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<td>ICE 3255</td>
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<tr>
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<td>Automation Lab</td>
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<td>Control System Lab</td>
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<td>DSP Lab</td>
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Total contact hour (L+T+P) + OE = 18 3 9 24

## Seventh Semester

<table>
<thead>
<tr>
<th>Sub. Code</th>
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<tbody>
<tr>
<td>ICE 4296</td>
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<td>ICE 4297</td>
<td>Project and practice school</td>
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<tr>
<td>ICE 4298</td>
<td>Project Work (Only for B.Tech honour Students)</td>
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<td>Open elective-IV</td>
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</table>

Total Contact Hours (L + T + P) +OE = 18
Minor Specialization

I. Computational Intelligence
ELE 4061: Artificial Intelligence
ECE 4051: Computer Vision
ECE 4052: Machine Learning
ELE 4062: Soft Computing Techniques

II. Control Systems
ICE 4051: Digital Control Systems
ICE 4052: Non-Linear Control Systems
ICE 4053: Robust Control
ICE 4054: System Identification

III. Embedded Systems
ECE 4053: Embedded System Design
ELE 4063: FPGA based system Design
ECE 4054: Internet of Things
ELE 4064: Real Time Systems

IV. Illumination Technology
ELE 4065: Integrated Lighting Design
ELE 4066: Lighting Controls: Technology & Applications
ELE 4067: Lighting Science: Devices and Systems
ELE 4068: Solid State Lighting

V. Sensor Technology
ICE 4055: Advanced Sensor Technology
ICE 4056: Micro Electro Mechanical Systems
ICE 4057: Multi Sensor Data Fusion
ICE 4058: Smart Sensor

VI. Signal Processing
ECE 4055: Advanced Digital Signal Processing
ELE 4073: Digital Image Processing
ECE 4056: Digital Speech Processing
ELE 4074: Linear Algebra for Signal Processing

VII. VLSI Design
ECE 4061: Analog& Mixed Signal Design
ECE 4062: Digital Design Verification
ECE 4063: Low power VLSI Design
ECE 4064: Semiconductor Device Theory

VIII. Material Science
PHY 4051: Physics of Low Dimensional Materials
PHY 4052: Physics of Photonic & Energy Storage Devices
CHM 4051: Chemical Bonding
CHM 4052: Chemistry of Carbon Compound

IX. Business Management
HUM 4051: Financial Management
HUM 4052: Human Resource Management
HUM 4053: Marketing Management
HUM 4054: Operation Management

X. Computational Mathematics
MAT 4051: Applied Statistics and Time Series Analysis
MAT 4052: Computational Linear Algebra
MAT 4053: Computational Probability and Design of Experiments
MAT 4054: Graphs and Matrices

Program Electives
ICE 4059: Neural Network and Fuzzy Logic
ICE 4060: Real Time Operating System
ICE 4061: DSP algorithms and Architecture
ICE 4062: Analytical and optical Instrumentation
ICE 4063: Automotive Electronics
ICE 4064: Biomedical Instrumentation and Equipment
ICE 4065: Data Structures using C++
ICE 4066: Cyber physical systems
ICE 4067: Power Electronics
ICE 4068: Robotics
ICE 4069: Reliability and safety Engineering
ICE 4070: Wireless Sensor Technology

Open Electives
ICE 4301: Feedback Control Theory
ICE 4302: Industrial Automation
ICE 4303: Industrial Instrumentation
ICE 4304: Sensor Technology
ICE 4305: Smart Sensor
ICE 4306: Virtual Instrumentation
MAT 2152: ENGINEERING MATHEMATICS III [21 0 3]

References:

ICE 2151: ANALOG ELECTRONIC CIRCUITS [3 1 0 4]

References:

ICE 2152: DIGITAL ELECTRONIC CIRCUITS [2 1 0 3]

References:

ICE 2153: ELECTRONIC MEASUREMENTS [3 0 0 3]

References:

ICE 2154: NETWORK ANALYSIS AND SIGNALS [3 1 0 4]
Analysis of circuits with dependent sources, Network theorems, Initial conditions and transient analysis of RL, RC and RLC circuits, Continuous time signals and systems, LTI systems - convolution integral, Response of Continuous time LTI systems to complex exponentials, Fourier series, Fourier transform, Properties of Fourier series and Fourier transform, Analysis of networks by Laplace transform method, Transform functions, Transform circuits, Network functions, Two port network parameters.

References:

ICE 2155 SENSORS & TRANSDUCERS [3 0 0 3]
Functional elements of an Instrument, Types of transducers, Null and Deflection methods, Input/output configurations, characteristics, types of errors, Resistive, Capacitive, Inductive transducers, Hall Effect sensors, magneto elastic transducers, solid state sensors, eddy current transducers, Piezo Electric transducers, pH Measurement, Semiconductor sensors, photo electric transducers, CCD, shaft encoder and decoders, optical encoders, gas sensors, density, viscosity, moisture and humidity measurements.

References:
2. DVS Murthy, Transducers & Instrumentation, PHI, (2e), 1999.

ICE 2161: DIGITAL CIRCUITS LAB [0 0 3 1]
Boolean functions using logic gates, Code Conversion Circuits, Adders, Subtractors, Magnitude comparator, Parity checker / generator, Multiplexers, Demultiplexers, Encoders, Decoders, Flip flops, Counters, Shift Registers, Sequential circuits.

References:
ICE2162: MEASUREMENTS AND TRANSDUCERS
LABORATORY [0 0 3 1]
AC bridges, network theorems, measurement of energy, measurement of self and mutual inductance, series and parallel resonance, characteristics of sensors and transducers, measurements of temperature, pressure, flow, torque, force, displacement and intensity of light.

References:

ICE 2163: VIRTUAL INSTRUMENTATION LAB [0 1 3 2]
Introduction to Lab VIEW, Arithmetic and logical operations, Arrays, Clusters, and Loops. Structures, Graphs, timing pallets, Strings and file I/O, Measurement and automation explorer, Simulation of DAQ, DIAdem, ULTiboard.

References:

FOURTH SEMESTER

MAT 2258: ENGINEERING MATHEMATICS IV [2 1 0 3]

References:

ICE 2251: DIGITAL SYSTEM DESIGN [2 1 0 3]
Digital System implementation using PLDs, PLAs and PALs, Programmable ASICs (PLDs & FPGAs), levels and domains of abstraction, Design flow, Introduction to CAD Tools, Introduction to Verilog, Verilog for Combinational Circuits – Conditional operator, Verilog Operators, Verilog for Sequential Circuits – Verilog Constructs of Storage Elements, Blocking and Non-Blocking Assignments, Module, Language Elements, Data Types, Register Types, Expressions, types of modeling, Verification, Architecture of CPLDs and FPGAs, Antifuse, SRAM, EEPROM based technologies, logic cells, I/O cells, programmable interconnect, Design flow, placement and routing, Testing combinational and sequential circuits, Functional and Timing simulation, boundary scan, faults, fault simulation, BIST, DFT, Verification.

References:

ICE 2252: INDUSTRIAL INSTRUMENTATION [3 0 0 3]

References:
1. Patranabis D, Principles of Industrial Instrumentation, TMH, (3e), 2005.

ICE 2253: LINEAR CONTROL THEORY [3 1 0 4]
Mathematical modeling, transfer functions, Block diagram representation and reduction, signal flow graph, Masons gain formula, time domain specifications. Stability, Steady state errors, generalized error coefficients, Routh-Hurwitz criterion, Root-Locus plots, compensator design using root-locus, frequency domain specifications. Correlation between frequency domain and time domain specifications, Bode diagrams, Polar plots, Nyquist stability criterion, compensator design by frequency response approach.

References:
1. Norman S. Nise, Control Systems Engineering, Wiley India, (5e), 2009.
2. K. Ogata, Modern control engineering, PHI, (5e), 2011.

ICE 2254: LINEAR INTEGRATED CIRCUITS [3 1 0 4]
Op Amp fundamentals, Current to Voltage, Voltage to current Converters, Current amplifiers, Difference Amplifiers, Instrumentation Amplifiers, Active Filters, Static and Dynamic Op Amp Limitations, Voltage comparators, Comparator applications, Schmitt trigger, Precision rectifiers, Peak detector, Sample and hold circuit. Sine wave generators, Multivibrators, Monolithic Timers, Triangular wave generators, Voltage to frequency and Frequency to voltage converters, Voltage regulators, Digital to Analog and Analog to Digital Converters, Phase locked loops, VCO.
ICE 2261: ANALOG CIRCUITS LABORATORY [0 0 3 1]

References:

ICE 2262: CIRCUIT SIMULATION AND HDL LAB [0 0 3 1]

References:

ICE 2263: INSTRUMENTATION LAB [0 0 3 1]

References:

FIFTH SEMESTER

HUM 3052: ESSENTIALS OF MANAGEMENT [2 1 0 3]

References:

ICE 3151: CONTROL SYSTEM COMPONENTS [3 0 0 3]
A.C & D.C Servomotor, Tachogenerator, Synchro, Stepper motor, I/P converter, Pressure booster, Issues in control valves, Valve positioner, Valve selection, Cavitation and flashing, Valve sizing, Types of Control valves, Actuators, Pneumatic relays, Gear and Gear Trains, Cams and followers, Fluid and Pneumatic control, Pneumatic control devices, Hydraulic control system, Gear pump, Vane pump, Ball pump, Spool type pilot valve, Centrifugal pump and displacement pump, Linear induction motors, Reluctance motors, Gyroscopes.

References:

ICE 3152: MICROCONTROLLERS [4 0 0 4]

References:

ICE 3153: MODERN CONTROL THEORY [3 1 0 4]

References:
ICE 3154: PROCESS INSTRUMENTATION AND CONTROL [3 0 0 3]
Mathematical modeling of level, pressure and thermal processes, Self-regulation, Servo and regulatory operation, On-off, proportional, single-speed, floating, integral and derivative control modes, PI, PD and PID control modes, Pneumatic and Electronic controller realization, Anti-reset windup, Controller evaluation criteria’s, Controller tuning – Process reaction curve method, Ziegler Nichols method, Damped oscillation method, Two-point method, Multitoggle Loop Control – Feed forward, Ratio, Cascade, Inferential, Split range control, Internal Model Controller, Dead time Compensator.

References:

ICE 3161: MICROCONTROLLERS LAB [0 1 3 2]
8051 Programming - Timer, Serial Port and Interrupt Programming, ARM programming, Peripherals Interfacing to 8051 and LPC2148.

References:

ICE 3162: PROCESS CONTROL LAB [0 0 3 1]
Open loop, On/Off, P, PI, PD and PID control actions for Temperature, Level, Flow and Pressure Control, Cascade, Feed Forward and Ratio Control, Control valve characteristics, Control of Non-linear system, PID tuning, DAQ system, Interacting tank control, Model extraction, MIMO control.

References:

SIXTH SEMESTER

HUM 3051: ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT [2 1 0 3]

References:

ICE 3251: DIGITAL SIGNAL PROCESSING [3 1 0 4]
LTI discrete time systems, Linear convolution, Cross correlation and autocorrelation, Analysis of discrete time systems, DFT, Inverse DFT, FFT Algorithms, Radix 2 DITFFT and DIFFFT, IIR Filters – Butterworth, Chebyshev and elliptic filters, Impulse invariance, Bilinear transformation, FIR Filters, Structures for FIR systems, Structures for IIR systems, Applications.

References:

ICE 3252: INDUSTRIAL AUTOMATION [4 0 0 4]
Data loggers, Data Acquisition Systems, Direct Digital Control, SCADA, Programmable Logic Controller, Ladder logic Programming, PID functions, analog PLC operation, Alternate Programming Languages, PLC Maintenance, Interface and Backplane Bus Standards, Field bus, HART protocol, Smart transmitters, Valves and Smart actuators, MODBUS, Profinet, IEC 1158-2 Transmission Technology, Distributed Control Systems, Local Control Unit, Communications for DCS, Displays - Engineering interfaces.
ICE 3261: AUTOMATION LAB [0 0 3 1]
Ladder and Function block diagram programming, Distributed control system programming, Interface of process loops with DCS/PLC/HMI.

References:

ICE 3262: CONTROL SYSTEMS LAB [0 0 3 1]
Block diagram reduction, Time domain analysis, Steady state errors, State space analysis, Stability analysis, Lag, Lead, Lag-Lead compensator design using Bode plot and root locus, Study of P, PI, PID controller, Modeling practice with SIMULINK.

References:
1. K. Ogata, Modern Control Engineering, PHI,(5e), 2011.

ICE 3263: DSP LAB [0 1 3 2]
Generation of basic signals and discrete sequences, Analysis of discrete time systems, DTFT, DFT computation, Analog filter design, IIR and FIR filter design.

References:

SEVENTH SEMESTER

There are five program electives and one open elective with total of 18 credits to be taught in this semester.

EIGHTH SEMESTER

ICE 4298: INDUSTRIAL TRAINING
Each student has to undergo industrial training for a minimum period of 4 weeks. This may be taken in a phased manner during the vacation starting from the end of third semester. Student has to submit to the department a training report in the prescribed format and also make a presentation of the same. The report should include the certificates issued by the industry.

ICE 4299: PROJECT WORK/PRACTICE SCHOOL
The project work may be carried out in the institution/industry/research laboratory or any other competent institutions. The duration of the project work shall be a minimum of 16 weeks which may be extended up to 24 weeks. A mid-semester evaluation of the project work shall be done after about 8 weeks. An interim project report on the progress of the work shall be submitted to the department during the mid-semester evaluation. The final evaluation and viva-voice will be conducted after submission of the final project report in the prescribed form. Student has to make a presentation on the work carried out, before the department committee as part of project evaluation.

PROGRAM ELECTIVES

ELE 4061: ARTIFICIAL INTELLIGENCE [2 1 0 3]

References:
4. IIT, Kharagpur

ECE 4051: COMPUTER VISION [2 1 0 3]
Image formation model using pinhole camera, Linear filters and convolution, Image derivatives, Features: corners, SIFT, HOG, textures. Segmentation using clustering (K-means, Mean-Shift, Watershed) and fitting model, Segmentation and fitting using probabilistic methods (EM algorithm), Geometry of two view and Camera calibration including radial distortion, Bayes Classifier: using class histograms, using class conditional density, Support Vector machine

References:

ECE 4052: MACHINE LEARNING [2 1 0 3]
machines, Statistical Hypothesis testing- t-test, ANOVA, feature selection methods – Filter based techniques and wrapper methods, Principal Component Analysis, Applications of PCA, PCA, Independent component analysis, Voting, Error correcting output codes, Bagging, Boosting

References:

ELE 4062: SOFT COMPUTING TECHNIQUES [2 1 0 3]

References:

ICE 4051: DIGITAL CONTROL SYSTEMS [3 0 0 3]
Sampling, Data acquisition, Quantization, sample and hold, zero order hold, frequency domain consideration in sampling and reconstruction, Difference equations, pulse transfer function, Block diagram analysis of sample data systems, time response of discrete time control systems, Steady State error analysis, Stability, Jury’s stability test, bilinear transformation, Root locus technique, W transformation, Bode Plot. Nyquist Stability analysis, Design of Lag, Lead, Lag-lead compensator using root locus and Bode plot, Design of PID controller, Lyapunov Stability Analysis, State Space Analysis, Diagonalization, Solution of state equations, Controllability, Observability, Representation of the system in different canonical forms, Pole Placement- Ackermann’s Formula, Dead beat Algorithm.

References:
1. K. Ogata, Discrete time control systems, PHI, (7e), 2011.

ICE 4052: NONLINEAR CONTROL SYSTEMS [3 0 0 3]

References:

ICE 4053: ROBUST CONTROL [3 0 0 3]

References:

ICE 4054: SYSTEM IDENTIFICATION [3 0 0 3]
Introduction to system modeling, Types of system models, Importance of system models, Model development techniques – first principle based and data driven based, Introduction to System Identification, Procedure for identification, Concept of Identifiability, Signal to Noise Rato,

Reference books:

ELE 4053: EMBEDDED SYSTEM DESIGN [2 1 0 3]
Typical embedded system: Core of the embedded system, memory, sensors & actuators, communication interface, Serial/Parallel Communication protocols, Hardware and software co-design: Data-path and controller design, Architecture design; Development Environment: OS and non-OS based firmware embedding techniques; Firmware Design and Development; operating system basics; Embedded development lifecycle.

References:

ELE 4063: FPGA BASED SYSTEM DESIGN [2 1 0 3]
Overview of Digital Systems – Implementation options, FPGA – Architecture, Programming technologies, Altera & Actel logic cells, I/O Blocks, Programmable interconnects, Logic implementation, Design verification- Test bench codes, Hardware testing, FPGA Architectural options; granularity of function and wiring resources, reconfigurable architectures- Fine grained, Coarse grained, Medium grained, Embedded multipliers, adders, MACs, processor cores, Configuring an FPGA ; Vendor specific issues, Logic block architecture, timing models-static and dynamic timing analysis, Input and Output cell characteristics, Power dissipation, Partitioning and placement, Routing resources, Embedded system design using FPGAs, DSP using FPGAs, Multi FPGA systems, Reconfigurable systems, Application case studies

References:

ELE 4054: INTERNET OF THINGS [2 1 0 3]
Introduction to Internet of Things, Sensing, actuation, Basics of Networking, Sensor networks, Machine to Machine communication (M2M), IOT technologies and Architectures: Infrastructure and service discovery protocols for the IOT ecosystems; Realization of IOT ecosystem using wireless technologies; Interoperability in IOT, Data handling and analytics, cloud computing, Real world design constraints; IOT use Cases

References:
5. Jan Axelsson, Parallel Port Complete, Penram publications

ELE 4064: REAL TIME SYSTEMS [2 1 0 3]
Introduction to real time embedded system, terminology, Real time design issues, characteristics. Types of real time systems, timing constraints, precedence constraints, dependencies, functional and resource parameters. Real time operating systems, kernels, queues, semaphores, Multi processing and multitasking, priority inversion, deadlock. Real time services, Real time standards, System resources, Processing, scheduling policies, Performance measures for real time systems. Scheduling algorithms, periodic and aperiodic, priority driven, frame size constraints, real time communication.

References:

ELE 4065: INTEGRATED LIGHTING DESIGN [2 1 0 3]

References:

ELE 4066: LIGHTING CONTROLS: TECHNOLOGY & APPLICATIONS [2 1 0 3]
Strategies and technologies: occupancy sensing, switching controls, daylight adaptation and photo sensors, Commissioning and energy codes, Controller and control algorithms: Integral reset, open-loop and closed loop control, adaptive control, predictive control, inverse control
with online adaptive learning, Camera based measurement, virtual scenario based intelligent lighting control, Protocols and Networking: architecture, standard lighting protocols, wired and wireless, centralized and distributed, WSAN lighting control application, connected lighting system, SoC solutions for lighting control system, Power-over-Ethernet, Commissioning of smart lighting system.

References:

ELE 4067: LIGHTING SCIENCE: DEVICES AND SYSTEMS [2 1 0 3]

References:

ELE 4068: SOLID STATE LIGHTING [2 1 0 3]
General Characteristics of LEDs, Electrical and optical characteristics of high brightness LEDs, CIE Chromaticity coordinates, viewing angle, Binning, Mac dam ellipse, spectral tuning and optimization algorithms, Case study: Circadian rhythm, Daylight matching spectrum and its applications in healthcare - skin and Brain related therapies, Vitamin D synthesis, LED-on-the-Tip Endoscope, LEDs in Horticulture and Automotive lighting, LED drivers: power supply, dimming and controller, Thermal management and Heat sink design, lifetime and reliability.

References:

ICE 4055: ADVANCED SENSOR TECHNOLOGY [3 0 0 3]

References:

ICE 4056: MICRO ELECTROMECHANICAL SYSTEMS [3 0 0 3]
Overview of MEMS and NEMS, Scaling laws, Rigid-body dynamics, Electrostatic and electro-magnetic forces, Materials, Photolithography, Ion implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical vapor Deposition-Sputtering, Deposition by epitaxy, Etching, Bulk Micro manufacturing, Surface Micromachining, LIGA process, Microsystem Design- Process design, Mechanical design, Introduction to computer aided design using COMSOL Multiphysics, Electrostatic sensors and actuation, Thermal sensing and actuation, Piezoelectric sensing and actuation, Microsystem Packaging-Types, Interfaces, Technologies, Selection, Design and packaging case study.

References:

ICE 4057: MULTISENSOR DATA FUSION [3 0 0 3]
Concept and role of fusion, Fusion types, Sensor configuration, Architecture of fusion nodes, Fusion topologies, Benefits of fusion, data refinement, Classification of data refinement, Spatial alignment, Temporal alignment, Semantic and radiometric alignment, Concept and need for data association and decision making, data registration, data association techniques, Decision making techniques, Information requirement for decision making, JDL framework, Revised JDL, Dasarathy's model, Thompolus framework, Luo-Key framework, Paar's framework, Waterfall and omnibus framework, distributed black box, Esteban framework, Kalman filter, Baysien filter, extended information filter, Estimation, Approximate agreement, Optimization filter, Distributed dynamic fusion, Dynamic data flow analysis.
References:

ICE 4058: SMART SENSOR [3 0 0 3]
Introduction, Signal conditioning, Separate versus integrated signal conditioning, Digital conversion, MCU control, MCUs for sensor interface, Techniques and Systems Considerations for MCUs, DSP control, Sensor integration, IEEE standards, Plug and play, Automated/Remote sensing, Process control over the Internet, Other communication standards with case studies, Wireless zone sensing, Surface acoustical wave devices, Intelligent transportation system, RFID, RF MEMS basics, Varactors, Micro optics, Micro grippers, Microprobes, Micro mirrors, FEDs, Data processing, Pattern recognition and classification, Centralized and decentralized system of the measurement chains.

References:

ECE 4055: ADVANCED DIGITAL SIGNAL PROCESSING [2 1 0 3]
Multi-rate systems, decimation and interpolation, interpolated FIR approach, poly phase filter structure, filter banks, perfect reconstruction, Principles and applications of adaptive filters, Weiner filters, steepest descent algorithm, LMS and RLS algorithms. Homomorphic system, cepstrum, homomorphic systems for convolution and de-convolution, applications of homomorphic signal processing. Stochastic models, Maximum likelihood, expected maximization, Bayesian estimation, random signal detection. Sparse representation, regularization, Total Variation, Compressed Sensing.

References:

ELE 4073: DIGITAL IMAGE PROCESSING [2 1 0 3]
Image representation, relationship between pixels, Convolution and correlation. Unitary 2D transforms, DFT, DCT, subband coding, multiresolution analysis, DWT, contourlet transform, SVD. Intensity transformations, histogram processing, spatial and frequency domain filters, noise types, Wiener filter, local and nonlocal filtering, Boundary detection, canny edge detector, segmentation, Otsu’s thresholding, image compression standards, Morphological operations and algorithms, Hit or Miss transform, colour image representation. Applications.

References:

ECE 4056: DIGITAL SPEECH PROCESSING [2 1 0 3]

References:

ELE 4074: LINEAR ALGEBRA FOR SIGNAL PROCESSING [2 1 0 3]

References:
4. Sohail A Dianat and Eli Saber, Advanced Linear Algebra for Engineers with MATLAB, (1e), CRC Press.

ECE 4061: ANALOG AND MIXED SIGNAL DESIGN [3 0 0 3]
Analog circuit design issues, second order effects, current mirror circuits: Wilson, cascode and wide swing, voltage references, cascode and differential amplifier, Gilbert cell, operational transconductance amplifier, current conveyor, current feedback op-amp; Mixed signal circuit design: fully differential circuits, current mode signal processing.

References:

ECE 4062: DIGITAL DESIGN VERIFICATION [3 0 0 3]

References:

ECE 4063: LOW POWER VLSI DESIGN [3 0 0 3]
Power dissipation in digital ICs, low power methodologies and their design. Impact of device technology and scaling on power, dynamic power reduction techniques. Sources of leakage current and techniques for leakage power reduction, power analysis and power estimation methods, switching activity reduction in CMOS circuits, Low power clock distribution techniques with zero or tolerable clock skew, Power and performance management, Circuit and system level architectures for low power, low power architectures for arithmetic and memory circuits.

References:

ECE 4064: SEMICONDUCTOR DEVICE THEORY [3 0 0 3]

References:

ICE 4059: NEURAL NETWORK AND FUZZY LOGIC [3 0 0 3]

References:
3. S. N. Sivanandan, S.N.Deepa, Principles of soft computing, Wiley India, 2010

ICE 4060: REAL TIME OPERATING SYSTEM [3 0 0 3]
Real Time Concept, Real time tasks, Timing constraints, Threads and tasks, Scheduling, Rate monotonic algorithm, Memory management, Interrupt routines and handling of interrupt, Interrupt latency, OS security Issues, UNIX based RTOS, Windows as RTOS, POSIX, PSOS, VRTX, VxWorks, QNX, RT Linux, Windows CE, Real time communication: LAN, IEEE 802.5 protocol, Routing, Resource reservation, Traffic shaping and policing, Scheduling Mechanisms, QoS Models.

References:

ICE4061: DSP ALGORITHM AND ARCHITECTURE [3 0 0 3]
Basic architectural features of DSP processors, Data addressing modes of TMS320C54XX, Memory space of TMS320C54XX, Program control, On-chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline operation, Implementation of DSP Algorithms, Signal spectrum, Interfacing peripherals to DSP Devices, Memory interface, Parallel I/O interface, Programmed I/O, Direct memory access, Synchronous serial interface, Multichannel buffered serial port, Applications.
References:

ICE 4062: ANALYTICAL AND OPTICAL INSTRUMENTATION [3 0 0 3]

References:

ICE 4063: AUTOMOTIVE ELECTRONICS [3 0 0 3]

References:

ICE 4064: BIO-MEDICAL INSTRUMENTATION & EQUIPMENT'S [3 0 0 3]
Biomedical transducers, Cardiovascular system, Electrocardiography, Central Nervous System and muscular system, Electroencephalography, Electromyography, Therapeutic equipment's and life saving devices, Blood flow meter, Oximeter, Plethysmography, Ultrasound therapy unit, Nerve stimulators, Pacemakers and defibrillators, Heart lung machine, Diathermy, Ventilators, Spirometer, Oxygenators, Artificial kidney, Modern Imaging systems.

References:

ICE 4065: DATA STRUCTURES USING C++ [3 0 0 3]
Data Types, Operators, Manipulators, Decision statements, Programming control statements, Functions, Pointers, Classes, Constructors and Destructors, Operator overloading, Friend classes and functions, Inheritance, Templates, Linked List, Recursion, Trees, Queues, Sorting and searching algorithms.

References:

ICE 4066: CYBER PHYSICAL SYSTEMS [3 0 0 3]
Synchronization in complex systems, Graph theory, Leader and leaderless cases, Motion invariants for first-order consensus, Lyapunov techniques for control, Potential fields and Motion control, Pinning control, Cooperative optimal control, Stability and optimality, Adaptive tuning laws, Impulsive systems, Safety of execution of CPS, Scheduling, Hybrid dynamical models, Hybrid automata, Deployment, Task mapping and partitioning, State estimation for attack detection, Automotive case study.

References:
3. Andre Platzer, Logical Foundations of Cyber-Physical Systems,(2e), Springer Publishing, 2018

ICE 4067: POWER ELECTRONICS [3 0 0 3]
Power Diodes, SCR, Gate Trigger Circuits of SCR, Traic, GTO, BJT, Power MOSFET, IGBT, DC Motor Drives, Battery chargers, HVDC transmission, Single phase fully controlled AC to DC converter, Snubber Single phase half controlled converter, Three phase half wave AC to DC converter, Three phase fully controlled ac to dc converter, Inverter mode of operation, Constraints of commutation in inverter mode, Effect of source inductance, Single phase unity power factor converter, DC-DC Power Converters, Switched Power supplies, DC-AC Power Converters, Three phase inverters, Line commutated inverters.

References:

ICE 4068: ROBOTICS [3 0 0 3]
Degrees of Freedom, Kinematics of Manipulators, Differential motions, Linear and angular velocity of a rigid body, Dynamics of Manipulators, Trajectory planning, Joint Space and Cartesian Space, Control schemes for robot manipulators: PID, State Feedback, Force control, Hybrid force control, Position controller.
References:

ICE 4069: RELIABILITY AND SAFETY ENGINEERING [3 0 0 3]

References:

ICE 4070: WIRELESS SENSOR TECHNOLOGY [3 0 0 3]

References:

ICE 4302: INDUSTRIAL AUTOMATION [3 0 0 3]

References:

ICE 4303: INDUSTRIAL INSTRUMENTATION [3 0 0 3]
Measurement System, Classification of transducers, Temperature and Pressure measurement, Level and Thickness measurement, Flow measurement-Variable head type, variable area type, Mass flowmeters, Measurement of Thermal conductivity, velocity, acceleration, pH and Force, Semiconductor sensors, Optical sensors.

References:
2. Patranabis D, Principles of Industrial Instrumentation, TMH, (3e), 2005.

ICE 4304: SENSOR TECHNOLOGY [3 0 0 3]

References:

ICE 4305: SMART SENSOR [3 0 0 3]
MCUs and DSPs, integrated signal conditioning, IEEE1451 standards, Plug and play, Sensor Communication, Wireless zone sensing, Surface acoustical wave devices, Intelligent transportation system, RF-ID, RF MEMS basics, Micro optics, Micro grippers, Microprobes, Micro mirrors, FEDs, Centralized and decentralized measurement chains, Intelligent sensors, Nanosensors, Biosensors.

References:
ICE 4306: VIRTUAL INSTRUMENTATION [3 0 0 3]
Architecture of a virtual instrument, Virtual instruments V/s Traditional instruments, Advantages of VI, Graphical programming, Creating Virtual Instruments using LabVIEW-Loops, Arrays, Clusters, String and file I/O, Graphs, Data Acquisition, Common Instrument Interfaces, Current loop, System buses, Interface buses, VISA, Image acquisition and processing, Design of ON/OFF controller for a mathematically described processes using VI software

References:
Instrumentation and Control is a branch of engineering that deals with measurement and control. Instrumentation Automation systems used are PLC, DCS, RTU, SCADA. Instrumentation is the branch of engineering that deals with measurement and control. According to ISA or known as Instrumentation and Systems Automation Society formerly known as Instrument Society of America, the official definition of Instrumentation is a collection of Instruments and their application for the purpose of Observation, Measurement and Control. Reference: ISA std. 51.1 (Instrument Society of America). Instrumentation and Control. An instrument is a device that measures or manipulates process physical variables such as flow, temperature, level, or pressure etc. Instrumentation and control Engineering is a vast field. It primarily deals with automation, field instruments and final control elements (valves) that measure and control various physical parameters (temperature, pressure, flow and so on...). Its application is very vast including bio-med, chemical, oil & gas, power and many more. I am from NIT NAGALAND, EIE DEPARTMENT and i must tell you the branch is good and offering incredible knowledge and experience. 5.8k views Â· View 18 Upvoters. Lalit Prakash, I love Instruments.