ADVANCED ENGINEERING MATHEMATICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	16ELD11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives: This course will enable students to:

- Acquaint with principles of linear algebra, calculus of variations, probability theory and random process.
- Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Linear Algebra-I Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank-Nullity theorem (without proof). Matrix form of linear transformations-Illustrative examples.	**10 Hours (Text 1 & Ref. 1)**	**L1,L2**
Module -2		
Linear Algebra-II Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations.	**10 Hours (Text 1 & Ref. 1)**	**L1,L2**
Module -3		

Calculus of Variations Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.	**10 Hours (Text 2 & Ref. 2)**	**L1,L2**
Module -4		
Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions-examples.	**10 Hours (Text 3 & Ref. 3)**	**L1,L2**
Module -5		
Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Statement of central limit theorem-Illustrative examples. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process.	**10 Hours (Text 3 & Ref. 3)**	**L1,L2**

Course Outcomes: After studying this course, students will be able to:

1. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
2. Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
3. Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.
4. Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.
5. Apply the idea of joint probability distributions and the role of parameter-dependent random variables in random process.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David C.Lay, Steven R. Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, “Advanced Engineering Mathematics”, 10th edition, Wiley, 2015.
3. Scott L.Miller, DonaldG. Childers: “Probability and Random Process with application to Signal Processing”, Elsevier Academic Press, 2nd Edition,2013.

Reference books:

1. Richard Bronson: “Schaum’s Outlines of Theory and Problems of Matrix Operations”, McGraw-Hill, 1988.
2. Elsgolts, L.:”Differential Equations and Calculus of Variations”, MIR Publications, 3rd Edition, 1977.
3. T.Veerarajan: “Probability, Statistics and Random Process“, 3rd Edition, Tata McGraw Hill Co.,2008.

Web links:

1. http://nptel.ac.in/courses.php?disciplineId=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://ocw.mit.edu/courses/mathematics/
4. www.wolfram.com

<table>
<tr><td colspan="4" align="center"><u>ADVANCED CONTROL SYSTEMS</u>
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I</td></tr>
<tr><td>Subject</td><td>16EIE12</td><td>IA Marks</td><td>20</td></tr>
<tr><td>Number</td><td>04</td><td>Exam Marks</td><td>80</td></tr>
<tr><td>Total Number</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 04</td></tr>
<tr><td colspan="4">Course Objectives: This course will enable the students to
Acquaint with basic digital controller analysis and design methods for computer controlled systems.
Understand the fundamentals of control design and analysis using state-space methods
Familiarize with State-space representation of dynamic systems
Design controllers using state-space methods, pole-placement and optimal control methods.
Provide an overview of techniques for design and analysis of nonlinear systems.</td></tr>
</table>

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Digital Control Systems: Review of Difference equations, Z — transforms and Inverse Z transforms, The Z- transfer function (Pulse transfer function), The Z -Transform Analysis of Sampled data Control Systems, The Z and S - domain relationship, Stability analysis (Jury‘s Stability Test and Bilinear Transformation) (Text 1, Text 2).	**10 Hours**	**L1, L2, L3, L4**
Module -2		

State Models& Solution of State equations: State models for Linear Continuous Time and Linear Discrete Time systems, Diagonalization, Solution of State Equations (for both Continuous and Discrete Time systems), Relevant problems (Text1).	**10 Hours**	**L2, L3, L4, L5**
Module -3		
State Feedback Systems: Concepts of Controllability and Observability (for both Continuous and Discrete Time systems), Pole Placement by State Feedback (for both continuous and discrete Time systems), Observer System (Full order and Reduced order observers for both Continuous and Discrete Time systems), Relevant problems (Text 1, Text 2).	**10 Hours**	**L2, L3, L4, L5**
Module -4		
Regulators: Dead beat Control by State Feedback, Optimal control problems using State Variable approach, State regulator and Output regulator, Concepts of Model Reference Adaptive Control (MRAC) (Text 1, Text 2).	**10 Hours**	**L2, L3, L4, L5**
Module -5		
Non Linear Control Systems: Behavior of Nonlinear Systems, Common Physical Nonlinearities, Describing Function Method, Stability Analysis by Describing Function Method, Phase Plane Method, Stability Analysis by Phase Plane Method (Text 1).	**10 Hours**	**L2, L3, L4**

Course Outcomes: After studying this course, students will be able to:

- Derive the pulse transfer function for various closed loop configurations and understand the stability analysis of sampled data control systems.
- Apply state space techniques to model linear continuous and discrete time systems, convert state space (SS) representations to transfer function (TF) representation and vice versa
- Apply controllability and observability tests and understand the design of state feedback systems using pole placement and observer systems.
- Solve the optimal control problems using state variable approach and to understand the basic concepts of adaptive control systems.
  Understand the types of nonlinearities, characteristics of Nonlinear systems and the stability analysis of Nonlinear control systems.

Graduate Attributes (as per NBA)

- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Interpretation of data

Question Paper Pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. I.J. Nagrath & M.Gopal, "Control Systems Engineering", New Age International Publishers, Fifth edition, 2007.
2. K. Ogata, "Discrete Time Control Systems", 2nd edition, PHI, 2009.

Reference Books:

1. K. Ogata, "Modern Control Engineering", 5th Edition , PHI , 2010.
2. 2. M. Gopal ,“Modern Control System Theory", New Age International, 2012.
3. M. Gopal, "Digital Control and State Variable methods", 4th edition, Tata McGrawHill, 2012.
4. A.Nagoorkani, “Advanced Control Theory”, RBA publications, 2006.

ADVANCED EMBEDDED SYSTEM [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	16EVE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives: This course will enable students to:

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Describe the hardware software co-design and firmware design approaches
- Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.
- Program ARM CORTEX M3 using the various instructions, for different applications

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Optocoupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Selected Topics from Ch -1, 2, 3 of Text 1).	**10 Hours**	**L1, L2, L3**
Module -2		
Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Selected Topics From Ch-7, 9, 12, 13 of Text 1).	**10 Hours**	**L1, L2, L3, L4**

Module -3		
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Ch 1, 2, 3 of Text 2).	**10 Hours**	**L1, L2, L3**
Module -4		
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Ch-4, 5, 6 of Text 2).	**10 Hours**	**L1, L2, L3, L4**
Module -5		
Exceptions, Nested Vector interrupt controller design, Systick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Ch-7, 8, 10 of Text 2).	**10 Hours**	**L1, L2, L3**

Course Outcomes:
After studying this course, students will be able to:
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Explain the hardware software co-design and firmware design approaches.
- Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.
- Apply the knowledge gained for Programming ARM CORTEX M3 for different applications.

Graduate Attributes (as per NBA)
- Engineering Knowledge.
- Problem Analysis.
- Design/Development of solutions

Question paper pattern:
- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.
2. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd edn, Newnes, (Elsevier), 2010.

Reference Book:

James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.

DIGITAL CIRCUITS AND LOGIC DESIGN
[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER – I

Subject Code	16ELD14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			

Course objectives: This course will enable students to:

- Understand the concepts of sequential machines
- Design Sequential Machines/Circuits
- Analyze the faults in the design of circuits
- Apply fault detection experiments to sequential circuits

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT)**
Module -1		
Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks, Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities.	**10 Hours**	**L1, L2,L3**
Module -2		
Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic, Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits.	**10 Hours**	**L1, L2, L3,L4**
Module -3		
Fault-Location Experiments, Boolean Differences, Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.	**10 Hours**	**L1, L2, L3,L4**
Module -4		

Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, FI Decompositions	**10 Hours**	**L1, L2, L3,L4**
Module -5		
State—Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault	**10 Hours**	**L1, L2, L3,L4**

Course out comes: At the end of the course, the students will be able to:

- Understand the concepts of sequential machines
- Design Sequential Machines/Circuits
- Analyze the faults in the design of circuits
- Apply fault detection experiments to sequential circuits

Graduating Attributes (as per NBA)

- Engineering Knowledge
- Problem Analysis
- Design / development of solutions (partly)
- o Investigations

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Zvi Kohavi, “Switching and Finite Automata Theory”, 2nd Edition, TMH.

Reference Books:

1. Charles Roth Jr., “Digital Circuits and logic Design”,
2. Parag K Lala, “Fault Tolerant And Fault Testable Hardware Design”, Prentice Hall Inc. 1985.
3. E. V. Krishnamurthy, “Introductory Theory of Computer”, Macmillan Press Ltd, 1983.
4. Mishra & Chandrasekaran, “Theory of computer science – Automata, Languages and Computation”, 2nd Edition, PHI, 2004.

PLCS AND INDUSTRIAL AUTOMATION

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	16EIE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the concepts of PLC programming and its operations.
- Design the connectivity between various modules in a system with PLC.
- To create ladder diagrams from process control descriptions.
- Understand various types of PLC registers and apply PLC Timers and Counters for the control of industrial processes.
- Understand PLC functions, Data Handling Function.

Modules	Teaching Hours	Revised Bloom’s Taxonomy (RBT) Level
Module -1		

Introduction to PLC Technical Definition , Advantages, Characteristic Functions, Chronological Evolution, Types, Unitary PLC, Modular PLC, SMEEl PLC, Medium PLC, Large PLC, Block Diagram Of PLC, Input / Output Section, Processor Section, Power Supply, Memory, Central Processing Unit, Processor Software / Executive Software, Multitasking, Languages, Ladder Language. **Bit Logic Instructions** Introduction, Input And Output Contact Program, Symbols, Numbering System Of Inputs And Outputs, Program Format, Introduction To Logic, Equivalent Ladder Diagram Of - AND Gate, OR Gate, NOT Gate, XOR Gate, NAND Gate, NOR Gate, Equivalent Ladder Diagram To Demonstrate De Morgan Theorem, Ladder Design.	**8 Hours**	**L1,L4**
Module -2		
PLC Timers And Counters Timer And Its Classification, Characteristics Of PLC Timer, Functions In Timer, Resetting – Retentive And Non-Retentive, Classification Of PLC Timer, On Delay, And Off Delay Timers, Timer-On Delay, Timer Off Delay, Retentive And Non-Retentive Timers, Format of a Timer Instruction. PLC Counter, Operation Of PLC Counter, Counter Parameters, Counter Instructions. Overview, Count Up (CTU), Count Down (CTD). **Advanced Instructions** Comparison Instructions, Addressing Data Files, Format Of Logical Address, Addressing Format For Micrologic System, Different Addressing Types. Data Movement Instructions.	**8 Hours**	**L2,L3, L4**
Module -3		

Logical Instructions Mathematical Instructions and its Features, Special Mathematical Instructions, Scale with Parameters or SCP Instruction. Data Handling Instructions and its Features, Program Flow Control Instructions, Proportional Integral Derivative (PID) Instruction. **PLC I/O Modules And Power Supply** Classification Of I/O, I/O System Overview, Practical I/O System and its mapping, Addressing Local and Expansion I/O, Input-Output Systems, Direct I/O Parallel I/O Systems Serial I/O Systems, Sinking And Sourcing, Sourcing and Sinking in PLC Interfacing, Discrete Input Module, Discrete DC Input Module, Discrete AC Input Module, Rectifier with Filter, Threshold Detection, Isolation, Logic Section, Discrete Output Modules, Advantages And Disadvantages Of Output Modules , Types Of Analog Input Module.	**8 Hours**	**L3,L4**
Module -4		
Industrial Communication Introduction, Evolution Of Industrial Control Process, Types Of Communication Interface, Types Of Networking Channels, Parallel Communication Interface. Serial Communication Interface, communication mode, Synchronous And Asynchronous Transmissions , Standard Interface RS 232C, RS 422, EIA 485, Comparison, Software Protocol, Industrial Network. Network Topology, Media Access Methods.	**8 Hours**	**L1,L2, L4**
Module -5		
Industrial Networking Open System Interconnection (OSI), Network Model, Network Components, Control Network Issues, Advantage of Standardized Industrial Network, Intelligent Devices, Industrial Network Bus Network, Device Bus Network Vs. Process Bus Network, Controller Area Network (CAN), Devicenet, Controlnet, Ethernet Protocol , AS-I Interface, FOUNDATION FIEAEBUS, Application of Profibus For Real PLC Communication. **Industrial Automation** Introduction, Utility Of Automation, General Structure of a Automated Process, Examples of Simple Automated Systems, Selection Of PLC.	**8 Hours**	**L1,L2,L4**

Course Outcomes:
After studying this course, students will be able to:

- Gain knowledge on Programmable Logic Controllers.
- Understand different types of Devices to which PLC input and output modules are connected.
- Able to create ladder diagrams from process control descriptions.
- Ability to apply PLC timers and counters for the control of industrial processes.
- To provide the Knowledge of Networking in Industrial automation.

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).
- Interpretation of data.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Madhuchhanda Mitra and Samarjit Sen Gupta, "Programmable Logic Controllers and Industrial Automation", Penram International Publishing (India) Pvt. Ltd., 2007. ISBN: 81-87972-17-3.

Reference Book:

1. Garry Dunning, "Introduction to Programmable Logic Controllers", 2nd Edition, Delmar Thomson Learning, 2001. ISBN: 981-240-625-5.
2. M. Chidambaram, "Computer Control of Processes", CRC Press, 2002. ISBN:0849310105.

NANOELECTRONICS

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	16EVE152	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			

Course objectives: This course will enable students to:

- Enhance basic engineering science and technological knowledge of nanoe lectronics.
- Explain basics of top down and bottom-up fabrication process, devices and systems.
- Describe technologies involved in modern day electronic devices.
- Appreciate the complexities in scaling down the electronic devices in the future.

Modules	Teaching hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction: Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moores law and continued miniaturization., Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometerlength scale, Fabrication methods: Top down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems (Text 1).	**8 Hours**	**L1, L2**
Module -2		
Characterization: Classification, Microscopic techniques, Field ion microscopy, scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques (Text 1).	**8 Hours**	**L2,L3**
Module -3		
Characterization: spectroscopy techniques: photon, radiofrequency, electron, surface analysis and dept profiling: electron, mass, Ion beam, Reflectrometry, Techniques for property measurement: mechanical, electron, magnetic, thermal properties (Text 1). **Inorganic semiconductor nanostructures:** overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states (Text 1).	**8 Hours**	**L1-L3**

Module -4		
Fabrication techniques: requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques (Text 1). **Physical processes:** modulation doping, quantum hall effect, resonant tunneling, charging effects, ballistic carrier transport, Inter band absorption, intraband absorption, Light emission processes, phonon bottleneck, quantum confined stark effect, nonlinear effects, coherence and dephasing, characterization of semiconductor nanostructures: optical electrical and structural (Text 1).	**8 Hours**	**L1-L3**
Module -5		
Methods of measuring properties: atomic, crystollography, microscopy, spectroscopy (Text 2). **Applications**: Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures, QWIP's, NEMS, MEMS (Text 1).	**8 Hours**	**L1-L4**

Course outcomes:

After studying this course, students will be able to:

- Know the principles behind Nanoscience engineering and Nanoelectronics.
- Apply the knowledge to prepare and characterize nanomaterials.
- Know the effect of particles size on mechanical, thermal, optical and electrical properties of nanomaterials.
- Design the process flow required to fabricate state of the art transistor techn ology.
- Analyze the requirements for new materials and device structure in the futur

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).
- Interpretation of data.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ed Robert Kelsall, Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007.
2. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, Copyright 2006, Reprint 2011.

Reference Book:

Ed William A Goddard III, Donald W Brenner, Sergey E. Lyshevski, Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", CRC press, 2003.

VIRTUAL INSTRUMENTATION

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EIE153	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

- **Course objectives:** This course will enable students to:
- Understand the difference between conventional and graphical programming
- Differentiate between real time and virtual instrument.
- Introduce the basics of LabVIEW and its programming concepts.
- Analyze the basics of data acquisition and learning the concepts of data acquisition with LabVIEW
- Provide the concepts of interfacing peripherals
- Create a virtual system for real time applications

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1		
Fundamentals of Virtual Instrumentation Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. **Software Overview** Lab VIEW , Graphical user interfaces, Controls and Indicators Data types , Data flow programming, Editing, Debugging and Running Virtual instrument, Graphical programming palletes and their configuration, VIs and sub-Vis, Typical examples-VIs.	**8 Hours**	**L1, L2**
Module -2		
Programming Structure: FOR loops, WHILE loop, CASE structure, formula node, Sequence structures, Examples. **Introduction to Arrays and Clusters:** Array operations Cluster Functions, Graphs and charts, local and global variables, Examples.	**8 Hours**	**L1, L2, L3 L4**
Module -3		
File Input/Output: Introduction, File Formats, File I/O Functions, Sample VIs to Demonstrate File WRITE and READ Function. **String Handling:** Introduction, String Functions, LabVIEW String Formats, Typical examples.	**8 Hours**	**L1, L2, L3, L4**
Module -4		
Basics of Data Acquisition: Introduction to data acquisition Classification of Signals, Analog Interfacing Connecting signal to board, Analog Input/output techniques digital I/O. **DAQ Hardware configuration** Introduction, Measurement and Automation Explorer, DAQ Assistants, Analysis Assistants, Instrument Assistant.	**8 Hours**	**L1, L2, L3, L4, L5**
Module -5		

Interfacing Instruments: GPIB and RS232 Introduction, RS232 Vs. GPIB, Handshaking, GPIB Interfacing, Standard commands for Programmable Instruments, VISA. **Use of analysis tools and application of VI** Fourier transforms Power spectrum, Correlation methods, windowing & filtering. Inter-Process Communication, Notifier, Queue, Semaphore, Data Sockets, Programmatically Printing Front Panel.	**8 Hours**	**L1, L2, L3, L4, L5**

Course Outcomes:

After studying this course, students will be able to:

- Design front panel and block diagram for the given application using Lab VIEW.
- Gain knowledge and understanding about the prominence of case structure and while loops
- Handle clusters and arrays to perform file operations
- Create a VI system to solve real time problems

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).
- Interpretation of data.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

Sanjay Gupta , Joseph John, “Virtual Instrumentation Using LabVIEW” ,McGraw Hill Publisher, 2nd Edition, 2010, ISBN: 978-0070700284.

Reference: Books:

1. Lisa. K. Wills , “LabVIEW for Everyone” , Prentice Hall of India, 2nd Edition, 2008, ISBN : 978-0132681940.
2. Garry Johnson, Richard Jennings, “LabVIEW Graphical Programming”, 4th Edition, McGraw Hill Professional, 2006. ISBN No-978-1259005336.

<table>
<tr><td colspan="6" align="center"><u>SIMULATION, MODELLING AND ANALYSIS</u>
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I</td></tr>
<tr><td>Subject Code</td><td colspan="2">16ECS154</td><td>IA Marks</td><td colspan="2">20</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td colspan="2">03</td><td>Exam Marks</td><td colspan="2">80</td></tr>
<tr><td>Total Number of Lecture Hours</td><td colspan="2">40</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="6" align="center">CREDITS – 03</td></tr>
<tr><td colspan="6">Course objectives: This course will enable students to:
• Understand the process of simulation and modeling
• Learn simulation of deterministic and probabilistic models, with a focus of statistical data analysis and simulation data.</td></tr>
<tr><td colspan="3" align="center">Modules</td><td colspan="2" align="center">Teaching Hours</td><td align="center">Revised Bloom's Taxonomy (RBT) Level</td></tr>
<tr><td colspan="6">Module -1</td></tr>
</table>

Basic Simulation Modeling: Nature of simulation, Systems, Models and Simulation, Discrete- Event Simulation, Simulation of Single Server Queuing System, Simulation of inventory system, Parallel and distributed simulation and the high level architecture, Steps in sound simulation study, and Other types of simulation, Advantages and disadvantages. (1.1, 1.2, 1.3, 1.4, 1.4.1, 1.4.2, 1.4.3, 1.5, 1.5.1, 1.5.2, 1.6, 1.7, 1.8, 1.9 of Text)	**8 Hours**	**L1,L2**
Module -2		
Review of Basic Probability and Statistics Random Variables and their properties, Simulation Output Data and Stochastic Processes, Estimation of Means, Variances and Correlations, Confidence Intervals and Hypothesis tests for the Mean **Building valid, credible and appropriately detailed simulation models**: Introduction and definitions, Guidelines for determining the level of models detail, Management's Role in the Simulation Process, Techniques for increasing model validity and credibility, Statistical procedure for comparing the real world observations and simulation output data. (4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 5.4, 5.5, 5.6, 5.6.1, 5.6.2 of Text)	**8 Hours**	**L1,L2, L3**
Module -3		
Selecting Input Probability Distributions: Useful probability distributions, activity I, II and III. Shifted and truncated distributions; Specifying multivariate distribution, correlations, and stochastic processes; Selecting the distribution in the absence of data, Models of arrival process (6.2, 6.4, 6.5, 6.6, 6.8, 6.10, 6.11, 6.12 of Text).	**8 Hours**	**L1,L2, l3**
Module -4		

Random Number Generators: Linear congruential Generators, Other kinds, Testing number generators, **Generating the Random Variates**: General approaches, Generating continuous random variates, Generating discrete random variates, Generating random vectors, and correlated random variates; Generating arrival processes. (7.2, 7.3, 7.4, 8.2, 8.3, 8.4, 8.5, 8.6 of Text))	**8 Hours**	**L1,L2, L3**
Module -5		
Output data analysis for a single system: Transient and steady state behavior of a stochastic process; Types of simulations with regard to analysis; Statistical analysis for terminating simulation; Statistical analysis for steady state parameters; Statistical analysis for steady state cycle parameters; Multiple measures of performance, Time plots of important variables. (9.2, 9.3, 9.4, 9.4.1, 9.4.3, 9.5, 9.5.1, 9.5.2, 9.5.3, 9.6, 9.7, 9.8 of Text)	**8 Hours**	**L1,L2,L3**
Course Outcomes: After studying this course, students will be able to: • Define the need of simulation and modeling. • Describe various simulation models. • Discuss the process of selecting of probability distributions. • Perform output data analysis.		
Post Graduate Attributes (as per NBA): o Engineering Knowledge. o Problem Analysis. o Design and development of solutions. o Interpretation of data		
Question paper pattern: • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module.		

Text Book:
Averill Law, "Simulation modeling and analysis", McGraw Hill 4th edition, 2007.

Reference Books:

1. Tayfur Altiok and Benjamin Melamed, "Simulation modeling and analysis with ARENA", Elsevier, Academic press, 2007.
2. Jerry Banks, "Discrete event system Simulation", Pearson, 2009
3. Seila Ceric and Tadikamalla, "Applied simulation modeling", Cengage, 2009.
4. George. S. Fishman, "Discrete event simulation", Springer, 2001.
5. Frank L. Severance, "System modeling and simulation", Wiley, 2009.

INDUSTRIAL ELECTRONICS LAB - 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory Code	16EIEL16	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Simulate ladder logic for various applications using PLC control system
- Practice LabVIEW for virtual instrumentation applications
- Learn Assembly language programming for different applications using ARM-Cortex M3 Kit and Keil uvision- 4 tool.
- Learn C language programming for different applications using ARM- Cortex M3 Kit and Keil uvision-4 tool.

Laboratory Experiments:	Revised Bloom's Taxonomy (RBT) Level

1. Use the suitable software simulation tool to develop and implement the ladder logic for PLC a. Binary to gray code using PLC. The logic should be solved using ladder diagram technique. b. Bottle filling process using PLC. The logic should be solved using ladder diagram technique. c. Elevator using PLC. The logic should be solved using ladder diagram technique. d. Controlling the Rotation of the motor using timer. The logic should be solved using ladder diagram technique.	**L2,L3,L4**
2. Introduction of the basics of data acquisition and computer controlled Instrumentation using Virtual Instrumentation (LabVIEW programs) a. Simulation of temperature indicators using LabVIEW. b. Simple calculator using LabVIEW. c. Design of a variable function generator using VI d. Creation of a CRO using VI and measurement of frequency and amplitude e. Data acquisition using VI for temperature measurement with thermocouple and AD590	**L2, L3, L4**
3. ARM Cortex M3 Programs: (Programming to be done using Keil uvision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U). a. Write an Assembly language program to calculate the sum and display the result for the addition of first ten numbers. SUM = 10+9+8+.........+1 b. Write a Assembly language program to link multiple object files and link them together. c. Write an Assembly language program to store data in RAM d. Write a C program to Output the “Hello World” message using UART e. Write a C program to Design a Stopwatch using interrupts.	**L2,L3,L4**

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Simulate ladder logic for various applications using PLC
- Use LabVIEW for virtual instrumentation applications
- Develop Assembly language programs for different applications using ARM-
- Cortex M3 Kit and Keil uvision-4 tool.
- Develop C language programs for different applications using ARM- Cortex M3 Kit and Keil uvision-4 tool.

Graduate Attributes (as per NBA)

- Engineering Knowledge.
- Problem Analysis.
- Design/Development of solutions.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. For examination, two questions using different tool to be set.
3. Students are allowed to pick one experiment from the lot.
4. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
5. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.