

## Metric No. 2.6.1

### Electrical and Instrumentation Engineering

#### Course Scheme-2014 (BE Electrical)

##### UDP004: INTRODUCTION TO ELECTRICAL ENGINEERING

- Types of generation in India
- Transmission and distribution networks
- Protection devices and Earthing
- Energy conservation, Safety guidelines, Electricity specifications and standards.

##### UCB008: APPLIED CHEMISTRY

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.
- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

##### UMA002: MATHEMATICS-II

- Solve differential equations of first and second order using various analytical methods.
- Solve ordinary and partial differential equations using the Laplace transform and Fourier series.
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations on harmonic and entire functions.
- Solve systems of linear equations and analyze vectors in  $R^n$  geometrically and algebraically.
- Analyze vector spaces and subspaces over a field, and to find linear transformations and their properties, matrices of linear transformations.

##### UTA002: MANUFACTURING PROCESS

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.

##### UDP004: INTRODUCTION TO ELECTRICAL ENGINEERING

- Types of generation in India
- Transmission and distribution networks
- Protection devices and Earthing
- Energy conservation, Safety guidelines, Electricity specifications and standards.

**UES001: ELECTRICAL & ELECTRONIC SCIENCE**

- Application of network laws and theorems to solve electric circuits
- Types of supply system
- Phasor and complex notation representation of series, parallel and combined circuits
- Principle, construction, characteristics and applications of Electro-Mechanical energy conversion devices and basic Electronic devices

**UEE301: DIRECT CURRENT MACHINES AND TRANSFORMERS**

After the completion of the course the students will be able to:

- Test the transformer and calculate its efficiency and performance in distribution system.
- Scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection.
- Select appropriate DC motor for specific purpose and can compute their steady performance.
- Compute the performance with DC generators and can supply increasing load with parallel operation.
- Thoughtfully select the speed control and starting method of DC motor.

**UEE302: ELECTROMAGNETIC FIELD THEORY**

After the completion of the course the students will be able to:

- Calculate electric and magnetic fields in different coordinates for various charge and current configurations
- Demonstrate different aspects of plane wave and in dielectric and conducting media
- Realize the analogy of wave with transmission line and Calculate the transmission line performance
- Select the appropriate guide for electromagnetic waves

**UEE303: POWER GENERATION AND ASSOCIATED ECONOMICS**

After the completion of the course the students will be able to:

- Apply knowledge of India's power scenario, power system structure and related agencies.
- Harness power from conventional and renewable sources.
- Select the methods and size of plant generating power for overall economy.
- Decide the tariff structure for different type of users.

**UEE401: ALTERNATING CURRENT MACHINES**

After the completion of the course the students will be able to:

- Simulate the steady-state and transient state performance of induction and synchronous machines to identify performance measures
- Validate and identify the machine parameters.
- Select the appropriate AC motor for different large power application.
- Analyse the stability of single machine – infinite bus system and form the grid to supply large load.
- Choose the appropriate fractional horse power motor as per the usage in daily life.

**UEE402: TRANSMISSION AND DISTRIBUTION OF POWER**

After the completion of the course the students will be able to:

- Understand the structure of power system.
- Analyse the transmission line models and evaluate its performance parameters.
- Design the transmission lines under various working conditions.
- Describe and select the configurations of different line insulators and evaluate their performance.
- Supervise the laying of cables and fault detection in cables.
- Design the distribution system network.

### **UEE503: NETWORK ANALYSIS AND SYNTHESIS**

After the completion of the course the students will be able to:

- Understand the various laws and theorems related to electric networks.
- Understand the concept of two port networks.
- Familiarize with network synthesis.

### **UEE502: HIGH VOLTAGE ENGINEERING**

After the completion of the course the students will be able to:

- Conceptualize the idea of high voltage and safety measures involved
- Analyse the breakdown mechanism of solids, liquids and gases
- Design insulation associated with various power system components such as transformer, rotating machines and switchgear
- Analyse and calculate the circuit parameters involved in generation of high voltages
- Measure direct, alternating and impulse high voltage signals.
- Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests

### **UEE504: POWER ELECTRONICS**

After the completion of the course the students will be able to:

- Identify the power – electronic devices and inference their usage as switch for energy conversion and control
- Select and design appropriate converter configuration / topology for typical power application such as DC drive, AC drive, HVDC and FACTS.
- Design the firing and commutation circuit for different converter configurations.
- Use power converters for harmonic mitigation, voltage and frequency control

### **UEE604: FLEXIBLE AC TRANSMISSION SYSTEMS**

After the completion of the course the students will be able to:

- Decide the scheme for power system stability and voltage control
- Decide the converter configuration for different power systems applications such as HVDC, FACTS etc.
- Decide the usage of different FACTS compensators for different purposes.
- Compute the harmonics on AC and DC side and decide their filtering.

### **UEE605: POWER SYSTEM ANALYSIS AND STABILITY**

After the completion of the course the students will be able to:

- Develop an appropriate mathematical model of power system component.

- Carry out load flow analysis of practical power system for balanced system.
- Conduct short circuit studies during balanced and unbalanced faults to decide the fault levels and circuit breaker ratings.
- Analyze the stability of single machine-infinite bus system and decide the critical clearing time of circuit breakers

### **UEE603: SWITCHGEAR AND PROTECTION**

After the completion of the course the students will be able to:

- Select the protection elements such as fuse, circuit breakers and relays etc. for a given configuration.
- Design the basic Earthing requirement for residential and other purposes.
- Select required protection measures against overcurrent, overvoltage in transmission lines.
- Select suitable protection scheme for different power system equipment.

### **UEE801: ELECTRIC DRIVES**

After the completion of the course the students will be able to:

- Conceptualize the basic drive system and analyse it for different types of loads
- Analyse the motor situation during starting and braking
- Develop control circuitry and devices for control of motor
- Estimate the motor rating for different condition of load
- Design the converter circuit for control purpose along with its different configuration
- Use PLC and converter control to drive on the basis of energy efficiency

### **UEE802: INTELLIGENT ALGORITHMS IN POWER SYSTEMS**

After the completion of the course the students will be able to:

- Implement fuzzy controllers by modelling the human intelligence into mathematical model
- Mathematically model the human learning capability and solve classification, control system and optimization problem.
- Obtain the optimum solution of well formulated optimization problem using evolutionary approach.
- Formulate hybrid intelligent algorithms for typical electrical application.

### **UEE804: OPERATION AND CONTROL OF POWER SYSTEMS**

After the completion of the course the students will be able to:

- Decide the scheduling of thermal units and hydro-thermal units for overall economy
- Develop small scale model of alternator, excitation and governing systems.
- Design and apply control for frequency and voltage of power system represented by single or multi-area.
- Comprehend power system security and contingency.
- Computation of small scale and voltage stability.

### **UEE712: ELECTRICAL ENGINEERING MATERIALS**

After the completion of the course the students will be able to:

- Explain the basic concepts of elementary material science.
- Elaborate the dielectric properties of insulators in static and alternating field.

- Explain the concept of superconductivity.
- Classify semiconductor materials and its properties.

### **UEE711: ALTERNATE SOURCES OF ENERGY**

After the completion of the course the students will be able to:

- familiarize with another source of electrical generation like solar, wind ,biomass etc
- Understand the need of other types of sources , their advantages and disadvantages
- familiarize with different standalone, off grid energy sources
- understand different technology associate with solar, wind , biomass and other renewable energy sources

### **UEE522: ENERGY AUDITING AND MANAGEMENT**

After the completion of the course the students will be able to:

- Analyze about energy scenario nationwide and worldwide
- Decide about energy management in more effective way.
- Analyze about various energy related aspect of electrical system.
- Carry out financial management.
- Conduct studies related to operational aspects of compressed air system and refrigeration system.

### **UEE523: HIGH VOLTAGE TRANSMISSION SYSTEMS**

After the completion of the course the students will be able to:

- Choose intelligently AC and DC transmission systems for the dedicated application(s).
- Identify the suitable two-level/multilevel configuration for high power converters.
- Select the suitable protection method for various converter faults.
- Identify suitable reactive power compensation method.
- Decide the configuration for harmonic mitigation on both AC and DC sides.

### **UEE524: POWER QUALITY MONITORING AND CONDITIONING**

After the completion of the course the students will be able to:

- Reliably identify the sources of various power quality problems.
- Estimate the impact of various power quality problems on appliances.
- Educate the harmful effects of poor power quality and harmonics.
- Decide the compensators and filters to keep the power quality indices within the standards.

### **UEE501: GENERALIZED THEORY OF ELECTRICAL MACHINES**

After the completion of the course the students will be able to:

- Express the revolving field and reference frame theory
- Develop mathematical model of three-phase AC machines and parameters in different reference frame
- Simulate the transient performance of three-phase ac machines in different reference frames.
- Investigate the transient performance of different DC machines.
- Select special purpose small machines for different applications

**UEE841: INDUSTRIAL ELECTRONICS**

After the completion of the course the students will be able to:

- Simulate and analyse the semiconductor controlled ac and DC drive system
- Design and develop an illumination system for domestic, industry and commercial sites.
- Design an electric heating system for industrial purposes.
- Equip the skill to design and develop a regulated power supply.
- Simulate and analyse the series and shunt compensators for power factor improvement in drive system

**UEE521: ELECTRIC MACHINE DESIGN**

After the completion of the course the students will be able to:

- Design DC machines
- Design transformers with reduced losses
- Calculate the losses and efficiency in the machines
- Learn about the Analysis and Synthesis approaches as well as optimal design of electrical machines.

**Course Scheme-2015 and 2016 (BE Electrical)****UMA003 Mathematics – I**

- Apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.
- Determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
- Evaluate multiple integrals and their applications to engineering problems.
- Examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.
- Analyze some mathematical problems encountered in engineering applications.

**UTA007: Computer Programming-I**

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm/pseudocode.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

**UPH004: Applied Physics**

- Understand damped and simple harmonic motion, the role of reverberation in designing a hall and generation and detection of ultrasonic waves.
- Use Maxwell's equations to describe propagation of EM waves in a medium.
- Demonstrate interference, diffraction and polarization of light.
- Explain the working principle of Lasers.

- Use the concept of wave function to find probability of a particle confined in a box.

### **UEE001: ELECTRICAL ENGINEERING**

#### **(COs):**

After the completion of the course the students will be able to:

- Learn about applications of networks laws and theorems to solve electric circuits.
- Represent AC quantities through phasor and compute AC system behaviour during steady state.
- Learn about principle, construction, characteristics and application of Electro-Mechanical energy conversion devices

### **UHU003: Professional Communication**

- Understand and appreciate the need of communication training.
- Use different strategies of effective communication.
- Select the most appropriate mode of communication for a given situation.
- Speak assertively and effectively.
- Correspond effectively through different modes of written communication.
- Write effective reports, proposals and papers.
- Present himself/ herself professionally through effective resumes and interviews.

### **UTA008: Engineering Design-I**

- Creatively comprehend geometrical details of common engineering objects.
- Draw dimensioned orthographic and isometric projections of simple engineering objects.
- Interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism.
- Create the engineering drawings for simple engineering objects using autocad.
- Manage screen menus and commands using autocad.
- Operate data entry modes and define drawings geometrically in terms of cartesian, polar and relative coordinates in autocad.
- Create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using autocad.

### **UMA004: MATHEMATICS-II**

- Solve the differential equations of first and second order and basic application problems described by these equations.
- Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.
- Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.
- Solve systems of linear equations by using elementary row operations.
- Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigen vectors.

### **UTA009: COMPUTER PROGRAMMING – II**

1. Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
2. Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
3. Demonstrate use of file handling.

4. Demonstrate use of templates and exception handling.
5. Demonstrate use of windows programming concepts using C++

**UES009 : Mechanics**

- Determine resultants in plane force systems.
- Identify and quantify all forces associated with a static framework.
- Solve problems in kinematic and dynamic systems.

**UEC001: ELECTRONIC ENGINEERING**

- Demonstrate the use of semiconductor diodes in various applications.
- Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
- Recognize and apply the number systems and Boolean algebra.
- Reduce Boolean expressions and implement them with Logic Gates.
- Analyze, design and implement combinational and sequential circuits.
- Analyze and differentiate logic families, TTL and CMOS.

**UCB008: Applied Chemistry**

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.
- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

**UMA031 : Optimization Techniques**

- Formulate and solve linear programming problems.
- Solve the problems on networks models such as Transportation, Assignment, Shortest path, minimal spanning tree, and Maximal flow.
- Solve the problems of Project Management using CPM and PERT
- Solve Non-linear Programming problems of some kinds.
- Implement the Linear programming techniques using C or any other optimization

**UTA002: Manufacturing Processes**

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

**UES010 : Solids and Structures**



- Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
- Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
- Calculate load carrying capacity of columns and struts and their buckling strength.
- Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
- Determine deformations and deflections in various kinds of beams and trusses.

### **UES011 THERMO-FLUIDS**

- Analyze and solve problems of simple fluid based engineering systems including
- Pressures and forces on submerged surfaces
- Analyze fluid flow problems with the application of the mass, momentum and energy equations
- Evaluate practical problems associated with pipe flow systems
- Conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
- Estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
- Analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
- Analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

### **UTA011: ENGINEERING DESIGN-III**

- Understand of features of Arduino board.
- Analyze of internal Architecture of Arduino board.
- Apply Arduino board programming concepts.
- Design and implement Buggy project based on different goals and challenges defined.

### **UEE301: DIRECT CURRENT MACHINES AND TRANSFORMERS**

#### **(COs):**

After the completion of the course the students will be able to:

- Test the transformer and calculate its efficiency and performance in distribution system
- Scrutinize three-phase transformer connections and use special purpose transformer measurement and protection.
- Select appropriate DC motor for specific purpose and can compute their st performance.
- Compute the performance with DC generators and can supply increasing load with par operation.
- Thoughtfully select the speed control and starting method of DC motor

### **UEE505: ANALOG AND DIGITAL SYSTEMS**

#### **(COs):**

After the completion of the course the students will be able to:

- Design different type of circuits such as rectifiers, clippers, clampers, filters etc.
- Design power supplies and solve problems related to amplifiers and oscillators.

- Design combinational and sequential circuits.
- Differentiate various type of memories and there use in different applications.
- Demonstrate the concept of logic circuits and converters.

#### **UEE405: NETWORK THEORY AND DESIGN**

##### **(COs):**

After the completion of the course the students will be able to:

- Apply the various laws and theorems related to electric networks.
- Explain the concept of two port networks.
- Familiarisation with network synthesis
- Theory and designing of passive filters and attenuators
- Design of active filters

#### **UEE401: ALTERNATING CURRENT MACHINES**

##### **(COs):**

After the completion of the course the students will be able to:

- Simulate the steady-state and transient state performance of induction and synchron machines to identify performance measures
- Validate and identify the machine parameters.
- Select the appropriate AC motor for different large power application.
- Analyse the stability of single machine – infinite bus system and form the grid to sup large load.
- Choose the appropriate fractional horse power motor as per the usage in daily life.

#### **UEE403: MEASUREMENT AND TRANSDUCERS**

##### **(COs):**

After the completion of the course the students will be able to:

- Use various types of instruments for measurement of variables.
- Select and use various types of sensors in different conditions.
- Select and use various type of bridge circuits with different sensors.

#### **UEE404: TRANSMISSION AND DISTRIBUTION OF POWER**

After the completion of the course the students will be able to:

- Analyse the transmission line models and evaluate its performance parameters.
- Design the transmission lines under various working conditions.
- Describe and select the configurations of different line insulators and evaluate th performance.
- Supervise the laying of cables and fault detection in cables.
- Design the distribution system network.

#### **UEE507: ENGINEERING ELECTROMAGNETICS**

After the completion of the course the students will be able to:

- Appraise need analysis for different coordinate systems in electromagnetics and th interrelations
- Apply vector calculus to solve field theory problems
- Calculate electric and magnetic fields in different coordinates for various charge a current configurations
- Exhibit the concept of time varying fields
- Demonstrate different aspects of plane wave in dielectric and conducting media
- Realize the analogy of wave with transmission line and determine the transmission li

performance

#### **UEE504: POWER ELECTRONICS**

After the completion of the course the students will be able to:

- Select the power devices as per the usage for energy conversion and control.
- Exhibit the designing of firing and commutation circuits for different converter configurations.
- Demonstrate capability to analyse various converter configuration / topology.
- Identify converter configurations for various power applications such as electric drive, HVDC and FACTS.
- Exhibit the usage of power converters for harmonic mitigation, voltage and frequency control.

#### **UEE506: DIGITAL SIGNAL PROCESSING FUNDAMENTALS**

After the completion of the course the students will be able to:

- Explain the digital signal processing concepts and stability analysis of digital system.
- Demonstrate the hardware architecture of DSP Processor.
- Design digital filter and harmonic mitigation.
- Carry out spectrum analysis using DFT.
- Apply DSP concepts for power system purposes such as relaying, protection and metering.

#### **UEE605: POWER SYSTEM ANALYSIS AND STABILITY**

After the completion of the course the students will be able to:

- Develop an appropriate mathematical model of power system
- Carry out power flow analysis of practical power system for balanced system.
- Conduct studies during balanced and unbalanced faults to decide the fault levels and circuit breaker ratings.
- Analyze the stability of single machine-infinite bus system and can decide the critical clearing time of circuit breakers.

#### **UEE603: SWITCHGEAR AND PROTECTION**

After the completion of the course the students will be able to:

- Select the protection elements such as fuse, circuit breakers, relays etc. for a given configuration.
- Design the basic Earthing requirement for residential and other purposes.
- Select required protection measures against overcurrent, overvoltage in transmission line.  
Select suitable protection scheme for different power system equipment.

#### **UEE801: ELECTRIC DRIVES**

After the completion of the course the students will be able to:

- Conceptualize the basic drive system and analyse it for different types of loads
- Analyse the motor situation during starting and braking
- Develop control circuitry and devices for control of motor
- Estimate the motor rating for different condition of load
- Design the converter circuit for control purpose along with its different configuration
- Use PLC and converter control to drive on the basis of energy efficiency

**UEE693: Capstone Project (Start)**

After the completion of the course, the students will be able:

- To identify design goals and analyze possible approaches to meet given specifications with realistic engineering constraints.
- To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.
- To perform simulations and incorporate appropriate adaptations using iterative synthesis.
- To use modern engineering hardware and software tools.
- To work amicably as a member of an engineering design team.
- To improve technical documentation and presentation skills.

**UEE502: HIGH VOLTAGE ENGINEERING**

After the completion of the course the students will be able to:

- Conceptualize the idea of high voltage and safety measures involved
- Analyse the breakdown mechanism of solids, liquids and gases
- Design insulation associated with various power system components such as transformer rotating machines and switchgear
- Analyse and calculate the circuit parameters involved in generation of high voltages
- Measure direct, alternating and impulse high voltage signals.
- Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests

**UEE604: FLEXIBLE AC TRANSMISSION SYSTEMS**

After the completion of the course the students will be able to:

- Describe the converter configuration for different power systems applications such as HVDC, FACTS etc.
- Evaluate the converters, harmonics on AC and DC side and filtering.
- Classify various compensators suited for various power system purposes.
- Analyze power system behaviour with different shunt compensators.
- Appraise series compensated power system behaviour with different series compensators.
- Analyse system behaviour with hybrid shunt-series compensators.

**UEE702: INTELLIGENT TECHNIQUES IN ELECTRICAL ENGINEERING**

After the completion of the course the students will be able to:

- Examine the fuzzy system and implement fuzzy controllers for control and classification.
- Explain neural networks behaviour and use them for classification, control system and optimization problem.
- Obtain the optimum solution of well formulated optimisation problem using evolutionary approach.
- Formulate hybrid intelligent algorithms for typical electrical application.

**UEE804: OPERATION AND CONTROL OF POWER SYSTEMS**

After the completion of the course the students will be able to:

- Decide the scheduling of thermal units and hydro-thermal units for overall economy
- Develop small scale model of alternator, excitation and governing systems.
- Design and apply control for frequency and voltage of power system represented by

single or multi-area.

- Comprehend power system security and contingency.
- Computation of small scale and voltage stability.

### **UEE795: Capstone Project (Completion)**

After the completion of the course, the students will be able:

- To identify design goals and analyze possible approaches to meet given specifications with realistic engineering constraints.
- To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.
- To perform simulations and incorporate appropriate adaptations using iterative synthesis.
- To use modern engineering hardware and software tools.
- To work amicably as a member of an engineering design team.
- To improve technical documentation and presentation skills.

### **UEE806: ALTERNATE SOURCES OF ENERGY**

After the completion of the course the students will be able to:

- Explain the basic renewable energy sources like solar, wind ,biomass etc
- Explain various advantages and disadvantages of renewable energy sources.
- Familiarization with different standalone, off grid energy sources
- Explain different technology associate with solar, wind, biomass and other renewable energy sources.
- Describe the working of micro/mini hydropower system.

### **UEE891: PROJECT**

Upon completion of project semester, the students will be able to:

- Acquire knowledge and experience of software and hardware practices in the area of project.
- Carry out design calculations and implementations in the area of project.
- Associate with the implementation of the project requiring individual and teamwork skills.
- Communicate their work effectively through writing and presentation.
- Demonstrate the knowledge of professional responsibilities and respect for ethics.

### **UEE892: DESIGN PROJECT**

Upon completion of project semester, the students will be able to:

- Acquire knowledge and experience of software and hardware practices in the area of project.
- Carry out design calculations and implementations in the area of project.
- Associate with the implementation of the project requiring individual and teamwork skills.
- Communicate their work effectively through writing and presentation.
- Demonstrate the professional responsibilities and respect for ethics in university ambience.

**UEE631: HVDC TRANSMISSION SYSTEMS**

After the completion of the course the students will be able to:

- Choose intelligently AC and DC transmission systems for the dedicated application(s).
- Identify the suitable two-level/multilevel configuration for high power converters.
- Select the suitable protection method for various converter faults.
- Identify suitable reactive power compensation method.
- Decide the configuration for harmonic mitigation on both AC and DC sides.

**UEE632: POWER GENERATION AND ECONOMICS**

After the completion of the course the students will be able to:

- Apply knowledge of India's power scenario, power system structure and related agencies.
- Harness power from conventional and renewable sources.
- Select the methods and size of plant generating power for overall economy.
- Decide the tariff structure for different type of users.

**UEE633: GENERALIZED THEORY OF ELECTRICAL MACHINES**

After the completion of the course the students will be able to:

- Express the revolving field and reference frame theory
- Develop mathematical model of three-phase AC machines and parameters in different reference frame
- Simulate the transient performance of three-phase ac machines in different reference frames.
- Investigate the transient performance of different DC machines.
- Select special purpose small machines for different applications

**UEE524: POWER QUALITY MONITORING AND CONDITIONING**

After the completion of the course the students will be able to:

- Reliably identify the sources of various power quality problems.
- Estimate the impact of various power quality problems on appliances.
- Educate the harmful effects of poor power quality and harmonics.
- Decide the compensators and filters to keep the power quality indices within the standards.

**UEE841: INDUSTRIAL ELECTRONICS**

**(COs):**

After the completion of the course the students will be able to:

- Simulate and analyse the semiconductor controlled ac and DC drive system
- Design and develop an illumination system for domestic, industry and commercial sites.
- Design an electric heating system for industrial purposes.
- Equip the skill to design and develop a regulated power supply.
- Simulate and analyse the series and shunt compensators for power factor

improvement in drive system.

### **UEE521: ELECTRIC MACHINE DESIGN**

#### **(COs):**

After the completion of the course the students will be able to:

- Design DC machines
- Design transformers with reduced losses
- Calculate the losses and efficiency in the machines

### **UEE850: SMART GRID**

#### **(COs):**

After the completion of the course the students will be able to:

- Explain various aspects of the smart grid, including, Technologies, Components, Architectures and Applications.
- Explain communication infrastructure of smart grid.
- Explain various integration aspects of conventional and non-conventional energy sources.
- Explain distributed generation coordination including monitoring of smart grid using modern communication infrastructure.
- Analyze Microgrid as a hybrid power system with advantages and challenges in future.

## **Course Scheme-2017 (BE Electrical)**

### **UPH004: APPLIED PHYSICS**

- On completion of this course, the students will be able to
- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- . Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

### **Computer Programming: UTA 007**

- On completion of this course, the students will be able to
- 
- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.

- 
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- 
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
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- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

### **UEE001: ELECTRICAL ENGINEERING**

- Apply networks laws and theorems to solve electric circuits.
- Analyze transient and steady state response of DC circuits.
- Signify AC quantities through phasor and compute AC system behaviour during steady state.
- Explain and analyse the behaviour of transformer.
- Elucidate the principle and characteristics of DC motor and DC generator.

### **UTA008 ENGINEERING DESIGN**

- Upon completion of this module, students will be able to:
- creatively comprehend geometrical details of common engineering objects
- draw dimensioned orthographic and isometric projections of simple engineering objects.
- interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism;
- create the engineering drawings for simple engineering objects using AutoCAD
- manage screen menus and commands using AutoCAD
- operate data entry modes and define drawings geometrically in terms of Cartesian, polar and relative coordinates in AutoCAD
- create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using AutoCAD

### **UHU 003 : Professional Communication**

- Apply communication concepts for effective interpersonal communication.
- Select the most appropriate media of communication for a given situation.
- Speak assertively and effectively.
- Write objective organizational correspondence.
- Design effective resumes, reports and proposals .

### **UMA003 Mathematics – I**

Upon completion of this course, the students will be able to

- apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.
- determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
- evaluate multiple integrals and their applications to engineering problems.
- examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.
- analyze some mathematical problems encountered in engineering applications.
-



**UCB008: Applied Chemistry**

- The students will be able to reflect on:
- concepts of electrodes in electrochemical cells, migration of ions, liquid junction potential and conductometric titrations.
- atomic and molecular spectroscopy fundamentals like Beer's law, flame photometry, atomic absorption spectrophotometry, UV-Vis and IR.
- water and its treatment methods like lime soda and ion exchange.
- concept of phase rule, fuel quality parameters and alternative fuels.
- polymerization, molecular weight determination and applications as biodegradable and conducting polymers.
- laboratory techniques like pH metry, potentiometry, colourimetry, conductometry and volumetry.

**UTA009: COMPUTER PROGRAMMING – II**

- On completion of this course, the students will be able to
- Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
- Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
- Demonstrate use of file handling.
- Demonstrate use of templates and exception handling.
- Demonstrate use of windows programming concepts using C++
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**UEC 001: Electronic Engineering**

- To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS and their minimization techniques, various logic families and information on different IC's and working of combinational circuits and their applications.

**UEN002: Energy and Environment**

- Correlate major local and regional environmental issues with changes in ecology and human health
- Monitor and document the development and dynamics of ecosystems in experimental or natural microcosms
- Define and document local resource consumption patterns and conservation strategies
- Define opportunities available for energy conservation and for use of renewable energy resources in local and regional entities.

**UTA013: ENGINEERING DESIGN PROJECT-I**

- simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based software tool to allow trajectories be optimized;
- perform a test to acquire an engineering material property of strength in bending and analyze the throwing arm of the "Mangonel" under conditions of static and dynamic loading;
- develop and test software code to process sensor data;
- design, construct and test an electronic hardware solution to process sensor data;
- construct and operate a Roman catapult "Mangonel" using tools, materials and assembly instructions, in a group, for a competition;
- operate and evaluate the innovative redesign of elements of the "Mangonel" for functional and structural performance;

**UMA004 Mathematics – II**

- Solve differential equations of first and 2nd order using various analytical methods.

- apply methods of Laplace transform and Fourier series to solve initial and boundary value problems, respectively.
- Solve systems of linear equations using row reduction method
- analyze vectors algebraically and geometrically in  $R^n$

#### **UES009 Mechanics**

- 1. Determine resultants in plane force systems
- 2. Identify and quantify all forces associated with a static framework
- 3. Solve problems in kinematic and dynamic systems

#### **UEE507: ENGINEERING ELECTROMAGNETICS**

##### **(COs):**

- Appraise need analysis for different coordinate systems in electromagnetics and their interrelations.
- Apply vector calculus to solve field theory problems.
- Calculate electric and magnetic fields in different coordinates for various charge and current configurations.
- Exhibit the concept of time varying fields.
- Demonstrate different aspects of plane wave in dielectric and conducting media.

#### **UEE404: TRANSMISSION AND DISTRIBUTION OF POWER**

##### **(COs):**

- Analyse the transmission line models and evaluate its performance parameters.
- Design the transmission lines under various working conditions.
- Describe and select the configurations of different line insulators and evaluate their performance.
- Supervise the laying of cables and fault detection in cables.
- Design the distribution system network.

#### **UEE505: ANALOG AND DIGITAL SYSTEMS**

##### **(COs):**

- Design different type of circuits such as rectifiers, clippers, clampers, filters etc.
- Design power supplies and solve problems related to amplifiers and oscillators.
- Design combinational and sequential circuits.
- Differentiate various type of memories and their use in different applications.
- Demonstrate the concept of logic circuits and converters.

#### **UEE301: DIRECT CURRENT MACHINES AND TRANSFORMERS**

##### **(COs):**

- Test the transformer and calculate its efficiency and performance in distribution system.
- Compare the performance of auto-transformer with that of two winding transformer.
- Use special purpose transformer for measurement and protection.
- Compute the performance of DC motors and generators in various modes.
- Explain the advantages of increasing load with parallel operation.
- Explain the speed control and starting methods of DC motors for specific purpose(s).

**UEE407: NETWORK THEORY AND DESIGN****(COs):**

- Apply various laws and theorems to solve electric networks.
- Explain and analyze the behaviour of two port networks.
- Familiarise with network synthesis.
- Analyze the behaviour of passive filters and attenuators.
- Design of passive and active filters.

**UEE406: POWER SYSTEM PRACTICES****(COs):**

- Analyze about energy scenario nationwide and worldwide
- Decide about energy management in more effective way.
- Carry out financial management.
- Analyze about deregulation of power industry.
- Explain about various pillars of electricity market design.

**UEE401: ALTERNATING CURRENT MACHINES****(COs):**

- Simulate the steady-state and transient state performance of induction and synchronous machines
- Validate and identify the machine parameters.
- Select the appropriate AC motor for different large power application.
- Analyse the stability of single machine – infinite bus system and form the grid to supply large load.
- Choose the appropriate fractional horse power motor as per the usage in daily life.

**UEE403: MEASUREMENT AND TRANSDUCERS****(COs):**

- Select various types of instruments for measurement of variables.
- Select and use various types of sensors in different conditions.
- Select and use various types of bridge circuits with different sensors.
- Explain the working of electronic instruments.
- Explain the working of sensors and transducers.

**UEE504: POWER ELECTRONICS****(COs):**

- Select the power devices as per the usage for energy conversion and control.
- Exhibit the designing of firing and commutation circuits for different converter configurations.
- Analyse various converter configuration / topology with different types of load.
- Identify converter configurations for various power applications.
- Exhibit the usage of power converters for harmonic mitigation, voltage and frequency control.

**CAPSTONE PROJECT****(COs):****UEE693: Semester VI (starts)****UEE795: Semester VII (Completion)**

- To identify design goals and analyze possible approaches to meet given specifications with realistic engineering constraints.
- To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.
- To perform simulations and incorporate appropriate adaptations using iterative synthesis.
- To use modern engineering hardware and software tools.
- To work amicably as a member of an engineering design team.
- To improve technical documentation and presentation skills.

#### **UEE801: ELECTRIC DRIVES**

##### **(COs):**

- Conceptualize the basic drive system and analyse it for different types of loads
- Analyse the motor situation during starting and braking
- Develop control circuitry and devices for control of motor
- Estimate the motor rating for different condition of load
- Design the converter circuit for control purpose along with its different configuration
- Use PLC and converter control to drive on the basis of energy efficiency

#### **UEE502: HIGH VOLTAGE ENGINEERING**

##### **(COs):**

- Conceptualize the idea of high voltage and safety measures involved.
- Analyse the breakdown mechanism of solids, liquids and gases.
- Analyse and calculate the circuit parameters involved in generation of high voltages.
- Measure direct, alternating and impulse high voltage signals.
- Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests.

#### **UEE605: POWER SYSTEM ANALYSIS AND STABILITY**

##### **(COs):**

- Develop an appropriate mathematical model of power system.
- Carry out power flow analysis of practical power system for balanced system.
- Conduct studies during balanced faults to decide the fault levels and circuit breaker ratings.
- Conduct studies during unbalanced faults to decide the fault levels and circuit breaker ratings.
- Analyze the stability of single machine-infinite bus system and can decide the critical clearing time of circuit breakers.

#### **UEE603: SWITCHGEAR AND PROTECTION**

##### **(COs):**

- Explain various protection strategies applied for power system protection.
- Select the protection elements namely fuse, circuit breakers and relays for a given configuration.
- Design the basic Earthing requirement for residential and other purposes.
- Select required protection measures against overcurrent, overvoltage in transmission lines.
- Select suitable protection scheme for different power system equipment.

#### **UEE703: DIGITAL SIGNAL PROCESSING FUNDAMENTALS**

##### **(COs):**

- Explain the digital signal processing concepts and stability analysis of digital system.
- Demonstrate the hardware architecture of DSP Processor.
- Design digital filter and harmonic mitigation.
- Carryout spectrum analysis using DFT.
- Apply DSP concepts for power system purposes such as relaying, protection and metering

#### **UEE604: FLEXIBLE AC TRANSMISSION SYSTEMS**

##### **(COs):**

- Describe the converter configuration for different power systems applications such as HVDC, FACTS etc.
- Evaluate the converters, harmonics on AC and DC side and filtering.
- Classify various compensators suited for various power system purposes.
- Analyze power system behaviour with different shunt compensators.
- Appraise series compensated power system behaviour with different series compensators.
- Analyse system behaviour with hybrid shunt-series compensators.

#### **UEE804: OPERATION AND CONTROL OF POWER SYSTEMS**

##### **(COs):**

- Develop small scale model of alternator, excitation and governing systems.
- Decide the scheduling of thermal units and hydro-thermal units for overall economy.
- Design and apply control for frequency and voltage of power system represented by multi area.
- Comprehend power system security and contingency.
- Computation of small scale and voltage stability.

#### **UEE608: SOFT COMPUTING IN ELECTRICAL ENGINEERING**

##### **(COs):**

- Examine the fuzzy system and implement fuzzy controllers for control and classification.
- Explain neural networks behaviour and use them for classification, control system and optimization problem.
- Obtain the optimum solution of well formulated optimisation problem using evolutionary approach.
- Develop hybrid system based on integration of neuro and fuzzy system.
- Formulate hybrid intelligent algorithms for typical electrical application.

#### **UEE891: PROJECT**

##### **(COs):**

- Acquire knowledge and experience of software and hardware practices in the area of project.
- Carry out design calculations and implementations in the area of project.
- Associate with the implementation of the project requiring individual and teamwork skills.
- Communicate their work effectively through writing and presentation.
- Demonstrate the knowledge of professional responsibilities and respect for ethics.

#### **UEE806: ALTERNATE SOURCES OF ENERGY**

##### **(COs):**

- Explain the basic renewable energy sources like solar, wind ,biomass etc
- Explain various advantages and disadvantages of renewable energy sources.
- Familiarization with different standalone, off grid energy sources
- Explain different technology associate with solar, wind, biomass and other renewable energy

sources.

- Describe the working of micro/mini hydropower system.

#### **UEE631: HVDC TRANSMISSION SYSTEMS**

**(COs):**

- Choose intelligently AC and DC transmission systems for the dedicated application(s).
- Identify the suitable two-level/multilevel configuration for high power converters.
- Select the suitable protection method for various converter faults.
- Identify suitable reactive power compensation method.
- Decide the configuration for harmonic mitigation on both AC and DC sides.

#### **UEE632: POWER GENERATION AND ECONOMICS**

**(COs):**

- Apply knowledge of India's power scenario, power system structure and related agencies.
- Explain about various types of power plants i.e., hydro, thermal, gas and nuclear.
- Harness power from conventional and renewable sources.
- Select the methods and size of plant generating power for overall economy.
- Decide the tariff structure for different type of users.

#### **UEE634: REAL TIME POWER SYSTEMS**

**(COs):**

- Demonstrate about Hardware-in-loop simulation systems.
- Explain about mathematical model for power system and control in real environment.
- Design control schemes for AC and DC electrical machine drives.
- Demonstrate the concepts of real time control strategy based on FPGA, dSpace.

#### **UEE892: DESIGN PROJECT**

**(COs):**

- Acquire knowledge and experience of software and hardware practices in the area of project.
- Carry out design calculations and implementations in the area of project.
- Associate with the implementation of the project requiring individual and teamwork skills.
- Communicate their work effectively through writing and presentation.
- Demonstrate the professional responsibilities and respect for ethics in university ambience.

#### **UEE893: STARTUP SEMESTER**

**(COs):**

- Demonstrate an ability to develop a business plan.
- Carry out design calculations/simulations and implementations in the area of project.
- Develop a prototype/working model/software application.
- Comprehend the fundamentals of business pitching.
- Demonstrate the knowledge of professional responsibilities and respect for ethics.

#### **UEE633: GENERALIZED THEORY OF ELECTRICAL MACHINES**

**(COs):**

- Express the revolving field and reference frame theory
- Develop mathematical model of three-phase AC machines and parameters in different reference frame
- Simulate the transient performance of three-phase ac machines in different reference frames.

- Investigate the transient performance of different DC machines.
- Select special purpose small machines for different applications

#### **UEE524: POWER QUALITY MONITORING AND CONDITIONING**

##### **(COs):**

- Reliably identify the sources of various power quality problems.
- Explain about causes of harmonic and its distortion effect.
- Estimate the impact of various power quality problems on appliances.
- Educate the harmful effects of poor power quality and harmonics.
- Decide the compensators and filters to keep the power quality indices within the standards.

#### **UEE841: INDUSTRIAL ELECTRONICS**

##### **(COs):**

- Simulate and analyse the semiconductor controlled ac and DC drive system.
- Design and develop an illumination system for domestic, industry and commercial sites.
- Design an electric heating system for industrial purposes.
- Equip the skill to design and develop a regulated power supply.
- Simulate and analyse the series and shunt compensators for power factor improvement in drive system.

#### **UEE521: ELECTRIC MACHINE DESIGN**

##### **(COs):**

- Design DC machines.
- Design transformers with reduced losses
- Calculate the losses and efficiency in the machines
- Analyze and synthesis of computer aided design of electrical machines.
- Design three phase induction motor.

#### **UEE850: SMART GRID**

##### **(COs):**

- Explain various aspects of the smart grid, including, Technologies, Components, Architectures and Applications.
- Explain communication infrastructure of smart grid.
- Explain various integration aspects of conventional and non-conventional energy sources.
- Explain distributed generation coordination including monitoring of smart grid using modern communication infrastructure.
- Analyze Microgrid as a hybrid power system with advantages and challenges in future.

<b>ME-POWER SYSTEM</b>	
<b>Course Scheme -2015-16 and 2016-17</b>	
<b>PEE104 Power System Dynamics and Stability</b>	<ul style="list-style-type: none"> <li>• The understanding of dynamic model of synchronous machine will be developed.</li> <li>• Simulation study of multi-machine dynamic model will be delivered.</li> <li>• The concepts of small signal stability will be understood.</li> <li>• The different aspect of energy function methods will be investigated.</li> <li>• The concept of voltage stability and sensitivity analysis will be understood</li> </ul>
<b>PEE105 Advanced Power Electronics</b>	<ul style="list-style-type: none"> <li>• Knowledge of power semiconductor devices and their Gate and base drive circuits</li> <li>• Develop skills to utilize the different PWM schemes</li> <li>• Know about the different types of power converters and their applications</li> </ul>
<b>PEE106 Modelling and Analysis of Power System</b>	<ul style="list-style-type: none"> <li>• To impart learning of mathematical models of power system components, power system analysis techniques and optimal power flow.</li> <li>• To learn the issues and concept of unit commitment, economic thermal and hydro-thermal scheduling</li> <li>• To learn the performance and modeling of power system during short circuit studies and the important of contingency analysis in power system security</li> </ul>
<b>PEE107 Power System Transients and Mitigation</b>	<ul style="list-style-type: none"> <li>• Understanding the causes and effects of switching and lightning surges and protection of power system equipment from them using ground wires,</li> <li>• To know about surge absorbers and arrestors.</li> <li>• To design of insulation of systems and their testing</li> </ul>
<b>PEE108 Static Protective relaying</b>	<ul style="list-style-type: none"> <li>• To give an overview of digital protection using different types of static relays, its application to modern power system and apparatus</li> <li>• Understanding the digital protection schemes for transmission lines, generators and transformers</li> <li>• To study the operation of relays using microcontrollers</li> </ul>
<b>PEE109: POWER SYSTEM DYNAMICS AND STABILITY</b>	<ul style="list-style-type: none"> <li>• To develop the dynamic model of synchronous machine</li> <li>• To simulate multi-machine dynamic model</li> <li>• To understand the concepts of small signal stability.</li> <li>• To Investigate the various aspects of energy function methods.</li> <li>• To Carry out the sensitivity analysis of the power system.</li> </ul>
<b>PEE205 Intelligent algorithms in Power Systems</b>	<ul style="list-style-type: none"> <li>• Student will understand the neuron models with analog and discrete inputs, network architectures and training of network through various learning algorithms in supervised and unsupervised mode.</li> <li>• Student will understand the concept of fuzzy logic concept and its implementation in controller applications</li> <li>• Student will understand the concept of evolutionary computation using Genetic algorithm for decision making problems.</li> </ul>
<b>PEE206 Power System Operation &amp; Control</b>	<ul style="list-style-type: none"> <li>• Understanding about the power system controls namely load-frequency and AVR control for both single-machine infinite bus system and multimachine systems.</li> </ul>



<ul style="list-style-type: none"> <li>• Student will understand the optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling and their implementation through various classical methods.</li> </ul>
<p><b>PEE207 Power System Planning and Restructuring</b></p> <ul style="list-style-type: none"> <li>• To explore objectives of national and regional planning of electricity</li> <li>• To understand criteria of generation planning</li> <li>• To impart learning about optimal power system expansion and its planning</li> </ul> <p>To learn about unintegrated and bundled power systems</p>
<p><b>PEE212 FACTS Controllers and Modelling</b></p> <ul style="list-style-type: none"> <li>• Understanding the power system control through various power electronic controllers including state of art FACTS controllers.</li> <li>• Understanding the operational aspects and their effectiveness in transient stability enhancement,</li> <li>• Student will learn the issues of damping to power system oscillations, real and reactive power control capability in power system, their integration in power flow analysis and their effectiveness in distribution system for harmonic mitigation etc.</li> </ul>
<p><b>PEE213 Power Quality Monitoring and Conditioning</b></p> <ul style="list-style-type: none"> <li>• Understanding the aspects of power quality in distribution system such as the sources of harmonics and various power quality problems and corresponding remedial measures through filtering and static controller,</li> <li>• To understand harmonic mitigation through multi-level converters</li> </ul>
<p><b>PEE215 Power System Reliability</b></p> <ul style="list-style-type: none"> <li>• Students will acquire the skills to perform reliability analysis of the power system such as generators, transmission lines etc. using analytical simulation tools.</li> <li>• Able to apply knowledge in the domains of stochastic processes for reliability study.</li> <li>• At the higher level of power system security related analysis they will be able to solve the problems through application of security function approach.</li> </ul> <p>Able to analyze the system modes of failure to enhance the power system reliability.</p>
<p><b>PEE216 Digital Control Systems</b></p> <ul style="list-style-type: none"> <li>• Understand the discrete digital control system and its stability analysis using various techniques,</li> <li>• able to implement the knowledge to design and develop of PID controller</li> </ul>
<p><b>PEE217 Distribution System Operation and Analysis</b></p> <ul style="list-style-type: none"> <li>• Understanding with the operational aspects of distribution system</li> <li>• To familiarise with distribution system configurations, loads, power flow, reconfiguration p and protection</li> </ul>
<p><b>PEE322 HVAC and HVDC Transmission Systems</b></p> <ul style="list-style-type: none"> <li>• Understanding HVAC and HVDC transmission systems. Analyzing system dynamic performance and reactive power requirements.</li> <li>• Understanding corona and radio &amp; TV interference.</li> <li>• Designing filters for reduction of harmonics.</li> <li>• Solving power flow equations.</li> </ul>
<p><b>PEE302 Electric Drives and Control</b></p> <ul style="list-style-type: none"> <li>▪ Students will acquire the knowledge of selection of drives as per practical operational industrial requirement.</li> <li>▪ They can apply their knowledge to prepare control schemes as per different types of motors used in industries.</li> <li>▪ Students can estimate and solve harmonic and power factor related problems in controlling AC and DC drives</li> </ul>
<p><b>PEE305 Load and Energy Management</b></p> <ul style="list-style-type: none"> <li>• To be familiar with different load forecasting method used in power system,</li> <li>• To understand different phase of load management and impacts of load management</li> </ul>

- To understand the concept of energy demand and method to satisfy meet the energy demand
- To understand the measurement of energy conservation and its case studies
- To be familiar with different ways of saving electricity in different utilities. Different phase of energy audit.
- To understand the role of energy management and energy forecasting

**PEE306 State Estimation and Supervisory Control**

- The SCADA organization and structure will be understood.
- The concept of state estimation, multi-area state estimation will be delivered.
- The smart grid concepts and its application will be understood.
- The concept of smart grid, micro grid, smart metering and virtual power plant will be understood.

**PEE308 Renewable Energy Systems**

- To be familiar the current status of generation of energy(both renewable and nonrenewable ) in India and worldwide
- To understand different conversion, solar and wind to electricity , Wind and Solar Technology in detail.
- To understand the basic of converter used in Wind and Solar
- To understand the designing of Solar panel , grid connection issues
- To be familiar with different ways to store electricity and their applications

**PEE309 Power Quality and Custom power**

- Understanding about the power quality indices, measurement errors,
- extraction of fundamental components,
- compensation techniques

**ME-PS 2017-18**

**PEE104 Power System Dynamics and Stability**

- To develop the dynamic model of synchronous machine
- To simulate multi-machine dynamic model
- To realise the concepts of small signal stability.
- To investigate the various aspects of energy function methods.
- To carry out the sensitivity analysis of the power system

**PEE105 Advanced Power Electronics**

- To identify the power semiconductor devices and its utilisation
- To design the Gate and base drive circuits
- To develop skills to utilize the different PWM schemes
- To validate the performance of different types of power converters
- To select the power converter for variety of applications

**PEE106 Modelling and Analysis of Power System**

- To develop with the mathematical model of power system components
- To carry out power system analysis techniques and optimal power flow.
- To analyse the behavior of system during short circuit and the important of contingency analysis.
- To validate the power system security through simulations

**PEE107 Power System Transients and Mitigation**

- To understand the causes and effects of switching and lightning surges
- To identify the protection schemes of power system equipment from overvoltages like ground wires, surge absorbers and arrestors.
- To design of insulation of power system components
- To carry out the insulation testing procedures

**PEE108 Static Protective relaying**

- To knowing static relays and its types.

<ul style="list-style-type: none"> <li>• To analyse the digital protection schemes for transmission lines, generators and transformers.</li> <li>• To simulate the protection schemes for radial and mesh connected systems.</li> <li>• To realize relaying algorithms with different relay settings and on microcontrollers or microprocessors.</li> </ul>
<p><b>PEE205 Intelligent algorithms in Power Systems</b></p> <ul style="list-style-type: none"> <li>• To develop the neuron models with analog and discrete inputs, network architectures and training of network through various learning algorithms in supervised and unsupervised mode.</li> <li>• To implement the concept of fuzzy logic concept and its implementation in controller applications</li> <li>• To demonstrate the concept of evolutionary computation using Genetic algorithm for decision making problems.</li> </ul>
<p><b>PEE206 Power System Operation &amp; Control</b></p> <ul style="list-style-type: none"> <li>• To understand the power system controls namely load-frequency and AVR control for both single-machine infinite bus system and multimachine systems,</li> <li>• To formulate problems of the optimal system operation through optimal generation dispatch, unit commitment, hydro-thermal scheduling and pumped storage plant scheduling</li> <li>• To implement the optimal power system operation problems through various classical methods.</li> <li>• To analyse the results of optimal dispatch and scheduling</li> </ul>
<p><b>PEE207 Power System Planning and Restructuring</b></p> <ul style="list-style-type: none"> <li>• To understand the concept and significance of power system restructuring and integrated generation.</li> <li>• To formulate the power system generation expansion as an optimization problem with cost, emission and reliability as major constraints</li> <li>• To qualify the technological impacts of transmission &amp; distribution planning under uncertainty factors</li> <li>• To conceptualize the impact of bidding and pricing in competitive electricity markets</li> </ul>
<p><b>PEE212 FACTS Controllers and Modelling</b></p> <ul style="list-style-type: none"> <li>• To understand the power system control through various power electronic controllers including state of art FACTS controllers.</li> <li>• To analyse the operational aspects and their effectiveness in transient stability enhancement,</li> <li>• To assess the issues of damping to power system oscillations, real and reactive power control capability in power system</li> <li>• To learn the integration in power flow analysis and their effectiveness in distribution system for harmonic mitigation etc.</li> </ul>
<p><b>PEE213 Power Quality Monitoring and Conditioning</b></p> <ul style="list-style-type: none"> <li>• To learn aspects of power quality in distribution system, sources of harmonics</li> <li>• To identify the power quality problems</li> <li>• To acquire knowledge about the measures through filtering and static controller,</li> <li>• to know about the harmonic mitigation through multi-level converters</li> </ul>
<p><b>PEE215 Power System Reliability</b></p> <ul style="list-style-type: none"> <li>• Students will acquire the skills to perform reliability analysis of the power system such as generators, transmission lines etc. using analytical simulation tools.</li> <li>• Able to apply knowledge in the domains of stochastic processes for reliability study.</li> <li>• At the higher level of power system security related analysis they will be able to solve the</li> </ul>

<p>problems through application of security function approach.</p> <ul style="list-style-type: none"> <li>• Able to analyze the system modes of failure to enhance the power system reliability.</li> </ul>
<p><b>PEE216 Digital Control Systems</b></p> <ul style="list-style-type: none"> <li>• To learn about the discrete digital control system</li> <li>• To perform the stability analysis using various techniques,</li> <li>• To design and develop of PID controller</li> </ul>
<p><b>PEE217 Distribution System Operation and Analysis</b></p> <ul style="list-style-type: none"> <li>• To learn the operational aspects of distribution system</li> <li>• To familiarization with distribution system configurations, loads, power flow,</li> <li>• To analyse the effect of reconfigurations</li> <li>• To learn about the protection in distribution systems.</li> </ul>
<p><b>PEE322 HVAC and HVDC Transmission Systems</b></p> <ul style="list-style-type: none"> <li>• To learn HVAC and HVDC transmission systems.</li> <li>• To analyse system dynamic performance and reactive power requirements.</li> <li>• To know about corona and radio &amp; TV interference.</li> <li>• To design filters for reduction of harmonics.</li> <li>• To solve power flow equations</li> </ul>
<p><b>PEE302 Electric Drives and Control</b></p> <ul style="list-style-type: none"> <li>▪ To acquire the knowledge of selection of drives as per practical operational industrial requirement.</li> <li>▪ To apply their knowledge to prepare control schemes as per different types of motors used in industries.</li> <li>▪ To estimate &amp; solve harmonic and power factor related problems in controlling AC and DC drives.</li> </ul>
<p><b>PEE305 Load and Energy Management</b></p> <ul style="list-style-type: none"> <li>• To be familiar with different load forecasting method used in power system,</li> <li>• To understand different phase of load management and impacts of load management</li> <li>• To understand the concept of energy demand and method to satisfy meet the energy demand</li> <li>• To understand the measurement of energy conservation and its case studies</li> <li>• To be familiar with ways of saving electricity in different utilities. Different phase of energy audit.</li> <li>• To understand the role of energy management and energy forecasting</li> </ul>
<p><b>PEE306 State Estimation and Supervisory Control</b></p> <ul style="list-style-type: none"> <li>• To understand the SCADA organization and structure.</li> <li>• To implement the concept of state estimation, multi-area state estimation.</li> <li>• To understand the smart grid concepts and its application</li> <li>• To familiarise with the concept of smart grid, micro grid, smart metering and virtual power plant</li> </ul>
<p><b>PEE308 Renewable Energy Systems</b></p> <ul style="list-style-type: none"> <li>• To be familiar the current status of generation of energy(both renewable and nonrenewable ) in India and worldwide</li> <li>• To understand different conversion ,solar and wind to electricity , Wind and Solar Technology in detail.</li> <li>• To understand the basic of converter used in Wind and Solar</li> <li>• To understand the designing of Solar panel , grid connection issues</li> <li>To be familiar with different ways to store electricity and their applications</li> </ul>
<p><b>PEE309 Power Quality and Custom power</b></p> <ul style="list-style-type: none"> <li>• To understand power quality standards.</li> <li>• To identify linear and non linear loads.</li> <li>• To know about various measurement techniques of voltage and current parameters.</li> <li>• To analyse harmonics and their mitigation</li> <li>To acquire knowledge of custom power devices and their role in T&amp;D system.</li> </ul>
<p><b>PMA Computational Techniques and Statistical Methods</b></p> <ul style="list-style-type: none"> <li>• To apply conventional techniques of direct search to solve un constrained optimisation problems</li> </ul>

- To solve constrained optimisation problems.
- To apply ANOVA test to assess the degree of variance,
- To analyse design of experiments through variance and covariance estimates
- To apply the concept of probability to understand the frequency of occurrence and adequacy estimate.

**PEE301 Digital Signal Processing and Applications**

- To learn to apply z-transform and FFT analysis
- To analyse continuous and discrete signals in frequency domain.
- To implement the concepts for measurement of frequency, harmonic level etc.
- To design digital filters for reduction of noise signals
- To apply concepts of DSP to power system protection for measurement of signals

**PEE303 High voltage Technology**

- To understand the causes of occurrence high voltage and travelling waves.
- To knowing the different devices used for protection against high voltage Testing HV cables.
- To learn about characteristics of Air and SF<sub>6</sub> and performance of GIS.

**PEE304 Digital Controllers and Applications**

- To develop controller application using DSP programming concept..
- To identify the architecture of processor concepts for I/O.
- To develop speed controller of motor using FPGA.

**PEE307 Power System Operation Under Deregulation**

- To understand issues related to whole sale electricity market.
- To make comparison estimation of prevailing open access transmission models.
- To conceptualise the wheeling of power and price strategies
- To understand the electricity business

# BE: ELECTRONICS INSTRUMENTATION

## BE-EIC 2014: Course scheme Course Outcomes

### UDP005 : INTRODUCTION TO ELECTRONICS INSTRUMENTATION ENGINEERING Course Outcome

- Basic concepts of Electronic Instrumentation & Control Engineering
- Components of Instrumentation like Measurement, Control and Automation
- The applications in the field of Process Industry, Embedded Systems, Signal Processing etc.
- The latest trends in their field for futuristic relevance.

### UCB008: APPLIED CHEMISTRY

#### Course Outcomes

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.
- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

### UMA002: MATHEMATICS II

#### Course Outcomes

- Solve differential equations of first and second order using various analytical methods.
- Solve ordinary and partial differential equations using the Laplace transform and Fourier series.
- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations on harmonic and entire functions.
- Solve systems of linear equations and analyze vectors in  $R^n$  geometrically and algebraically.
- Analyze vector spaces and subspaces over a field, and to find linear transformations and their properties, matrices of linear transformations.

### UTA002: MANUFACTURING PROCESS

#### Course Outcomes

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

### UCS401: COMPUTER SYSTEM ARCHITECTURE

**Course Outcomes**

- Explain the basics of digital electronics.
- Elaborate basic computer organization, control unit and central processing unit.
- Do binary addition, subtraction, multiplication and division.
- Explain the input output organization of a processor.
- Differentiate between various types of memories.

**UEI301 : DIGITAL ELECTRONICS****Course Outcome**

- Understand number systems, codes and conversions
- Apply minimization techniques
- Design combinational and sequential circuits
- Understand various types of memories
- Understand the concept of logic circuits and converters

**UEI201 ANALOG ELECTRONICS DEVICES AND CIRCUITS****Course Outcome**

- Understand transistor amplifier circuits, their analysis and frequency response.
- Use various types of differential and tuned amplifiers in any project.
- Understand the working of feedback amplifiers, oscillator and multivibrators.
- Understand rectifiers, its types and power supplies.
- Design and implement circuit using various electronic devices for the benefit of society and mankind.

**UMA032: NUMERICAL AND STATISTICAL METHODS**

- Understand the various approaches dealing the data using theory of probability.
- Analyze the different samples of data at different level of significance using various hypothesis testing.
- Develop a framework for estimating and predicting the different sample of data for handling the uncertainties.
- Understand error, source of error and its affect on any numerical computation and also analyzing the efficiency of any numerical algorithm.
- Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
- Solve system of linear equations numerically using direct and iterative methods.
- Understand the methods to construct interpolating polynomials with practical exposure.

**UEI302 SENSORS AND SIGNAL CONDITIONING****Course Outcome**

- Understand the principles and applications of sensors and transducers
- Analyze and design active filters
- Understand the working of dc and ac bridges
- Do signal conditioning of RTD and strain gauges

**UEI303 TECHNIQUES ON SIGNALS AND SYSTEMS****Course Outcome**

1. Understand the basics of signals and systems.
2. Solve different type of problems related to Fourier series and Fourier transforms
3. Use Laplace and Fourier transforms for different applications.
4. Describe the concept of random signals.

**UEI401 ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS****Course Outcome**

- Understand the knowledge and general concepts of artificial intelligence.
- Understand the concept of Artificial Neural Networks, Learning and Pattern Classification
- Understand fuzzy logic, genetic algorithms and its applications in control systems

**UEI402 BIO-MEDICAL INSTRUMENTATION****Course Outcome**

- Explain the physiology of the heart, lung, blood circulation and circulation respiration.
- Describe the biomedical applications of different transducers used and various sensing and measurement devices of electrical origin.
- Elucidate electrical safety in medical equipment.
- Describe different medical imaging techniques.

**UEI403 ELECTRICAL AND ELECTRONIC MEASUREMENTS****Course Outcome**

- Compare various electromechanical indicating instruments
- Measure power and energy
- Design various ac bridges
- Analyze various waveform with the help of storage oscilloscope

**UEE503: NETWORK ANALYSIS AND SYNTHESIS****Course Outcome**

- Understanding the various laws and theorems related to electric networks.
- Understanding the concept of two port networks.
- Familiarisation with network synthesis.

**UEE201 ELECTRICAL MACHINES****Course Outcome**

- Test the transformer and calculate its efficiency and performance in distribution system.
- Scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection.
- Select appropriate DC motor for specific purpose and can compute their steady performance.
- Thoughtfully select the speed control and starting method of DC motor.
  - Test the induction motor and compute its parameters.
- Test the synchronous motor to compute voltage regulation.

**UEI501 CONTROL SYSTEMS****Course Outcome**

- Develop the mathematical model of the physical systems.
- Analyze the response of the closed and open loop systems.
- Analyze the stability of the closed and open loop systems.
- Design the various kinds of compensator.
- Develop and analyze state space models

**UEI502 DATA ACQUISITION SYSTEMS****Course Outcome**

- Understand the concept of various display systems and data acquisition systems.
- Understand the working of various types of recorders.
- Understand the modulation and multiplexing techniques used in general telemetric systems.
- Use various protocols in given data transfer techniques.



**UEI503 DIGITAL SIGNAL PROCESSING AND APPLICATIONS****Course Outcome**

- Analyze the signals in time and frequency domain.
- Apply the transformation tools on signals and systems and analyze.
- Design the structures of different types of digital filters.
- Design various digital filters and analyze their frequency response.
- Analyse finite word length effects.

**UEI504 MICROPROCESSORS AND APPLICATIONS****Course Outcome**

- Demonstrate the concept of microprocessor and to be able to design a microprocessor based system to get desired results.
- Use 8086 microprocessor in advanced applications, which will give them a good platform to work further.
- Update with current trends through self-study and show genuine need to learn on continuous basis.

**UEI602 MICROCONTROLLERS AND APPLICATIONS****Course Outcome**

- Understand the concept of 8051 microcontroller architectures.
- Understand the addressing modes, data types and instruction set.
- Understand and implement hardware interfacing.
- Understand the concept of advanced microcontrollers.

**UEI604 PROCESS DYNAMICS AND CONTROL****Course Outcome**

- Develop the mathematical modeling of various chemical processes.
- Implement PID and IMC PID controllers for different processes.
- Explain the working of various types of valves.
- Implement advance control schemes such as ratio control, selective control on suitable processes.

**UEI801 ADVANCED PROCESS CONTROL****Course Outcome**

- Explain the concept of advanced control schemes used in process.
- Explain the working of distributed control system.
- Elaborate the use of artificial intelligence techniques in process.
- Explain the fundamental concepts of plc.
- Explain the concept of digital control system.

**UEI703 MEASUREMENT SCIENCE****Course Outcome**

- Explain different terms used in measurement.
- Analyze experimental data.
- Differentiate among various statistical techniques.
- Explain the measurement of Sound, temperature and pressure.

**UEI722 INDUSTRIAL INSTRUMENTATION****Course Outcome**

- Explain the basic concepts of metrology.
- Describe the construction and working of different type of devices used to measure motion, vibration, pressure, sound, temperature, level and flow.
- Elucidate different methods for the measurement of, humidity, viscosity and nuclear radiation etc.

- Select the appropriate instrument/transducer for a given application/parameter.

#### **UEI844 VIRTUAL INSTRUMENTATION**

##### **Course Outcome**

- Demonstrate the working of labview.
- Explain the various types of structures used in labview.
- Analyze and design different type of programs based on data.
- Demonstrate the use of labview for signal processing image

#### **UEI512 ROBOTICS AND RELATED INSTRUMENTATION**

##### **Course Outcome**

- Demonstrate the basic concepts of robotics, their classification and structure.
- Explain the type of the drive and control systems used in robotics.
- Describe the type of sensors and other instruments used in robotics.
- Perform the robot language programming.

#### **UEI841 ADVANCED CONTROL SYSTEMS**

##### **Course Outcome**

- Explain the basic concepts of nonlinear control systems.
- Illustrate the concept and methods of optimal control.
- Analyze and represent control systems in discrete domain.
- Represent and analyze the control system in state space domain.

#### **UEI842 BIO-MEDICAL DSP**

##### **Course Outcome**

- Explain the concepts of DSP in biomedical.
- Distinguish among different digital filters.
- Explain the concept of adaptive filtering.
- Implement different type of data reduction techniques.
- Analyse ECG and neurological signal using DSP.

#### **UEI831 BIOSENSORS AND MEMS**

##### **Course Outcome**

- Understand the concept molecular reorganization, fundamentals of surfaces and interfaces.
- Understand the Principles of different types of biosensors.
- Understand the concept of MEMS design, and fabrication technology and its applications.

#### **UEI832 DIGITAL IMAGE PROCESSING**

##### **Course Outcome**

- Understand the concept of image processing.
- Understand the various methods for image enhancement, restoration, segmentation and compression.
- Understand the concept of colored images and object recognition techniques.

#### **UEI843 EMBEDDED CONTROL SYSTEMS**

##### **Course Outcome**

- Understand the concept of embedded Systems, architecture and system mode
- Understand the programming, interfacing devices
- Understand software and hardware tools and real-time operating systems

#### **UEE522: ENERGY AUDITING AND MANAGEMENT**

##### **Course Outcome**

- Analyse about energy scenario nationwide and worldwide
- Decide about energy management in more effective way.
- Analyse about various energy related aspect of electrical system.

- Carry out financial management.
- Conduct studies related to operational aspects of compressed air system and refrigeration system.

#### **UEI621 ANALYTICAL INSTRUMENTATION**

##### **Course Outcome**

- Understand the concept of spectrometry and optical techniques
- Understand the working of chromatography, elemental analyzer and potentiometer
- Understand the working of X- ray diffractometer and scanning electron microscope
- Monitor selected parameters for air and water pollution

### **BE-EIC 2015: Course Scheme**

#### **UMA004: MATHEMATICS-II**

- Solve the differential equations of first and second order and basic application problems described by these equations.
- Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.
- Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.
- Solve systems of linear equations by using elementary row operations.
- Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigen vectors.

#### **UTA009: COMPUTER PROGRAMMING – II**

1. Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
2. Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
3. Demonstrate use of file handling.
4. Demonstrate use of templates and exception handling.
5. Demonstrate use of windows programming concepts using C++

#### **UES009 : Mechanics**

- Determine resultants in plane force systems.
- Identify and quantify all forces associated with a static framework.
- Solve problems in kinematic and dynamic systems.

**UEC001: ELECTRONIC ENGINEERING**

- Demonstrate the use of semiconductor diodes in various applications.
- Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
- Recognize and apply the number systems and Boolean algebra.
- Reduce Boolean expressions and implement them with Logic Gates.
- Analyze, design and implement combinational and sequential circuits.
- Analyze and differentiate logic families, TTL and CMOS.

**UCB008: Applied Chemistry**

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.
- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

**UTA010: ENGINEERING DESIGN-II**

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

**UMA031 : Optimization Techniques**

- Formulate and solve linear programming problems.
- Solve the problems on networks models such as Transportation, Assignment, Shortest path, minimal spanning tree, and Maximal flow.
- Solve the problems of Project Management using CPM and PERT
- Solve Non-linear Programming problems of some kinds.

Implement the Linear programming techniques using C or any other optimization software.

**UTA002: Manufacturing Processes**

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities,

forces.

- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

### **UES010 : Solids and Structures**

- Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
- Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
- Calculate load carrying capacity of columns and struts and their buckling strength.
- Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
- Determine deformations and deflections in various kinds of beams and trusses.

### **UES011 THERMO-FLUIDS**

- Analyze and solve problems of simple fluid based engineering systems including
- Pressures and forces on submerged surfaces
- Analyze fluid flow problems with the application of the mass, momentum and energy equations
- Evaluate practical problems associated with pipe flow systems
- Conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
- Estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
- Analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
- Analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

### **UTA011: ENGINEERING DESIGN-III**

- Understand of features of Arduino board.
- Analyze of internal Architecture of Arduino board.
- Apply Arduino board programming concepts.
- Design and implement Buggy project based on different goals and challenges defined.

### **UEI403: ELECTRICAL AND ELECTRONIC MEASUREMENTS**

- compare various electromechanical indicating instruments,
- measure power and energy
- design various AC bridges
- analyze various waveform with the help of storage oscilloscope

### **UHU005: Humanities for Engineers**

- Improve the understanding of human behavior with the help of interplay of professional, psychological and economic activities.
- Able to apply the knowledge of basic principles of psychology, economics and ethics for the solution of engineering problems.
- Explain the impact of contemporary issues in psychology, economics and ethical principles on engineering.

### **UES012: ENGINEERING MATERIALS**

- Classify engineering materials based on its structure.
- Draw crystallographic planes and directions.
- Distinguish between elastic and plastic behavior of materials.
- Distinguish between isomorphous and eutectic phase diagram.
- Classify materials based on their electrical and magnetic properties.
- Propose a solution to prevent corrosion.

### **UMA007: NUMERICAL ANALYSIS**

- Understand the errors, source of error and its effect on any numerical computations and also analysis the efficiency of any numerical algorithms.
- Learn how to obtain numerical solution of nonlinear equations using bisection, secant, newton, and fixed-point iteration methods.
- Solve system of linear equations numerically using direct and iterative methods.
- Understand how to approximate the functions using interpolating polynomials.
- Learn how to solve definite integrals and initial value problems numerically

### **UEN002: ENERGY AND ENVIRONMENT**

- Correlate major local and regional environmental issues with changes in ecology and human health.
- Monitor and document the development and dynamics of ecosystems in experimental or natural microcosms.
- Define and document local resource consumption patterns and conservation strategies.
- Define opportunities available for energy conservation and for use of renewable energy resources in local and regional entities.

### **UEI304: SENSORS AND SIGNAL CONDITIONING (WITH PROJECT)**

- Apply different methods for the measurement of length and angle
- Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
- Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity
- Ability to analyse, formulate and select suitable sensor for the given industrial applications

- Describe signal conditioning circuits

### **UEI303: TECHNIQUES ON SIGNALS AND SYSTEMS**

- Apply sampling theorem for different applications
- Solve problems related to Fourier transforms
- Apply Fourier transforms for different applications
- Apply z-transform and Laplace transform for system characterization
- Elucidate the concepts of random signals

### **UEI501: CONTROL SYSTEMS**

- develop the mathematical model of the physical systems.
- analyze the response of the closed and open loop systems.
- analyze the stability of the closed and open loop systems.
- design the various kinds of compensator.
- develop and analyze state space models

### **UEI601: INDUSTRIAL INSTRUMENTATION**

- illustrate the different methods for the measurement of length and angle
- elucidate the construction and working of various industrial devices used to measure pressure, sound and flow
- explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and humidity
- ability to analyze, formulate and select suitable sensor for the given industrial applications

### **UEI609: FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS**

- demonstrate the concept of microprocessor and to be able to design a microprocessor based system to get desired results.
- use 8086 microprocessor in advanced applications, which will give them a good platform to work further.
- graduates will be able to update with current trends through self-study and show genuine need to learn on continuous basis.
- students will be able to use hardware interfacing of 8051 to develop solutions of real world electrical problems.

### **UEE503: NETWORK ANALYSIS AND SYNTHESIS**

- understanding the various laws and theorems related to electric networks.
- understanding the concept of two port networks.
- familiarisation with network synthesis.

### **UEI605: PROCESS DYNAMICS AND CONTROL**

- demonstrate fundamental understanding of process control.
- develop the mathematical model of various chemical processes.
- explain different control modes and their application in controlling various processes.
- explain the working of electric, hydraulic and pneumatic controllers.
- demonstrate the working and application of different type of actuators and control valves

### **UEI841: ADVANCED CONTROL SYSTEMS**

- demonstrate non-linear system behavior by phase plane and describing function methods.
- perform the stability analysis nonlinear systems by Lyapunov method develop design skills in optimal control problems
- derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform).
- predict and analyze transient and steady-state responses and stability and sensitivity of both open-loop and closed-loop linear, time-invariant, discrete-time control systems.
  - **acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers**

### **UEI607: DIGITAL SIGNAL PROCESSING AND APPLICATIONS**

- Analyze the signals in time and frequency domain
- Apply the transformation tools on signals and systems and analyze their significance and applications.
- design the structures of different types of digital filters
- design various digital filters and analyze their frequency response
- Analyse finite word length effects.

### **UEI608: BIO-MEDICAL INSTRUMENTATION**

- differentiate and analyse the biomedical signal sources.
- elucidate cardiovascular system and related measurements.
- explain the respiratory and nervous systems and related measurements
- **measure non-invasive diagnostic parameters.**

### **UEI701: DATA ACQUISITION AND SYSTEM DESIGN**

- elucidate the elements of data acquisition techniques.
- design and simulate signal conditioning circuits.
- explain various data transfer techniques
- understand the components of data acquisition system

### **UEI801: ADVANCED PROCESS CONTROL**

- explain the concept of advanced control schemes used in process control.
- explain the working of distributed control system
- elaborate the use of artificial intelligence techniques in process control.



- explain the fundamental concepts of PLC.
- explain the concept of digital control system.

#### **UEI844: VIRTUAL INSTRUMENTATION**

- demonstrate the working of LabVIEW.
- explain the various types of structures used in LabVIEW.
- analyze and design different type of programs based on data acquisition.
- **demonstrate the use of LabVIEW for signal processing, image processing etc.**

#### **UEE606: ELECTRIC MACHINE AND DRIVES**

- Analyse the various forces and torques in electromechanical devices
- explain the working of power electronic converters and inverters
- elucidate the concepts of feedback control theory
- analyze and compare the performance of DC and AC machines in various drive applications
- **design controllers for electric drives which achieve the regulation of torque, speed, or position in the above machines.**

#### **UEI805: ENVIRONMENTAL INSTRUMENTATION**

- explain sources and effects of air and water pollutants
- explain air pollution sampling and measurement techniques
- explain water sampling and analysis techniques
- explain solid waste management and noise level measurement techniques

#### **UEI831: BIOSENSORS AND MEMS**

- explain the concept of molecular reorganization, fundamentals of surfaces and interfaces
- elucidate the principles of different types of biosensors
- explain the concept of MEMS design, and fabrication technology
- explain the different types of MEMS and its applications

#### **UEI833: OPTICAL INSTRUMENTATION**

- explain the basic concepts of optical transmitting and receiving
- describe different opto- electronic devices
- elucidate different methods of interferometry
- **DESCRIBE SELECTION OF THE APPROPRIATE OPTICAL FIBER SENSORS FOR INDUSTRIAL APPLICATION**

#### **UEI846 BIO-MEDICAL DSP**

- describe adaptive filters and their application in biomedical signal processing
- apply data reduction techniques in biomedical signals
- analyse ECG signals
- analyse EEG signals

- describe neurological signal processing

#### **UEI847 ROBOTICS AND AUTOMATION**

- explain the fundamentals of robotics and its components
- illustrate the Kinematics and Dynamics of robotics
- elucidate the need and implementation of related Instrumentation & control in robotics
- illustrate the movement of robotic joints with computers/microcontrollers.
- **Explain sensors and instrumentation in robotics**

#### **UEI401: ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS**

- elucidate the knowledge and general concepts of artificial intelligence.
- explain the concept of Artificial Neural Networks, Learning and Pattern Classification
- illustrate the concept of fuzzy logic and its applications
- illustrate the concept of genetic algorithms and its applications

#### **UEI721 DIGITAL IMAGE PROCESSING**

- Explain the fundamentals of digital image and its processing
- Perform image enhancement techniques in spatial and frequency domain.
- Elucidate the mathematical modelling of image restoration and compression
- Apply the concept of image segmentation.
- Describe object detection and recognition techniques.

#### **UEI720: ANALYTICAL INSTRUMENTATION**

- explain the concept of spectrometry and optical techniques
- elucidate the working of chromatography, elemental analyser
- illustrate the working of X- ray diffractometer and scanning electron microscope
- explain the concept of potentiometry and its applications

#### **UEI719 EMBEDDED CONTROL SYSTEMS**

- Explain the concept of embedded Systems and its architecture
- Elucidate the concept of programming for different interfacing devices
- Analyze various software and hardware tools
- Explain real-time operating systems

### **2016 BE-EIC: Course Outcomes**

#### **UMA003 Mathematics – I**

- apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.

- determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
- evaluate multiple integrals and their applications to engineering problems.
- examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.
- analyze some mathematical problems encountered in engineering applications.

#### **UTA007: COMPUTER PROGRAMMING-I**

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

#### **UPH004 :APPLIED PHYSICS**

- Demonstrate a detailed knowledge of oscillations, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics;
- Discuss how the laws of physics have been exploited and applied in the development and design of simple engineering systems
- Collate, analyse and formulate an experimental report with error analysis and conclusions.

#### **UEE001: Electrical Engineering**

- Apply networks laws and theorems to solve electric circuits.
- Analyze transient and steady state response of DC circuits.
- Signify AC quantities through phasor and compute AC system behaviour during steady state.
- Explain and analyse the behaviour of transformer.
- Elucidate the principle and characteristics of DC motor and DC generator.

#### **UHU003: PROFESSIONAL COMMUNICATION**

- Understand and appreciate the need of communication training.
- Use different strategies of effective communication.
- Select the most appropriate mode of communication for a given situation.
- Speak assertively and effectively. □
- Correspond effectively through different modes of written communication
- Write effective reports, proposals and papers.
- Present himself/ herself professionally through effective resumes and interviews

**UTA008: Engineering Design-I**

- Creatively comprehend geometrical details of common engineering objects.
- Draw dimensioned orthographic and isometric projections of simple engineering objects.
- Interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism. Create the engineering drawings for simple engineering objects using autocad.
- Manage screen menus and commands using autocad.
- Operate data entry modes and define drawings geometrically in terms of cartesian, polar and relative coordinates in autocad.
- Create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using autocad.

**UMA004: MATHEMATICS-II**

- Solve the differential equations of first and second order and basic application problems described by these equations.
- Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.
- Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.
- Solve systems of linear equations by using elementary row operations.
- Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigen vectors.

**UES009 : Mechanics**

- Determine resultants in plane force systems.
- Identify and quantify all forces associated with a static framework.
- Solve problems in kinematic and dynamic systems.

**UEC001: ELECTRONIC ENGINEERING**

- Demonstrate the use of semiconductor diodes in various applications.
- Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
- Recognize and apply the number systems and Boolean algebra.
- Reduce Boolean expressions and implement them with Logic Gates.
- Analyze, design and implement combinational and sequential circuits.
- Analyze and differentiate logic families, TTL and CMOS.

**UCB008: Applied Chemistry**

- Analyse trends in periodic table with electronic and atomic structure.
- Interpret phase diagrams of pure and binary substances.

- Demonstrate the working of electrodes and their applications.
- Calculate various parameters defining water and fuel quality.
- Identify the various functional groups through IR spectra.
- Carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

### **UTA010: ENGINEERING DESIGN-II**

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

### **UMA031 Optimization Techniques**

- Formulate and solve linear programming problems.
- Solve the problems on networks models such as Transportation, Assignment, Shortest path, minimal spanning tree, and Maximal flow.
- Solve the problems of Project Management using CPM and PERT
- Solve Non-linear Programming problems of some kinds.
- Implement the Linear programming techniques using C or any other optimization software.

### **UTA002: Manufacturing Processes**

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

### **UES010 : Solids and Structures**

- Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
- Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
- Calculate load carrying capacity of columns and struts and their buckling strength.

- Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
- Determine deformations and deflections in various kinds of beams and trusses.

### **UES011 THERMO-FLUIDS**

- Analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces.
- Analyze fluid flow problems with the application of the mass, momentum and energy equations.
- Evaluate practical problems associated with pipe flow systems.
- Conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis.
- Estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
- Analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
- Analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

### **UEI601: INDUSTRIAL INSTRUMENTATION**

- illustrate the different methods for the measurement of length and angle
- elucidate the construction and working of various industrial devices used to measure pressure, sound and flow
- explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and humidity.
- ability to analyze, formulate and select suitable sensor for the given industrial applications

### **UEI609: FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS**

- demonstrate the concept of microprocessor and to be able to design a microprocessor based system to get desired results.
- use 8086 microprocessor in advanced applications, which will give them a good platform to work further.
- graduates will be able to update with current trends through self-study and show genuine need to learn on continuous basis.
- students will be able to use hardware interfacing of 8051 to develop solutions of real world electrical problems.

### **UEI403: ELECTRICAL AND ELECTRONIC MEASUREMENTS**

- compare various electromechanical indicating instruments,
- measure power and energy
- design various AC bridges
- analyze various waveform with the help of storage oscilloscope

### **UEI304: SENSORS AND SIGNAL CONDITIONING (WITH PROJECT)**

- Apply different methods for the measurement of length and angle

- Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
- Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity
- Ability to analyze, formulate and select suitable sensor for the given industrial applications
- Describe signal conditioning circuits

### **UEI303: TECHNIQUES ON SIGNALS AND SYSTEMS**

- Apply sampling theorem for different applications
- Solve problems related to Fourier transforms
- Apply Fourier transforms for different applications
- Apply z-transform and Laplace transform for system characterization
- Elucidate the concepts of random signals

### **UEI501: CONTROL SYSTEMS**

- develop the mathematical model of the physical systems.
- analyze the response of the closed and open loop systems.
- analyze the stability of the closed and open loop systems.
- design the various kinds of compensator.
- develop and analyze state space models

### **UEI601: INDUSTRIAL INSTRUMENTATION**

- illustrate the different methods for the measurement of length and angle
- elucidate the construction and working of various industrial devices used to measure pressure, sound and flow
- explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and humidity
- ability to analyze, formulate and select suitable sensor for the given industrial applications

### **UEI609: FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS**

- demonstrate the concept of microprocessor and to be able to design a microprocessor based system to get desired results.
- use 8086 microprocessor in advanced applications, which will give them a good platform to work further.
- graduates will be able to update with current trends through self-study and show genuine need to learn on continuous basis.
- students will be able to use hardware interfacing of 8051 to develop solutions of real world electrical problems.

### **UEE503: NETWORK ANALYSIS AND SYNTHESIS**

- understanding the various laws and theorems related to electric networks.
- understanding the concept of two port networks.
- familiarisation with network synthesis.

### **UEI605: PROCESS DYNAMICS AND CONTROL**

- demonstrate fundamental understanding of process control.
- develop the mathematical model of various chemical processes.
- explain different control modes and their application in controlling various processes.
- explain the working of electric, hydraulic and pneumatic controllers.
- demonstrate the working and application of different type of actuators and control valves

#### **UEI841: ADVANCED CONTROL SYSTEMS**

- demonstrate non-linear system behavior by phase plane and describing function methods and the
- perform the stability analysis nonlinear systems by Lyapunov method develop design skills in optimal control problems
- derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform).
- predict and analyze transient and steady-state responses and stability and sensitivity of both open-loop and closed-loop linear, time-invariant, discrete-time control systems.
- acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers

#### **UEI607: DIGITAL SIGNAL PROCESSING AND APPLICATIONS**

- Analyze the signals in time and frequency domain
- Apply the transformation tools on signals and systems and analyze their significance and applications.
- design the structures of different types of digital filters
- design various digital filters and analyze their frequency response
- Analyse finite word length effects.

#### **UEI608: BIO-MEDICAL INSTRUMENTATION**

##### **Course Outcomes**

- differentiate and analyse the biomedical signal sources.
- elucidate cardiovascular system and related measurements.
- explain the respiratory and nervous systems and related measurements
- measure non-invasive diagnostic parameters.

#### **UEI701: DATA ACQUISITION AND SYSTEM DESIGN**

- elucidate the elements of data acquisition techniques.
- design and simulate signal conditioning circuits.
- explain various data transfer techniques
- understand the components of data acquisition system

#### **UEI801: ADVANCED PROCESS CONTROL**

##### **Course Outcomes**

- explain the concept of advanced control schemes used in process control.
- explain the working of distributed control system
- elaborate the use of artificial intelligence techniques in process control.
- explain the fundamental concepts of PLC.
- explain the concept of digital control system.

#### **UEI702: VIRTUAL INSTRUMENTATION**



**Course Outcomes**

- demonstrate the working of LabVIEW.
- explain the various types of structures used in LabVIEW.
- analyze and design different type of programs based on data acquisition.
- demonstrate the use of LabVIEW for signal processing, image processing etc.

**UEE606: ELECTRIC MACHINE AND DRIVES****Course Outcomes**

- Analyse the various forces and torques in electromechanical devices
- explain the working of power electronic converters and inverters
- elucidate the concepts of feedback control theory
- analyze and compare the performance of DC and AC machines in various drive applications
- design controllers for electric drives which achieve the regulation of torque, speed, or position in the above machines.

**UEI805: ENVIRONMENTAL INSTRUMENTATION****Course Outcomes**

- explain sources and effects of air and water pollutants
- explain air pollution sampling and measurement techniques
- explain water sampling and analysis techniques
- explain solid waste management and noise level measurement techniques

**UEI719 EMBEDDED CONTROL SYSTEMS****Course Outcomes**

- Explain the concept of embedded Systems and its architecture
- Elucidate the concept of programming for different interfacing devices
- Analyze various software and hardware tools
- Explain real-time operating systems

**2017 BE-EIC: Course Scheme  
Course Outcomes****UPH004: APPLIED PHYSICS**

On completion of this course, the students will be able to

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.

- . Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

### **Computer Programming: UTA 007**

On completion of this course, the students will be able to

- Comprehend concepts related to computer hardware and software, draw flowcharts and write algorithm and pseudo-code.
- Write, compile and debug programs in C language, use different data types, operators and console I/O function in a computer program.
- Design programs involving decision control statements, loop control statements, case control structures, arrays, strings, pointers, functions and implement the dynamics of memory by the use of pointers.
- Comprehend the concepts of linear and Non-Linear data structures by implementing linked lists, stacks and queues.

### **UEE001: ELECTRICAL ENGINEERING**

Apply networks laws and theorems to solve electric circuits.

- Analyze transient and steady state response of DC circuits.
- Signify AC quantities through phasor and compute AC system behaviour during steady state.
- Explain and analyse the behaviour of transformer.
- Elucidate the principle and characteristics of DC motor and DC generator.

### **UTA008 ENGINEERING DESIGN**

Upon completion of this module, students will be able to:

- creatively comprehend geometrical details of common engineering objects
- draw dimensioned orthographic and isometric projections of simple engineering objects.
- interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism;
- create the engineering drawings for simple engineering objects using AutoCAD
- manage screen menus and commands using AutoCAD
- operate data entry modes and define drawings geometrically in terms of Cartesian, polar and relative coordinates in AutoCAD
- create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using AutoCAD

### **UHU 003 : Professional Communication**

- Apply communication concepts for effective interpersonal communication.
- Select the most appropriate media of communication for a given situation.
- Speak assertively and effectively.
- Write objective organizational correspondence.
- Design effective resumes, reports and proposals .

### **UMA003 Mathematics – I**

Upon completion of this course, the students will be able to

- apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.
- determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
- evaluate multiple integrals and their applications to engineering problems.
- examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.
- analyze some mathematical problems encountered in engineering applications.

### **UCB008: Applied Chemistry**

The students will be able to reflect on:

- concepts of electrodes in electrochemical cells, migration of ions, liquid junction potential and conductometric titrations.
- atomic and molecular spectroscopy fundamentals like Beer's law, flame photometry, atomic absorption spectrophotometry, UV-Vis and IR.
- water and its treatment methods like lime soda and ion exchange.
- concept of phase rule, fuel quality parameters and alternative fuels.
- polymerization, molecular weight determination and applications as biodegradable and conducting polymers.
- laboratory techniques like pH metry, potentiometry, colourimetry, conductometry and volumetry.

### **UTA009: COMPUTER PROGRAMMING – II**

On completion of this course, the students will be able to

- Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
- Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
- Demonstrate use of file handling.
- Demonstrate use of templates and exception handling.
- Demonstrate use of windows programming concepts using C++

### **UEC 001: Electronic Engineering**

To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS and their minimization techniques, various logic families and information on different IC's and working of combinational circuits and their applications.

### **UEN002: Energy and Environment**

After the completion of this course, the student will be able to –

- Correlate major local and regional environmental issues with changes in ecology and human health
- Monitor and document the development and dynamics of ecosystems in experimental or natural microcosms
- Define and document local resource consumption patterns and conservation strategies
- Define opportunities available for energy conservation and for use of renewable energy resources in local and regional entities.

### **UTA013: ENGINEERING DESIGN PROJECT-I**

Upon completion of this module, students will be able to:

- simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based

software tool to allow trajectories be optimized;

- perform a test to acquire an engineering material property of strength in bending and analyze the throwing arm of the “Mangonel” under conditions of static and dynamic loading;.
- develop and test software code to process sensor data;
- design, construct and test an electronic hardware solution to process sensor data;
- construct and operate a Roman catapult “Mangonel” using tools, materials and assembly instructions, in a group, for a competition;
- operate and evaluate the innovative redesign of elements of the “Mangonel” for functional and structural performance;

### **UMA004 Mathematics – II**

#### **Course Objectives:**

Upon completion of this course, the students will be able to:

- Solve differential equations of first and 2nd order using various analytical methods.
- apply methods of Laplace transform and Fourier series to solve initial and boundary value problems, respectively.
- Solve systems of linear equations using row reduction method
- analyze vectors algebraically and geometrically in  $R^n$

### **UES009 Mechanics**

The students will be able to

- Determine resultants in plane force systems
- Identify and quantify all forces associated with a static framework
- 3. Solve problems in kinematic and dynamic systems

### **UTA014: ENGINEERING DESIGN PROJECT-II (6 Self-Effort Hours) (Buggy)**

- understand of features of Arduino board.
- analyze of internal Architecture of Arduino board.
- apply Arduino board programming concepts.
- 4. design and implement Buggy project based on different goals and challenges defined.

### **UTA002: Manufacturing Processes**

After the completion of this module, students will be able to:

- Develop simple CNC code, and use it to produce components while working in groups.
- Analyse various machining processes and calculate relevant quantities such as velocities, forces.
- Recognise cutting tool wear and identify possible causes and solutions.
- Understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- Analyse various shearing operations for tooling design.
- Apply the knowledge of metal casting for different requirements.
- Analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

### **UMA031 Optimization Techniques**

After the completion of the course, the students will be able to:

- Formulate and solve linear programming problems.
- Solve the problems on networks models such as Transportation, Assignment, Shortest path, minimal spanning tree, and Maximal flow.
- Solve the problems of Project Management using CPM and PERT

- Solve Non-linear Programming problems of some kinds.
- Implement the Linear programming techniques using C or any other optimization software.

### **UES010 : Solids and Structures**

After completion of this course, the students will be able to:

- Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
- Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
- Calculate load carrying capacity of columns and struts and their buckling strength.
- Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
- Determine deformations and deflections in various kinds of beams and trusses.

### **UES011 THERMO-FLUIDS**

Course Learning Outcomes (CLO): Upon completion of this course, the students will be able to:

- analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces
- analyze fluid flow problems with the application of the mass, momentum and energy equations 3. evaluate practical problems associated with pipe flow systems
- conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
- estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
- analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
- analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

### **UTA012: Innovation and Entrepreneurship**

After the completion of the course, the students will be able to:

- Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
- Demonstrate an ability to design a business model canvas.
- Evaluate the various sources of raising finance for startup ventures.
- Understand the fundamentals of developing and presenting business pitching to potential investors.

### **UHU005: Humanities for Engineers**

After the completion of the course, the students will be able to:

- Improve the understanding of human behavior with the help of interplay of professional, psychological and economic activities.
- Able to apply the knowledge of basic principles of psychology, economics and ethics for the solution of engineering problems.
- Explain the impact of contemporary issues in psychology, economics and ethical principles on engineering.

### **UEE503 NETWORK ANALYSIS AND SYNTHESIS**

- Describe various laws and theorems related to electric networks.
- State the concept of two port networks.
- Familiarise with network synthesis.
- Elucidate Foster and Cauer forms of LC Networks
- Interpret passive network synthesis

### **UEI407 SIGNALS AND SYSTEMS**

- Apply sampling theorem for different applications
- Solve problems related to Fourier transforms
- Apply Fourier transforms for different applications
- Apply z-transform and Laplace transform for system characterization
- Elucidate the concepts of random signals

### **UEI408 ANALOG DEVICES AND CIRCUITS**

- Differentiate between different diodes on the basis of their working principle.
- Elucidate the working principle of BJT and FET
- Explain the analysis of transistor amplifier using h-model and analyse the effect of feedback on amplifiers.
- Design the oscillator circuit.

### **UEI409 DIGITAL SIGNAL PROCESSING AND APPLICATIONS**

- Analyze the signals in time and frequency domain
- Apply the transformation tools on signals and systems and analyze their significance and applications.
- design the structures of different types of digital filters
- design various digital filters and analyze their frequency response
- Analyse finite word length effects.

### **UEI403 ELECTRICAL AND ELECTRONIC MEASUREMENTS**

- Explain the working of different electromechanical indicating instruments.
- Elucidate the concept of several AC bridges for inductance and capacitance
- Describe basic working of instrument transformers.
- Measure power and energy with the help of wattmeter and energy meter.
- Describe the construction and working of various electronic instruments.

### **UEI608 BIO-MEDICAL INSTRUMENTATION**

- differentiate and analyse the biomedical signal sources.
- elucidate cardiovascular system and related measurements.
- explain the respiratory and nervous systems and related measurements
- measure non-invasive diagnostic parameters.

- Describe diagnostic instrumentation

### **UEI501 CONTROL SYSTEMS**

- develop the mathematical model of the physical systems.
- analyze the response of the closed and open loop systems.
- analyze the stability of the closed and open loop systems.
- design the various kinds of compensator.
- develop and analyze state space models

### **UEI301 DIGITAL ELECTRONICS**

- Differentiate between different number systems and various codes
- Apply minimization techniques for the simplification of Boolean functions
- Design the combinational and sequential circuits.
- Compare the different analog to digital converters.
- **Elucidate the concept of memories and logic circuits**

### **UEI610 FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS**

- Elucidate the architecture and addressing modes of 8-bit microprocessor.
- Elucidate the architecture and addressing modes of 8051 microcontroller.
- Perform assembly language programming for microprocessors and microcontrollers for the given application.
- Use hardware interfacing of 8051 to develop solutions of real world problems.

### **UEI507 SENSORS AND SIGNAL CONDITIONING**

- Apply different methods for the measurement of length and angle
- Elucidate the construction and working of various industrial parameters / devices used to measure pressure, sound and flow
- Explicate the construction and working of various industrial parameters / devices used to measure temperature, level, vibration, viscosity and humidity
- Ability to analyse, formulate and select suitable sensor for the given industrial applications
- Describe signal conditioning circuits

### **UEE609 ELECTRIC MACHINE AND DRIVES**

- derive expressions for forces and torques in electromechanical devices
- understand how power electronic converters and inverters operate
- possess an understanding of feedback control theory
- analyze and compare the performance of DC and AC machines in various drive applications
- design controllers for electric drives which achieve the regulation of torque, speed, or position in the above machines.

### **UEI601 INDUSTRIAL INSTRUMENTATION**

- illustrate the different methods for the measurement of length and angle
- elucidate construction & working of various industrial devices used to measure pressure, sound & flow
- explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and humidity

- to analyze, formulate and select suitable sensor for the given industrial applications
- summarize different methods for level measurement

#### **UEI605 PROCESS DYNAMICS AND CONTROL**

- demonstrate fundamental understanding of process control.
- develop the mathematical model of various chemical processes.
- explain different control modes and their application in controlling various processes.
- explain the working of electric, hydraulic and pneumatic controllers.
- demonstrate the working and application of different type of actuators and control valves

#### **UEI624 REHABILITATIVE ENGINEERING**

- Apply Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopaedics
- Engineer rehabilitation engineering anthropometry
- Use sensory rehabilitation engineering concepts.
- Rehabilitation using orthopedic prosthetics and orthotics in
- Handle applications of active prostheses.

#### **UEI831 BIOSENSORS AND MEMS**

- explain the concept of molecular reorganization, fundamentals of surfaces and interfaces
- elucidate the principles of different types of biosensors
- explain the concept of MEMS design, and fabrication technology
- explain bioinstrumentation and bioelectronics devices.
- explain the different types of MEMS and its applications

#### **UEI833 OPTICAL INSTRUMENTATION**

- explain the basic concepts of optical transmitting and receiving
- describe different opto- electronic devices
- elucidate different methods of interferometry
- describe selection of the appropriate optical fiber sensors for industrial application
- EXPLAIN FIBRE OPTIC FUNDAMENTALS

#### **UEI847 ROBOTICS AND AUTOMATION**

- explain the fundamentals of robotics and its components
- illustrate the Kinematics and Dynamics of robotics
- elucidate the need and implementation of related Instrumentation & control in robotics
- illustrate the movement of robotic joints with computers/microcontrollers.
- Explain sensors and instrumentation in robotics

#### **UEI841 ADVANCED CONTROL SYSTEMS**

- demonstrate non-linear system behaviour by phase plane and describing function methods and the
- perform the stability analysis nonlinear systems by Lyapunov method develop design skills in optimal control problems
- derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform).



- predict and analyze transient and steady-state responses and stability and sensitivity of both open-loop and closed-loop linear, time-invariant, discrete-time control systems.
- acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers

#### **UEI401 ARTIFICIAL INTELLIGENT TECHNIQUES AND APPLICATIONS**

- explain the concept of artificial neural networks and its learning techniques.
- apply back propagation algorithm for different applications
- express fuzzy sets, membership functions and knowledge representation using fuzzy rules.
- explain basics of expert systems.
- use genetic algorithms for single and multiple objective optimization problems

#### **UEI801 ADVANCED PROCESS CONTROL**

- explain the concept of advanced control schemes used in process control.
- explain the working of distributed control system
- elaborate the use of artificial intelligence techniques in process control.
- explain the fundamental concepts of PLC.
- explain the concept of digital control system.

#### **UEI701 DATA ACQUISITION AND SYSTEM DESIGN**

- elucidate the elements of data acquisition techniques.
- design and simulate signal conditioning circuits.
- explain various data transfer techniques
- explain the components of data acquisition system
- differentiate between single and multi-channel

#### **UEI718 VIRTUAL INSTRUMENTATION**

- demonstrate the working of LabVIEW.
- explain the various types of structures used in LabVIEW.
- analyze and design different type of programs based on data acquisition.
- demonstrate the use of LabVIEW for signal processing, image processing etc.
- use different analysis tools

#### **UEI720 ANALYTICAL INSTRUMENTATION**

- explain the concept of spectrometry and optical techniques
- elucidate the working of chromatography, elemental analyser
- illustrate the working of X- ray diffractometer and scanning electron microscope
- explain the concept of potentiometry and its applications
- describe the working of different electrodes

#### **UEI721 DIGITAL IMAGE PROCESSING**

- Explain the fundamentals of digital image and its processing
- Perform image enhancement techniques in spatial and frequency domain.
- Elucidate the mathematical modelling of image restoration and compression
- Apply the concept of image segmentation.

- Describe object detection and recognition techniques.

#### **UEI724 COMPUTER ARCHITECTURE AND OPERATING SYSTEMS**

- explain about the basics of computer functioning
- elucidate the concepts of operating system of the machines
- get insight into the hardware and software interactions
- Build their knowledge for low level programming

#### **UEI805 ENVIRONMENTAL INSTRUMENTATION**

- explain sources and effects of air and water pollutants
- explain air pollution sampling and measurement techniques
- explain water sampling and analysis techniques
- explain solid waste management and noise level measurement techniques
- describe solid waste management techniques

## **ME-EIC**

### **Course Scheme 2014**

#### **PEI101 ADVANCED MICROCONTROLLERS**

After the completion of this course the student will be able to:

- understand architecture and hardware of various microcontrollers
- understand assembly and programming concepts, jump and call instructions
- understand hardware interfacing of microcontroller with LEDs, seven segment, sensors
- understand introduction to 16-bit microcontrollers

#### **PEI102 DIGITAL SIGNAL PROCESSING AND APPLICATIONS**

After the completion of this course the student will be able to:

- work using Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)
- work using digital filter structure and design
- acquire knowledge about multirate digital signal processing
- acquire knowledge about optimum filters
- acquire knowledge about hardware architecture of DSP processor
- understand case studies on temporal and spatial signal processing knowledge about optimum filters

#### **PEI103 INTELLIGENT CONTROL TECHNIQUES AND APPLICATION**

After the completion of this course the student will be able to:

- acquire knowledge about Artificial Intelligence and Expert Systems
- ability to understand Artificial Neural Networks
- understand Fuzzy Logic
- understand Evolutionary Computation
- acquire knowledge about Hybrid Techniques
- understand applications of Intelligent techniques in Process control, Robotics and industrial control systems

#### **PEI104 INDUSTRIAL INSTRUMENTATION AND CONTROL**

After the completion of this course the student will be able to:

- acquire knowledge about industrial instrumentation and control
- understand programming of Programmable Logic Control
- understand DCS Topology Design
- study and analyze Robotic system
- interface the hardware and software through buses for Process Control system

#### **PEI 105 PROCESS MODELING AND CONTROL**

After the completion of this course the student will be able to:

- understand the fundamentals and overview of process control
- understand the static and Dynamic analysis of instrumentation system
- understand the concept of Simulation and Modeling
- understand the Advanced Control Schemes
- understand the Design of Multiloop Controllers and Digital controller and to study Discrete Event System Modeling
- analyse the system through State Space Analysis, its Controllability and Observability

and Stability Analysis

- study Real Time Control strategies

### **PEI201 BIOMEDICAL INSTRUMENTATION AND TECHNIQUES**

After the completion of this course the student will be able to:

- acquire knowledge about Characteristics of Transducers and Electrodes for Biological Measurement
- study Cardiac System and Respiratory System
- work using Instrumentation for Measuring Nervous Function
- work using ECG Analysis and Neurological signal processing
- acquire knowledge about Telemedicine

### **PEI202 MICRO-SENSORS AND ACTUATORS**

After the completion of this course the student will be able to:

- have an introductory knowledge of Nanotechnology and MEMS, MEMS design and fabrication technology, Lithography, Etching, MEMS material
- understand MEMS types and their applications
- study Magnetic MEMS and introduction to Bio-MEMS

### **PEI203 VIRTUAL INSTRUMENTATION AND APPLICATIONS**

After the completion of this course the student will be able to:

- acquire knowledge about Graphical programming
- ability to identify Elements of Data acquisition for Software and hardware installation
- work using Signal processing, Sampling Signals and filtering
- work using Network Interface Layer Protocol, System buses, Interface buses.
- acquire knowledge about implementation and designing of Machine Vision and motion control

### **PEI204 COGNITIVE ENGINEERING**

After the completion of this course the student will be able to:

- have an overview of Nervous System
- acquire basic knowledge of Cognitive Neuroscience
- acquire basic knowledge of Psychophysiology
- acquire basic knowledge of Functional neuroimaging of cognition and Image processing
- understand Signal Processing and Neural Engineering
- design experiments related to Cognitive Engineering

### **PEI205 DIGITAL IMAGE PROCESSING AND ANALYSIS**

After the completion of this course the student will be able to:

- understand the concept of digital image processing
- learn about Image Smoothing and Spatial Filtering
- study and analyze the performance through Frequency Domain Processing
- understand Image Restoration, Compression, Segmentation and Morphological Image Processing

**PEI206 ENVIRONMENT MONITORING INSTRUMENTATION**

After the completion of this course the student will be able to:

- have overview of Air pollution sources and its effects
- have overview of Air pollution sources and its effects
- have know-how of Sources And classification of water pollution
- have knowledge of Air pollution sampling and measurement, Air pollution control methods and equipment, Air sampling techniques
- study Pollution Management, Noise level measurement techniques, Instrumentation for environmental pollution, Monitoring and audit

**PEI207 REMOTE SENSING AND TELEMETRY**

After the completion of this course the student will be able to:

- understand the basic concept of Remote Sensing
- understand Telemetry and Components of Telemetering and Remote Control Systems
- understand the Multiplexing
- understand the Data acquisition and distribution system, Digital Modulation and demodulation Techniques in Telemetry System

**PEI301 ADVANCED SOFT COMPUTING TECHNIQUES**

After the completion of this course the student will be able to:

- acquire knowledge about Soft Computing technologies
- understand Multiobjective optimization
- understand advanced AI techniques of swarm intelligence , particle swarm optimization, ant-colony optimization and petrinets
- study and analyze rough set theory and granular computing
- understand Hybrid AI Techniques

**PEI302 BIOMECHANICS AND REHABILITATION**

After the completion of this course the student will be able to:

- acquire knowledge about Biomechanics
- ability to understand Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopedics
- understand engineering concepts in rehabilitation engineering anthropometry
- understand engineering concepts in sensory rehabilitation engineering
- acquire knowledge about orthopedic prosthetics and orthotics in rehabilitation

understand applications Active Prostheses

**PEI303 BIOMETRICS TECHNIQUES**

After the completion of this course the student will be able to:

- acquire knowledge about working of biometric matching
- ability to identify algorithms for Finger Biometric Technology
- work using Facial Biometrics
- work using System Iris Biometric and Voice Biometric
- acquire knowledge about Other Physiological Biometrics

**PEI304 CIRCUIT DESIGNING AND TESTING**

After the completion of this course the student will be able to:

- design analog circuits

- use EDA tools
- meet with the compliance requirements
- use reliability prediction tools
- validate the design

### **PEI305 COMPUTATIONAL ELECTROMAGNETIC**

After the completion of this course the student will be able to:

- understand the fundamentals and overview of Partial Differential Equation and Time-Domain Methods
- understand one-dimensional scalar wave equation
- understand the concept of Maxwell's' Equations and Yee Algorithm
- understand the Numerical Stability Schemes
- understand the Numerical Dispersion

### **PEI306 EMBEDDED SYSTEM FUNDAMENTALS AND PROGRAMMING**

After the completion of this course the student will be able to:

- acquire knowledge about HCS12/S12X series Microcontrollers, Embedded Hardware Building Blocks
- learn about HCS12 System Programming and Serial Peripheral Interface Interfacing to Keypad, Motors, Graphic LCDs
- study and analyze the Networking and Connectivity
- analyse Development and Programming Tools, Hardware and Software development tools, C language
- understand Real-time Operating Systems

### **PEI307 INDUSTRIAL ELECTRONICS**

After the completion of this course the student will be able to:

- acquire knowledge about solid state devices
- understand working and design Industrial Electronic converters and devices
- apply the acquired knowledge of Industrial application of industrial electronic devices and their control
- learn the testing and design for drive controllers, microprocessor based drive controllers and their Analysis
- acquire knowledge of a c power conditioner and applications

### **PEI308 MICROCONTROLLER BASED SYSTEM DESIGN**

After the completion of this course the student will be able to:

- review 8-bit microcontrollers
- learn assembly and C-programming of PIC
- learn Interfacing of Microcontroller
- get familiar with real time operating system

### **PEI309 OPTIMAL AND ROBUST CONTROL**

After the completion of this course the student will be able to:

- have review of Parametric Optimization
- acquire knowledge of Calculus of variations
- acquire knowledge of Pontryegans Max/min Principle
- learn Dynamic Programming in Continuous and Discrete Time:

- apply iterative method of optimization
- analyze and design a robust Control System

### **PEI310 POWER SYSTEM INSTRUMENTATION**

After the completion of this course the student will be able to:

- acquire knowledge about Power System
- identify Energy storage methods
- work on Transmission lines and Instrumentation scheme used for HVDC
- understand the working of Automatic Generation and Voltage Control
- acquire knowledge about Instrumentation schemes for monitoring and control
- acquire knowledge about Signal Transmission Techniques

understand case studies of Power Plant Instrumentation

### **PEI311 ROBOTIC TECHNOLOGY**

After the completion of this course the student will be able to:

- understand the concept of robot components and its characteristics
- learn about Robot Kinematics
- study and analyze the Differential motions, Inverse Manipulator Kinematics
- understand robot dynamic analysis and forces, trajectory planning
- study use of Actuators and Sensors in robot
- learn Robot Programming, Systems and Applications and FLC

### **PEI312 ULTRASONIC AND OPTO-ELECTRONIC INSTRUMENTATION**

After the completion of this course the student will be able to:

- acquire knowledge about Ultrasonic based instrumentation
- acquire knowledge about Opto-Electronics
- study Optical Instrumentation System
- work using Optical Techniques and Spectrometric methods of analysis
- work using Optical Techniques and Spectrometric methods of analysis
- work using Lasers based Instrumentation System processing
- acquire knowledge about application of laser in biomedical science, Defense systems Instrumentation systems, Robotics

## **Course Scheme 2015**

### **PEI 101: ADVANCED MICROCONTROLLERS**

- Learn basic hardware of various microcontrollers.
- Assembly and programming concepts, jump and call instructions.
- Hardware interfacing of microcontroller with led's, seven segment, sensors.
- Introduction to 16 bit microcontrollers

### **PEI 102: DIGITAL SIGNAL PROCESSING TECHNIQUES**

- After the completion of the course the students will be able to

- Identify various type of discrete signal.
- Recognise various types of systems.
- Analyse frequency domain response of systems.
- Design various type of filter.
- Implement filter structures.

### **PEI 103: INDUSTRIAL INSTRUMENTATION AND CONTROL**

After the completion of the course the students will be able to

- Acquire knowledge about industrial instrumentation and control
- Programme programmable logic control
- Handle DCS system
- Programme and analyze robotic system
- Interface the hardware and software through buses for process control system

### **PEI 104: INTELLIGENT CONTROL TECHNIQUES AND APPLICATION**

**After the completion of the course the students will be able to**

- Apply artificial intelligence and expert system concepts.
- Apply fuzzy logic control to process.
- Use evolutionary computation applications.
- Acquire knowledge about hybrid techniques
- Apply intelligent techniques in process control, robotics and industrial control systems

### **PEI 105 : PROCESS MODELING AND CONTROL**

After the completion of the course the students will be able to

- Perform static and dynamic analysis of existing instrumentation system
- Model and simulate instrumentation system
- Implement advanced control schemes for different process.
- Design multi loop controllers and digital controller and model discrete event system.
- Analyse the system using state space analysis.
- Apply fundamentals to real time control problems.

### **PEI 201: BIOMEDICAL INSTRUMENTATION AND TECHNIQUES**

After the completion of the course the students will be able to

- Study characteristics of transducers and electrodes for biological measurement.
- Understand cardiac system and respiratory system.



- Apply instrumentation system for measuring nerve function parameter.
- Use ECG and neurological signal processing for analysis.
- Apply telemedicine concepts for handling distant patients.

### **PEI 202: MICRO SENSORS AND ACTUATORS**

After the completion of the course the students will be able to

- Design MEMS system.
- Handle Magnetic MEMS for process applications.
- Use Bio MEMS for process measurements.

### **PEI 203: VIRTUAL INSTRUMENTATION AND APPLICATIONS**

After the completion of the course the students will be able to

- Use graphical programming
- Identify elements of data acquisition for software and hardware installation
- Use signal processing, sampling signals and filtering
- Handle network interface layer protocol, system buses, interface buses.
- Implement and design machine vision and motion control.

### **PEI 204: COGNITIVE ENGINEERING**

After the completion of the course the students will be able to

- Acquire basic knowledge of cognitive neuroscience.
- Acquire basic knowledge of psychophysiology
- Acquire basic knowledge of functional neuro imaging of cognition and image processing
- Use signal processing and neural engineering in relation to cognitive engineering.
- Design experiments related to cognitive engineering

### **PEI 205: DIGITAL IMAGE PROCESSING AND ANALYSIS**

**After the completion of the course the students will be able to**

- Understand the concept of digital image processing.
- Use image smoothing and spatial filtering for images.
- Study and analyze the performance through frequency domain analysis.
- Apply image restoration, compression, segmentation and morphological image processing.

**PEI 206: ENVIRONMENT MONITORING INSTRUMENTATION**

**After the completion of the course the students will be able to**

- Study air pollution sources and its effects
- Analyse air pollution sources and its effects
- Investigate sources and classification of water pollution
- Perform air pollution sampling and measurement, air pollution control methods and equipment, air sampling techniques
- Monitor and audit management, noise level measurement techniques, instrumentation for environmental pollution

**PEI 207: REMOTE SENSING AND TELEMETRY**

- **Course learning outcome (CLO):** After the completion of the course the students will be able to
- Study remote sensing applications.
- Use components of telemetring and remote control systems
- Use data acquisition and distribution system, digital modulation and demodulation techniques in telemetry system

**PEI 301: ADVANCED SOFT COMPUTING TECHNIQUES**

After the completion of the course the students will be able to

- Use soft computing techniques.
- Handle multi objective optimization problems.
- Use advanced AI techniques of swarm intelligence , particle swarm optimization, ant colony optimization and petrinets
- Use rough set theory and granular computing

**PEI 302: BIOMECHANICS AND REHABILITATION**

After the completion of the course the students will be able to

- Use Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopedics
- Engineer rehabilitation engineering anthropometry
- Use sensory rehabilitation engineering concepts.
- Use orthopedic prosthetics and orthotics in rehabilitation
- Handle applications of active prostheses.

**PEI 303: BIOMETRICS TECHNIQUES**

**After the completion of the course the students will be able to**

- Use biometric matching for identification
- Identify algorithms for finger biometric technology
- Use facial biometrics for identification.
- Apply iris biometric, voice biometric, physiological biometrics etc. for identification.

#### **PEI 304: CIRCUIT DESIGNING AND TESTING**

After the completion of the course the students will be able to

- Design analog circuits
- Use EDA tools
- Meet with the compliance requirements
- Use reliability prediction tools
- Validate the design

#### **PEI 305: COMPUTATIONAL ELECTROMAGNETIC**

**After the completion of the course the students will be able to**

- Apply partial differential equation and time domain methods for analysis.
- Use one dimensional scalar wave equation
- Handle the concept of maxwell's equations and yee algorithm
- Apply the numerical stability schemes
- Apply the numerical dispersion techniques

#### **PEI 306: EMBEDDED SYSTEM FUNDAMENTALS AND PROGRAMMING**

After the completion of the course the students will be able to

- Use basic hardware of HCS12/S12X series Microcontrollers.
- Handle HCS12 System Programming and Serial Peripheral Interface Interfacing to Keypad, Motors, Graphic lcds.
- Use the Networking and Connectivity
- Handle Development and Programming Tools, Hardware and Software development tools, C language
- Use Real time Operating Systems

#### **PEI 307: INDUSTRIAL ELECTRONICS**

After the completion of the course the students will be able to

- Handle knowledge about solid state devices
- Design industrial electronic converters and devices
- Handle industrial application of industrial electronic devices and their control
- Test drive controllers, microprocessor based drive controllers and their analysis

- Use power conditioner and applications

### **PEI 308: MICROCONTROLLER BASED SYSTEM DESIGN**

- Review 8 bit microcontrollers
- Use assembly and c programming of ARM microcontrollers.
- Design of basic circuits for ARM microcontroller.
- Design interfacing circuits for ARM microcontroller.

### **PEI 309: OPTIMAL AND ROBUST CONTROL**

After the completion of the course the students will be able to

- Use Parametric Optimization
- Use Calculus of variations for optimization problems.
- Use of Pontryegans Max/min Principle for optimization.
- Apply Dynamic Programming in Continuous and Discrete Time systems
- Apply iterative method of optimization
- Analyze and design a robust Control System

### **PEI 310: POWER SYSTEM INSTRUMENTATION**

After the completion of the course the students will be able to

- Understand power system
- Identify energy storage methods
- Work on transmission lines and instrumentation scheme used for hvdc
- Handle automatic generation and voltage control in power generation station.
- Understand instrumentation schemes for monitoring and control
- Understand signal transmission techniques
- Study cases of power plant instrumentation

### **PEI 311 ROBOTIC TECHNOLOGY**

**After the completion of the course the students will be able to**

- Handle robot components and study its characteristics
- Learn about robot kinematics.
- Analyze the differential motions, inverse manipulator kinematics.
- Perform robot dynamic analysis and trajectory planning.
- Use actuators and sensors in robot.
- Program systems for different applications.

**PEI 312: ULTRASONIC AND OPTO-ELECTRONIC INSTRUMENTATION**

- Use ultrasonic based instrumentation
- Use opto electronics for signal conditioning.
- Use optical techniques and spectrometric methods of analysis
- Use optical techniques and spectrometric methods of analysis
- Handle lasers based instrumentation system.
- Study application of laser in biomedical science, defense systems instrumentation systems, robotics

**ME-EIC Course Scheme-2016****PEI101: ADVANCED MICROCONTROLLERS**

- Learn basic hardware of various microcontrollers.
- Assembly and programming concepts, jump and call instructions.
- Hardware interfacing of microcontroller with led's, seven segment, sensors.
- Introduction to 16-bit microcontrollers.

**PEI102: DIGITAL SIGNAL PROCESSING TECHNIQUES**

After the completion of the course the students will be able to

- Identify various type of discrete signal.
- Recognise various types of systems.
- Analyse frequency domain response of systems.
- Design various type of filter.

**PEI103: INDUSTRIAL INSTRUMENTATION AND CONTROL**

- Acquire knowledge about industrial instrumentation and control
- Programme programmable logic control
- Handle DCS system
- Programme and analyze robotic system
- Interface the hardware and software through buses for process control system

**PEI104: INTELLIGENT CONTROL TECHNIQUES AND APPLICATION**

- Apply artificial intelligence and expert system concepts.

- Apply fuzzy logic control to process.
- Use evolutionary computation applications.
- Acquire knowledge about hybrid techniques
- Apply intelligent techniques in process control, robotics and industrial control systems

#### **PEI 105 : PROCESS MODELING AND CONTROL**

- Perform static and dynamic analysis of existing instrumentation system
- Model and simulate instrumentation system
- Implement advanced control schemes for different process.
- Design multi-loop controllers and digital controller and model discrete event system.
- Analyse the system using state space analysis.
- Apply fundamentals to real time control problems.

#### **PEI201: BIOMEDICAL INSTRUMENTATION AND TECHNIQUES**

- Study characteristics of transducers and electrodes for biological measurement.
- Understand cardiac system and respiratory system.
- Apply instrumentation system for measuring nerve function parameter.
- Use ECG and neurological signal processing for analysis.
- Apply telemedicine concepts for handling distant patients.

#### **PEI202: MICRO-SENSORS AND ACTUATORS**

- Design MEMS system.
- Handle Magnetic MEMS for process applications.

#### **PEI203: VIRTUAL INSTRUMENTATION AND APPLICATIONS**

- Use graphical programming
- Identify elements of data acquisition for software and hardware installation
- Use signal processing, sampling signals and filtering
- Handle network interface layer protocol, system buses, interface buses.
- Implement and design machine vision and motion control.

#### **PEI204: COGNITIVE ENGINEERING**

- Acquire basic knowledge of cognitive neuroscience.

- Acquire basic knowledge of psychophysiology
- Acquire basic knowledge of functional neuro-imaging of cognition and image processing
- Use signal processing and neural engineering in relation to cognitive engineering.

#### **PEI205: DIGITAL IMAGE PROCESSING AND ANALYSIS**

- Understand the concept of digital image processing.
- Use image smoothing and spatial filtering for images.
- Study and analyze the performance through frequency domain analysis.
- **Apply image restoration, compression, segmentation and morphological image processing**

#### **PEI206: ENVIRONMENT MONITORING INSTRUMENTATION**

- Study air pollution sources and its effects
- Analyse air pollution sources and its effects
- Investigate sources and classification of water pollution
- Perform air pollution sampling and measurement, air pollution control methods and equipment, air sampling techniques
- Monitor and audit management, noise level measurement techniques, instrumentation for environmental pollution.

#### **PEI207: REMOTE SENSING AND TELEMETRY**

- Study remote sensing applications.
- Use components of telemetring and remote control systems
- Use data acquisition and distribution system, digital modulation and demodulation techniques in telemetry system

#### **PEI301: ADVANCED SOFT COMPUTING TECHNIQUES**

- Use soft computing techniques.
- Handle multi-objective optimization problems.
- Use advanced AI techniques of swarm intelligence , particle swarm optimization, ant-colony optimization and petrinets
- Use rough set theory and granular computing

### **PEI302: BIOMECHANICS AND REHABILITATION**

- Use Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopedics
- Engineer rehabilitation engineering anthropometry
- Use sensory rehabilitation engineering concepts.
- Use orthopedic prosthetics and orthotics in rehabilitation
- Handle applications of active prostheses.

### **PEI303: BIOMETRICS TECHNIQUES**

- Use biometric matching for identification
- Identify algorithms for finger biometric technology
- Use facial biometrics for identification.
- Apply iris biometric, voice biometric, physiological biometrics etc. for identification.

### **PEI304: CIRCUIT DESIGNING AND TESTING**

- Design analog circuits
- Use EDA tools
- Meet with the compliance requirements
- Use reliability prediction tools
- Validate the design

### **PEI305: COMPUTATIONAL ELECTROMAGNETIC**

- Apply partial differential equation and time-domain methods for analysis.
- Use one-dimensional scalar wave equation
- Handle the concept of maxwell's' equations and yee algorithm
- Apply the numerical stability schemes
- Apply the numerical dispersion techniques.

### **PEI306: EMBEDDED SYSTEM FUNDAMENTALS AND PROGRAMMING**

- Use basic hardware of HCS12/S12X series Microcontrollers.
- Handle HCS12 System Programming and Serial Peripheral Interface Interfacing to Keypad, Motors, Graphic lcds.
- Use the Networking and Connectivity
- Handle Development and Programming Tools, Hardware and Software development tools, C language
- Use Real-time Operating Systems



**PEI307: INDUSTRIAL ELECTRONICS**

- Handle knowledge about solid state devices
- Design industrial electronic converters and devices
- Handle industrial application of industrial electronic devices and their control
- Test drive controllers, microprocessor based drive controllers and their analysis
- Use power conditioner and applications

**PEI308: MICROCONTROLLER BASED SYSTEM DESIGN**

- Review 8-bit microcontrollers
- Use assembly and c-programming of ARM microcontrollers.
- Design of basic circuits for ARM microcontroller.
  - **Design interfacing circuits for ARM microcontroller**

**PEI309: OPTIMAL AND ROBUST CONTROL**

- Use Parametric Optimization
- Use Calculus of variations for optimization problems.
- Use of Pontryegans Max/min Principle for optimization.
- Apply Dynamic Programming in Continuous and Discrete Time systems
- Apply iterative method of optimization
- Analyze and design a robust Control System

**PEI310: POWER SYSTEM INSTRUMENTATION**

- Understand power system
- Identify energy storage methods
- Work on transmission lines and instrumentation scheme used for hvdc
- Handle automatic generation and voltage control in power generation station.
- Understand instrumentation schemes for monitoring and control
- Understand signal transmission techniques
- Study cases of power plant instrumentation

**PEI-311 ROBOTIC TECHNOLOGY**

- Handle robot components and study its characteristics
- Learn about robot kinematics.
- Analyze the differential motions, inverse manipulator kinematics.

- Perform robot dynamic analysis and trajectory planning.
- Use actuators and sensors in robot.
- Program systems for different applications.

### **PEI312: ULTRASONIC AND OPTO-ELECTRONIC INSTRUMENTATION**

- Use ultrasonic based instrumentation
- Use opto-electronics for signal conditioning.
- Use optical techniques and spectrometric methods of analysis
- Use optical techniques and spectrometric methods of analysis
- Handle lasers based instrumentation system.
- Study application of laser in biomedical science, defense systems instrumentation systems, robotics

### **PEI306: EMBEDDED CONTROL SYSTEMS**

- Express the building block of microcontrollers and specifically S12X architecture.
- Elucidate the C-programming using IDE like code warrior for S12X microcontroller and can develop the programs for timers, PWM etc.
- Demonstrate the interfacing modules (ADC, LCD etc.) in control applications.
- Express understanding of real time operating system.

### **PEIXXX: SYSTEM IDENTIFICATION AND CONTROL**

- Develop input output process model, state space process models, discrete time process models.
- Use the concept of least square methods and recursive least square method.
- Solve optimal control problem and design of optimal controller.
- Design adaptive control system.

## **ME-EIC Course Scheme 2017**

### **PEI108: MICROCONTROLLERS AND EMBEDDED SYSTEMS**

- Learn basic hardware of various microcontrollers.
- Assembly and programming concepts, jump and call instructions.
- Hardware interfacing of microcontroller with led's, seven segment, sensors.
- Introduction to 16-bit microcontrollers.

### **PEI107: DIGITAL SIGNAL PROCESSING TECHNIQUES**

- Identify various type of discrete signal and systems.
- Analyse frequency domain response of systems.
- Design various type of filter.
- Implement filter structures.

### **PEI102: INDUSTRIAL INSTRUMENTATION AND CONTROL**

- Acquire knowledge about industrial instrumentation and control
- Handle PLC and DCS system
- Programme and analyze robotic system
- Interface the hardware and software through buses for process control system

### **PEI109: INTELLIGENT TECHNIQUES AND APPLICATIONS**

- Apply artificial intelligence and expert system concepts to control process.
- Use of evolutionary computation algorithm to solve engineering problems.
- Acquire knowledge about hybrid search techniques.
- Apply intelligent techniques in process control, robotics and industrial control systems.

### **PEI110: MEASUREMENT TECHNIQUES**

- Apply different techniques for the analysis of errors
- Analyse the response of systems for various test signals
- Explain different sensors and signal conditioning circuits.
- Elucidate techniques for the measurement of the Shaft Power Torque, speed, vibration, Viscosity, pH, and Humidity
- Examine various techniques for the measurement of Temperature, Pressure, and Flow.

### **PEI104: PROCESS MODELING AND CONTROL**

- Perform static and dynamic analysis of existing instrumentation system
- Implement advanced control schemes for different process.
- Design multi-loop controllers and digital controller and model discrete event system.
- Analyse the system using state space analysis.
- Apply fundamentals to real time control problems.

### **PEI201: BIOMEDICAL INSTRUMENTATION AND TECHNIQUES**

- Study characteristics of transducers and electrodes for biological measurement.
- Understand cardiac system and respiratory system.
- Apply instrumentation system for measuring nerve function parameter.
- Apply ECG and neurological signal processing for analysis.
- Apply telemedicine concepts for handling distant patients.

### **PEI211: DIGITAL IMAGE PROCESSING AND ANALYSIS**

- Understand the concept of digital image processing.
- Apply image smoothing and spatial filtering for images.
- Study and analyze the performance through frequency domain analysis.
- Apply image restoration, compression, segmentation and morphological image processing.

### **PEI216: OPTIMAL AND ROBUST CONTROL**

- Apply Parametric Optimization
- Apply Calculus of variations for optimization problems.
- Apply of Pontryegans Max/min Principle for optimization.
- Apply Dynamic Programming in Continuous and Discrete Time systems
- Apply iterative method of optimization
- Analyze and design a robust Control System

### **PEI204: VIRTUAL INSTRUMENTATION AND APPLICATIONS**

- Apply graphical programming
- Identify elements of data acquisition for software and hardware installation
- Apply signal processing, sampling signals and filtering
- Handle network interface layer protocol, system buses, interface buses.
- Implement and design machine vision and motion control.

### **PEI306: EMBEDDED SYSTEM FUNDAMENTALS AND PROGRAMMING**

- Implement basic hardware of HCS12/S12X series Microcontrollers.
- Handle HCS12 System Programming and Serial Peripheral Interface Interfacing to Keypad, Motors, Graphic lcds.
- Implement the Networking and Connectivity
- Handle Development and Programming Tools, Hardware and Software development tools, C language
- Implement Real-time Operating Systems

### **PEI307: INDUSTRIAL ELECTRONICS**

- Handle knowledge about solid state devices
- Design industrial electronic converters and devices
- Handle industrial application of industrial electronic devices and their control
- Test drive controllers, microprocessor based drive controllers and their analysis
- Implement power conditioner and applications

### **PEI205: MICRO-SENSORS AND ACTUATORS**

- Design MEMS system.
- Handle Magnetic MEMS for process applications.
- Use Bio-MEMS for process measurements.

### **PEI215: REMOTE SENSING AND TELEMETRY**

After the completion of the course the students will be able to

- Study remote sensing applications.
- Use components of telemetring and remote control systems
- Use data acquisition and distribution system, digital modulation and demodulation techniques in telemetry system

### **PEI311 ROBOTIC TECHNOLOGY**

After the completion of the course the students will be able to

- Handle robot components and study its characteristics
- Learn about robot kinematics.
- Analyze the differential motions, inverse manipulator kinematics.
- Perform robot dynamic analysis and trajectory planning.
- Use actuators and sensors in robot.

### **PEI301: ADVANCED SOFT COMPUTING TECHNIQUES**

After the completion of the course the students will be able to

- Apply soft computing techniques to solve engineering problems.
- Handle multi-objective optimization problems.
- Apply advanced AI techniques of swarm intelligence , particle swarm optimization, ant-colony optimization and petrinets.
- Apply rough set theory and granular computing to solve process control applications

### **PEI303: BIOMETRICS TECHNIQUES**

**After the completion of the course the students will be able to**

- Apply biometric matching for identification
- Identify algorithms for finger biometric technology
- Apply facial biometrics for identification.
- Apply iris biometric, voice biometric, physiological biometrics etc. for identification.

### **PEI305: COMPUTATIONAL ELECTROMAGNETIC**

**After the completion of the course the students will be able to**

1. Apply partial differential equation and time-domain methods for analysis.
2. Apply one-dimensional scalar wave equation
3. Handle the concept of maxwell's' equations and yee algorithm
4. Apply the numerical stability schemes
5. Apply the numerical dispersion techniques.

### **PEI329: EMBEDDED CONTROL SYSTEMS**

After the completion of the course the students will be able to

1. Express the building block of microcontrollers and specifically S12X architecture.
2. Elucidate the C-programming using IDE like code warrior for S12X microcontroller and can develop the programs for timers, PWM etc.
3. Demonstrate the interfacing modules (ADC, LCD etc.) in control applications.
4. Express understanding of real time operating system.

### **PEI308: MICROCONTROLLER BASED SYSTEM DESIGN**

- Review 8-bit microcontrollers
- Implement assembly and c-program of ARM microcontrollers.
- Design of basic circuits for ARM microcontroller.
- Design interfacing circuits for ARM microcontroller.

### **PEI302: BIOMECHANICS AND REHABILITATION**

After the completion of the course the students will be able to

- Apply Orthopedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopaedics
- Engineer rehabilitation engineering anthropometry
- Use sensory rehabilitation engineering concepts.

- Rehabilitation using orthopedic prosthetics and orthotics in
- Handle applications of active prostheses.

### **PEI207: COGNITIVE ENGINEERING**

After the completion of the course the students will be able to

- Acquire basic knowledge of cognitive neuroscience.
- Acquire basic knowledge of psychophysiology
- Acquire basic knowledge of functional neuro-imaging of cognition and image processing
- Apply signal processing and neural engineering in relation to cognitive engineering.
- *Design experiments related to cognitive engineering*

### **PEI213: ENVIRONMENT MONITORING INSTRUMENTATION**

After the completion of the course the students will be able to:

- Study air pollution sources and its effects
- Analyse air pollution sources and its effects
- Investigate sources and classification of water pollution
- Perform air pollution sampling and measurement, air pollution control methods and equipment, air sampling techniques
- Monitor and audit management, noise level measurement techniques, instrumentation for environmental pollution

### **PEI310: POWER SYSTEM INSTRUMENTATION**

After the completion of the course the students will be able to

- Identify energy storage methods
- Work on transmission lines and instrumentation scheme used for HVDC
- Handle automatic generation and voltage control in power generation station.
- Identify instrumentation schemes for monitoring and control
- Apply signal transmission techniques for sharing process information

### **PEI327: SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**

After the completion of the course the students will be able to

- Develop input output process model, state space process models and discrete time process models.
- Use the concept of least square methods and recursive least square method.
- Solve optimal control problem and design of optimal controller.
- Design adaptive control system.

### **PEI312: ULTRASONIC AND OPTO-ELECTRONIC INSTRUMENTATION**

- Use ultrasonic based instrumentation.
- Use opto-electronics for signal conditioning.
- Use optical techniques and spectrometric methods of analysis