

**Program Outcomes** 



Department of Mechanical Engineering GMR Institute of Technology

Rajam, Andhra Pradesh (An Autonomous Institute Affiliated to JNTU Kakinada, AP) NBA Accredited and NAAC Accredited



## Program Outcomes (POs):

Engineering graduate will be able to:

- PO 1: Apply the knowledge of basic sciences and fundamental engineering concepts in solving civil engineering problems (Engineering knowledge)
- PO 2: Identify and define civil engineering problems and investigate to analyze and interpret data to arrive at substantial conclusions. (Problem analysis)
- PO 3: Propose appropriate solutions for engineering problems complying with functional constraints such as economic, environmental, societal, ethical, safety and sustainability in accordance with Indian standard codes of practices.(Design/development of solutions)
- PO 4: Perform investigations, design and conduct experiments, analyze and interpret the results to provide valid conclusions. (Conduct investigations of complex problems)
- PO 5: Select/develop and apply appropriate techniques and IT tools to analyze, design and scheduling of activities with an understanding of the limitations. (Modern tool usage)
- PO 6: Give reasoning and assess societal, health, legal and cultural issues with competency in professional engineering practice. (The engineer and society)
- PO 7: Demonstrate professional skills and contextual reasoning to assess environmental/societal issues for sustainable development. (Environment and sustainability)
- PO 8: Demonstrate Knowledge of professional and ethical practices. (Ethics)
- PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary situations. (Individual and team work)
- PO10:Communicate effectively with respect to oral, written and graphical communication(Communication)
- PO 11: Demonstrate and apply engineering & management principles in their own / team projects in multidisciplinary environment. (Project management and finance)
- PO 12: Recognize the need for, and have the ability to engage in independent and lifelong learning. (Life-long learning)
- PSO#1: Demonstrate the quality and suitability of construction materials (Program Specific)
- PSO#2: Understand the practical aspect of analysis, design and safe construction practices (Program Specific)

### **Electrical & Electronics Engineering**

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. (Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. (Design/development of solutions)
- PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. (Conduct investigations of complex problems)
- PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. (Modern tool usage)
- PO 6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. (The engineer and society)

- PO 7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. (Environment and sustainability)
- PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (Ethics)
- PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. (Individual and team work)
- PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. (Communication)
- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. (Project management and finance)
- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. (Life-long learning)
- PO 13: Utilize statistics, transformation methods, discrete mathematics and application of differential equations in analyzing and design of electrical/electronic systems.. (Program Specific)
- PO 14: Analyze, design and implement control of electrical systems in any problem/application of electrical/electronic (s) engineering. (Program Specific)

#### **Electronics and Comunication Engineering**

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.(Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.(Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.(Design/development of solutions)
- PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.(Conduct investigations of complex problems)
- PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.(Modern tool usage)
- PO 6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.(The engineer and society)
- PO 7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.(Environment and sustainability)
- PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.(Ethics) PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.(Individual and team work)
- PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.(Communication)
- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.(Project management and finance)

- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.(Life-long learning)
- PO 14: Understand and apply the fundamentals of communication and signal processing to develop systems wrapped with industry standard protocols and standards. (Program Specific)
- PO 13: Apply the knowledge of technological evolutions, model / character the devices and design the integrated as to build analog and digital systems. (Program Specific) the integrated

### **Computer Science and Engineering**

Engineering graduate will be able to

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. (Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. (Design/development of solutions)
- PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. (Conduct investigations of complex problems)
- PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. (Modern tool usage)
- PO 6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. (The engineer and society)
- PO 7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. (Environment and sustainability)
- PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (Ethics)
- PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. (Individual and team work)
- PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. (Communication)
- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. (Project management and finance)
- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. (Life-long learning)
- PSO1: Understand of social & civic responsibilities, and rights of individuals or groups while developing software tools. (Program Specific)
- PSO2: Demonstrate personal strengths & limitations, committed to critical thinking and performance evaluation to manage software projects. (Program Specific)

#### **Information Technology**

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.(Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.(Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.(Design/development of solutions)
- PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.(Conduct investigations of complex problems)
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- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.(Project management and finance)
- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.(Life-long learning)
- PSO1: Implementation of soft computing applications for secure environment to support contemporary services (Program Specific)
- PSO2: Construct software solutions to deliver quality products for Future Enterprise Mobility (Program Specific)

### **Mechanical Engineering**

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. (Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. (Design/development of solutions)
- PO 4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. (Conduct investigations of complex problems)

- PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. (Modern tool usage)
- PO 6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. (The engineer and society)
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- PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. (Communication)
- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. (Project management and finance)
- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. (Life-long learning)
- PSO1: Demonstrate the knowledge and application of Geometric modeling, Analysis and Simulation of mechanical engineering systems. (Program Specific)
- PSO2: Demonstrate the knowledge and application of advanced techniques in manufacturing. (Program Specific).

### **Chemical Engineering**

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.(Engineering knowledge)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.(Problem analysis)
- PO 3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.(Design/development of solutions)
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effective reports and design documentation, make effective presentations, and give and receive clear instructions.(Communication)

- PO 11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.(Project management and finance)
- PO 12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.(Life-long learning)
- PO 13: Utilize the knowledge of chemistry, thermodynamics, material and energy balances, transport processes, reaction engineering, process dynamics and control in optimal design of Chemical Engineering equipment and processes to meet the desired needs. (Program Specific)

#### **Course Outcomes**



**GMR Institute of Technology** Rajam, Andhra Pradesh (An Autonomous Institute Affiliated to JNTU Kakinada, AP) NBA Accredited and NAAC Accredited



#### ommon to all Departments

#### **Course Outcomes**

### **19HSX01** Communicative English

- 1. Develop effective listening skills for better comprehension of English spoken in different social and workplace contexts.
- 2. Compose speech clearly on a specific topic using appropriate language in informal discussions
- 3. Explain the implicit and explicit meanings of a text while reading
- 4. Summarize the texts of reading and listening based on comprehension
- 5. Construct sentences using proper grammatical sentence structures
- 6. Choose and use the appropriate vocabulary, phrases in different contexts

#### **Course Outcomes**

1. Find the solution of system of linear equations, eigen values and eigen vectors

**19MAX01 Engineering Mathematics I** 

2. Identify the nature of the quadratic form using matrix theory

- 3. Classify and solve first and higher order ordinary differential equations with constant coefficients
- 4. Apply the knowledge of Mean value theorems, Maxima and Minima of functions of several variables
- 5. Analyze the characteristics to trace the curve
- 6. Adapt methods for measuring lengths, volumes, surface area of an object and also the procedure to transform change of variables and order of integration

### **Course Outcomes**

## **19PYX01 Engineering Physics**

- 1. Interpret the concepts of mechanics to understand the conservative principles
- 2. Outline the principles of electrostatics, magnetostatics and able to explain electromagnetism
- 3. Illustrate the concepts of Interference, Diffraction, Polarization and their applications
- 4. Summarize the fundamental concepts of quantum theory and identify the applications of quantum theory in various contexts
- 5. Classify solids into conductors, insulators and semiconductors and understand conductivity in intrinsic and extrinsic semiconductors
- 6. Demonstrate the emission of laser light and their applications in various engineering fields. Interpret and classify optical fibers and their applications in modern communication systems.

## **19CYX01 Engineering Chemistry**

# **Course Outcomes**

- 1. Illustrate the different types of polymers and their applications
- 2. Interpret the Nernst equation for electrode potential and construct various types of energy storage devices
- 3. Describe corrosion factors and implement prevention measures
- 4. Estimate the calorific value of a fuel and select a suitable fuel as an energy resource
- 5. Describe the important renewable energy sources and their usage
- 6. Explain bonding, colour and magnetic properties of molecules

### **19BEX01 Basics of Engineering**

## **Course Outcomes**

- 1. Understand the principles of surveying and building materials and components
- 2. Understand the working principle of steam, Gas, Diesel, Hydro-electric, Nuclear Power plants and IC Engines
- 3. Understand the working principle of vapour compression & vapour absorption refrigeration systems, Window and Split type AC systems
- 4. Illustrate the behavior of basic electric circuit elements for both DC and AC excitation
- 5. Outline the construction and working principle of DC machines with appropriate safety measures
- 6. Understand the operation of sensors for engineering applications.

# 19BEX02 Problem Solving and Programming Skills

### **Course Outcomes**

- 1. Explain and illustrate aspects of the problem solving using algorithm, flowchart
- 2. Demonstrate conditional and iterative statements to write programs
- 3. Understand and apply the concepts of arrays and user defined functions
- 4. Describe and apply the concepts of pointers and structures
- 5. Understand and apply the file manipulation functions to handle data files
- 6. Solve problems of varying complexity by developing programs in C

### 19BEX03 Problem Solving and Programming Skills Lab

- 1. Implement, execute the programs in C language for solving a problem
- 2. Exercise conditional and iterative statements to Write C programs
- 3. Implement programs to develop applications using functions
- 4. Apply Arrays and structures to solve real world problems
- 5. Make use of pointers to design applications with efficient use of memory
- 6. Solve problems using files concept

# 19HSX02 Communicative English Lab

## **Course Outcomes**

- 1. Make use of the acquired knowledge of English sound system
- 2. Improve articulation of sounds using the patterns of accent, rhythm and intonation
- 3. Develop the skills of communication in formal and informal situations
- 4. Choose and play different roles and practice interpersonal communication
- 5. Organize ideas in a structured manner in public speaking activities
- 6. Demonstrate the necessary verbal and non-verbal communication in technical presentations

### **19BEX04 Engineering Drawing**

### **Course Outcomes**

- 1. Understand Principles of engineering drawing
- 2. Construct Conic sections using general methods and other methods
- 3. Construct Orthographic projections of Points, Lines and Planes
- 4. Construct Orthographic projections of Solids using basic drafting software
- 5. Construct Isometric projections using basic drafting software
- 6. Construct Orthographic projections from given isometric projections of an object and vice versa

### **19BEX05 Engineering Workshop**

### **Course Outcomes**

- 1. Make use of basic hand tools of carpentry, fitting, tin smithy and house wiring
- 2. Develop simple wooden components cross lap, T-Lap, Dovetail and Mortise and Tennon joints
- 3. Develop simple house hold items Square Box without lid ,Taper Tray, Open Scoop and Funnel
- 4. Develop Square, V, Half Round and Dovetail Fits using mild steel
- 5. Understand simple house wiring circuits
- 6. Create a model using the basic principles of all workshop trades

### **19PYX02 Engineering Physics Lab**

### **Course Outcomes**

- 1. Infer the knowledge from the scientific methods and learn the process of measuring different physical parameters
- 2. Develop the laboratory skills in handling of electrical and Optical instruments
- 3. Demonstrate the interference and diffraction phenomena of light
- 4. Inspect and experience physical principles of Magnetic fields and optical fiber communications
- 5. Apply the principles of physics and measure the solid state properties of materials
- 6. Design and analyze experiment based on physics concepts

# **Course Outcomes**

# 19CYX02 Engineering Chemistry Lab

1. Utilize different Analytical tools and execute experiments involving estimation of raw materials, finished products and environmental samples etc.

- 2. Utilize modern instruments like ion analyzer, UV Vis spectrophotometer for characterization of materials used in industry & environment
- 3. Determine the amount of fluoride present in water for its quality in drinking purpose
- 4. Estimate the acid number of oil and assess its suitability as a lubricant.
- 5. Prepare a cross-linked & thermosetting polymer Bakelite
- 6. Identify the adulteration of food items such as milk, honey, tea, coffee

### **Course Outcomes**

# **19MAX02 Engineering Mathematics II**

- 1. Solve problems related to engineering applications using integral transform techniques
- 2. Make use of Laplace transforms in solving the differential equations with the initial and boundary conditions
- 3. Utilize basic knowledge of conservative field, potential function and work done and also identify the relationships between line, surface and volume integrals in engineering problems
- 4. Find the Fourier series of periodic functions and expand a function in sine and cosine series
- 5. Solve problems related to basic linear and non-linear partial differential equations
- 6. Formulate and solve some of the physical problems of engineering using partial differential equations

#### **Course Outcomes**

#### **19HSX04 Communicative German**

- 1. Demonstrate an awareness of the relevance of foreign languages and understanding of the foreign culture
- 2. Show a basic level of proficiency necessary in an environment where German is used professions and careers exclusively
- 3. Make use of German language in description, narration, asking/answering questions and short statements for the variety of topics and situations
- 4. Build familiar vocabulary, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs
- 5. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations
- 6. Write sentences and short paragraphs in German language

### **19HSX05 Communicative French**

#### **Course Outcomes**

- 1. Demonstrate an awareness of the relevance of foreign languages and understanding of the foreign culture
- 2. Show a basic level of proficiency necessary in an environment where French is used professions and careers exclusively
- 3. Make use of French language in description, narration, asking/answering questions and short statements for the variety of topics and situations
- 4. Build familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs
- 5. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations
- 6. Write sentences and short paragraphs in French language

### **19HSX09** Communicative Hindi

- 1. Build confidence to speak Hindi language and demonstrate an awareness and relevance of Hindi language
- 2. Show a basic level of proficiency in speaking in meaningful conversations in careers

- 3. Make use of good vocabulary in description, narration, asking/answering questions and short statements for the variety of topics and situations
- 4. Practice familiar, everyday expressions and sentence structures, which relate to the satisfying of concrete needs
- 5. Comprehend the language and grasp the main idea and some supporting details in short conversations.
- 6. Write simple sentences and short paragraphs in Hindi language

# **Civil Engineering**

## 16MA303 Engineering mathematics III

- 1. Utilize numerical techniques to find approximate solutions of non-linear Algebraic equations
- 2. Understand the concepts of interpolation, extrapolation to estimate the unknown functional values
- 3. Make use of method of least squares to fit a best curve for the given data
- 4. Find approximate values of derivatives and finite integrals using numerical techniques
- 5. Understand basic probability axioms and apply Baye's theorem related to engineering problems
- 6. Identify the suitable distribution among Binomial, Poisson, normal to compute probabilities

### 16CE302 Surveying

- 1. Explain the difference between planar and geodetic surveying
- 2. Infer various tools and methodologies in obtaining desirable results
- 3. Plan and organize a survey with least possible probable errors
- 4. Measure levels and draw contours
- 5. Assess areas of irregular boundaries, volumes of borrow pits, embankments and capacity of reservoirs
- 6. Make use of equipment viz., Compass, Level, Theodolite, Tachometer and Total station that are used in the construction industry
- 7.

# 16CE303 Strength of materials I

- 1. Contrast between normal, shear stresses and various elastic constants
- 2. Examine the variation of bending moment and shear force at every cross section of a beam under all practical loading cases
- 3. Examine the variation of flexural /shear stresses for various cross sections of a beam along its depth, under all practical loading cases
- 4. Select the diameter of the shaft subjected to pure torque
- 5. Analyze the perfect frames for their internal forces
- 6. Decide suitable method for calculating deflections in simply supported and cantilever beams

### 16CE304 Building materials and construction

- 1. Explain the sources, properties and applications of common building materials
- 2. Demonstrate how materials are manufactured and assembled into building component parts

- 3. Explain materials like lime, cement, wood, geo-synthetics, bricks and stone masonry in building construction and also their importance
- 4. Outline structural components, including foundations, slabs-on-grade, frames and elevated slabs
- 5. Illustrate various building components and finishing's in building construction
- 6. Illustrate the basic functions, options, and differences between building systems

16CE305 Fluid mechanics

- 1. Explain the importance of fluid properties and their influence on fluid motion
- 2. Apply the principles of total pressure, center of pressure and buoyancy in the design of different components in hydraulic structures
- 3. Utilize the principles of fluid kinematics and dynamics in different fluid flow problems
- 4. Explain the concepts of laminar flow, turbulent flow and boundary layer theory
- 5. Solve various problems related to fluid flow through pipes
- 6. Make use of fundamental principles of fluid motion in the measurement of flow

7.

# 16CE306 Building planning and drawing

- 1. Explain various building bye-Laws laid by town planning authorities and local regulatory bodies
- 2. Apply techniques for effective project planning and management
- 3. Plan the different types of residential buildings based on the minimum requirements
- 4. Plan various public buildings like educational, office buildings and hospital buildings
- 5. Outline the detailing of components of building
- 6. Develop the building drawing as per standards

# 16CE307 Survey practical

- 1. Utilize conventional and modern survey equipment to measure angles and distances
- 2. Evaluate differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork
- 3. Take part in detailing of ground profiles for accurate and thorough note taking in field work to serve as a legal record
- 4. Make use of theodolite to find heights and distances as well as conducting trigonometric surveying
- 5. Interpret the principles and operation of the Global Positioning System
- 6. Organize a team of surveyors to fix positioning and property lines in line with legal agreements during setting out works

# 16CE308 Strength of materials lab

- 1. Demonstrate the basic knowledge of the mechanical properties of materials
- 2. Estimate compressive strength of wood, concrete, brick materials and decide their suitability for the construction purpose
- 3. Evaluate the tensile strength and comment on their usage in reinforced concrete structures
- 4. Determine the impact resistance of steel used in construction works
- 5. Estimate young's modulus of wood/steel materials

6. Estimate rigidity modulus for a given spring

# 16CE309 Computer aided building drawing lab

- 1. Create, display, and plot working drawings
- 2. Construct drawings using layer techniques
- 3. Construct technical drawings using a standard computer aided drafting program
- 4. Identify proper templates suitable for residential buildings as per IS specifications / byelaws.
- 5. Demonstrate proper detailing of RCC & electrical components of residential building
- 6. Construct drawings of plan, section and elevation of residential structures

# 16HSX04 Engineering Economics and Project Management

- 1. Explain basic principles of engineering economics
- 2. Apply cost-volume-profit (CVP) analysis in their business decision making
- 3. Evaluate investment proposals through various capital budgeting methods
- 4. Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- 5. Analyze key issues of organization, management and administration
- 6. Evaluate project for accurate cost estimates and plan future activities

# 16CE402Strength of Materials II

- 1. Identify the orientation of principal planes and magnitude of principal stresses on an element under a complex loading
- 2. Make use of different failure theories to assess the stresses at the probable failure stage
- 3. Evaluate the buckling loads of columns with axial and eccentric loading
- 4. Design the diameter of the helical springs subjected to axial pull, axial couple
- 5. Select the thickness of cylinder subjected to longitudinal, hoop and radial stresses in case of thin and thick cylinders
- 6. Assess the resultant stresses in the case of chimneys, retaining walls and dams and checking their stability

# 16CE403 Engineering Geology

- 1. Acquire the knowledge of the topographical formation, interior earth, earth process and weathering.
- 2. Interpret the various types of minerals and assessment of its physical, mechanical and engineering properties.
- 3. Interpret the various types of rocks and assessment of its physical, mechanical and engineering properties.
- 4. Determine geological structures and its relevance on civil engineering projects.
- 5. Analyze the subsurface geological structures through geophysical exploration and application with relevance to civil engineering projects.
- 6. Assess the geological aspects of the site suitability with relevance to the design of civil engineering structures

# 16CE404 Soil Mechanics

- 1. Outline the significance of geotechnical engineering.
- 2. Examine and determine physical properties of soil.
- 3. Analyze the hydraulic conductivity in soils due to seepage.
- 4. Analyze the stress distribution due to different types of loading.

- 5. Determine one-dimensional consolidation characteristics of fine-grained soils under vertical load.
- 6. Determine the shear strength of soils and describe the differences between drained and untrained shear strength.

# 16CE405Hydraulics and Hydraulic Machinery

- 1. Explain the behavior of the flow in an open channels for different flow conditions
- 2. Develop empirical relationships among physical variables involved in flow phenomenon of model and prototype
- 3. Determine the hydrodynamic forces exerted by the fluid jet on flat, inclined and curved vanes
- 4. Develop velocity triangles in understanding the functioning of various turbines and pumps
- 5. Design the turbines based on different hydraulic conditions.
- 6. Evaluate the performance characteristics of turbine and pump working under different working conditions

# 16CE406 Transportation Engineering

- 1. Build the knowledge on road network in India and highway alignment
- 2. Design various road Geometric elements based on the geographic conditions
- 3. Identify traffic characteristics and build knowledge on design of Intersections
- 4. Build the knowledge on basics of railway engineering and airport engineering
- 5. Design various Railway track Geometric elements
- 6. Plan runway orientation and length

# 16CE407 Soil Mechanics Lab

- 1. Organize specific field investigations including collection of soil samples for testing and observation of soil behavior/ Building damage
- 2. Identify and classify soil based on standard geotechnical Engineering practice
- 3. Determine physical and engineering properties of soil samples by performing laboratory tests
- 4. Develop and implement laboratory procedures to test Geotechnical engineering concept(s)
- 5. Analyze the behavior of soil sample under different test conditions simulating field conditions
- 6. Compare the design parameters with those that comply with statutory regulations

# 16CE408Fluid Mechanics and Hydraulic Machines Lab

- 1. Demonstrate the calibration of different flow meters
- 2. Estimate the coefficient of discharge for different flow conditions
- 3. Estimate the energy equation to pipe flow problems
- 4. Apply Bernoulli's equation and Momentum equation for real fluid flowproblems
- 5. Select the required flow rate, pressure rise and the proper pump to optimize pumping efficiency
- 6. Analyze a variety of practical fluid flow devices and utilize fluid mechanics principles in design

16CE409	Transportation	<b>Engineering Lab</b>
	-	0 0

- 1. Build knowledge on quality behavior of road aggregates
- 2. Develop Knowledge on types of bitumen and their quality behavior
- 3. Utilize aggregate and bitumen properties in pavement design
- 4. Examine the traffic characteristics
- 5. Inspect traffic capacity and safety
- 6. Utilize traffic characteristics in pavement design

# 16CE501 Concrete Technology

- 1. Demonstrate a comprehensive Overview and understanding of hydration mechanism in concrete
- 2. Distinguish on different types of Cements & concrete
- 3. Classification of the properties of cement, sand, coarse aggregate water & admixtures
- 4. Interpret & understand the main operations of concreting i.e. selection of materials its mix Proportioning, mixing, placing, compaction, curing & finishing
- 5. Develop the skill of testing, supervision of concrete work & interpretation of tests results
- 6. Perceiving & broadening the knowledge of new concrete types and their design methods, testing and applications

# 16CE502 Structural Analysis I

- 1. Analyze cables subjected to uniformly distributed load and concentrated loads
- 2. Analyze the reactions at every cross section in propped cantilevers and fixed beams for all practical loadings
- 3. Analyze the reactions at every cross section in a continuous beam for all practical loadings
- 4. Compute the deflections in a simply supported beams, and pin jointed trusses using Castigliano's theorem-I
- 5. Determine the Static and Kinematic indeterminacy in continuous beams and trusses
- 6. Model the determinate beams for practical moving load combinations to obtain design forces

# 16CE503 Foundation Engineering

- 1. Define geotechnical engineering and the process of exploration for different type of geotechnical engineering projects
- 2. Know the importance of soil properties and design requirements
- 3. Define the forces and activities that provoke slope failures and estimate the stability of slopes with simple geometry and geological features
- 4. Explain and determine lateral earth pressures using Rankine's and Coulomb's methods
- 5. Illustrate the types of retaining walls and modes of failure
- 6. Find out the safe bearing capacity of soils

# 16CE504Design of Steel Structures

- 1. Apply the basic requirements of the IS design specifications
- 2. Choose the suitable I.S Rolled Steel Sections for design
- 3. Apply the concepts of strain compatibility and equilibrium concepts to determine the strength of members made of steel
- 4. Design of Bolted & Welded connections between the steel members
- 5. Design of Steel Members subjected to Tension, Compression Flexure and combination of same
- 6. Design of Gantry Girders and Plate Girders subjected to Loadings

# 16CE505 Water Resources Engineering

- 1. Identify the components of hydrological cycle
- 2. Estimate average rainfall, direct run off from total rain fall, groundwater flow and flood dischargein the catchment area
- 3. Develop Hydrograph for a given catchment
- 4. Examine the aquifer properties and assess the yield of the aquifer
- 5. Estimate duty and delta, depth and frequency of irrigation to improve the irrigation efficiency
- 6. Design of irrigation canals suitable for different type of soils

# 16CE001 Construction Technology

- 1. Outline the knowledge of construction of substructures and superstructures
- 2. Analyze the techniques of Erection of Construction units
- 3. Demonstrate basic knowledge about Construction equipment and machinery
- 4. Discuss about hauling and conveying equipment
- 5. Demonstrate the ability to identify and manage with respect to time and their motion with respect to their movements
- 6. Agree the importance of mechanization of construction

## **Elements of Rock Mechanics**

- 1. Summarize the different properties of rocks
- 2. Estimate the different types of strengths of rock materials
- 3. Explain the different aspects of wave propagation in rock bodies
- 4. Discuss the Stress- Strain relationships in rocks and deformability of rocks
- 5. Demonstrate the importance of grouting from rock mechanics point of view
- 6. Apply the principles of rock mechanics to solve engineering problems

# 16CE003 Pavem

**16CE002** 

## Pavement Engineering

- 1. Assess types of stresses in flexible and rigid pavements
- 2. Design flexible Pavement for high and low volume roads
- 3. Design Rigid Pavement for high and low volume roads
- 4. Build knowledge on construction methods of pavements
- 5. Decide types of highway drainage systems
- 6. Interpret types of failures in flexible and rigid pavements

# 16CE507 Survey Camp

- 1. Justify methods and equipment to suit purpose of survey
- 2. Take part in preparing site maps of the objects in the area under consideration with contours.
- 3. Organize a team of surveyors to fix positioning and property lines in line with legal agreements during setting out works
- 4. Measure the horizontal angles and vertical angles (Base Line measurement) for Triangulation work
- 5. Determine the area by triangulation using theodolite
- 6. Measure and draw the Longitudinal sectioning and cross sectioning of a topography

# 16CE601Structural Analysis II

- 1. Analyze three /two hinged arches and obtain internal forces at any cross section
- 2. Evaluate design forces in arches subjected to concentrated, distributed and varying loads

- 3. Evaluate the forces in indeterminate frames subjected to lateral loads by using approximate methods of analysis
- 4. Analyze statically indeterminate beams and frames using classical methods
- 5. Evaluate the suitability of classical methods for a given structure and loading
- 6. Evaluate statically determinate beams using matrix methods

# 16CE602Design of RC Structures

- 1. Design a singly reinforced concrete beam of rectangular cross section by using Working Stress Design philosophy
- 2. Design a singly, doubly reinforced beams of rectangular, T and L cross sections using Limit State Design philosophy of IS: 456-2000 codal provisions
- 3. Apply IS: 456-2000, codal requirements of limit state philosophy related to shear bond, torsion.
- 4. Design long and short rectangular and circular columns subjected to axial load, uniaxial and biaxial moments as per IS: 456-2000
- 5. Design the isolated square, rectangular, circular footing subjected to axial load, axial load and moment as per IS: 456-2000
- 6. Design one way and two way slabs as per IS: 456-2000 and checking the serviceability conditions

# 16CE603 Environmental Engineering

- 1. List the factors affecting water supply and wastewater
- 2. Explain the various types of water and wastewater characteristics
- 3. Adapt a water treatment facility within a water supply system
- 4. Demonstrate the common physical, chemical and biological unit operations encountered in treatment processes
- 5. Identify various treatment techniques for water, wastewater and recycled water
- 6. Analyze available disposal options and their practical implications

### 16CE604 Water Resources Engineering II

- 1. Discuss component parts of diversion head works and its design
- 2. Explain about types of dams and factors affecting selection of dams
- 3. Analyze the causes of failures of the dams and its design
- 4. Explain about types of falls and spillways and its design principles
- 5. Explain about the types of canal regulators, cross drainage works and their applications
- 6. Develop the design principles of canal regulators and cross drainage works

## 16CE004Ground Water Hydrology

- 1. Explain the geological occurrence and movement of ground water in the earth's subsurface
- 2. Apply the principles of fluid mechanics to understand well behavior in different conditions
- 3. Apply suitable surface and subsurface investigation techniques for the exploration of ground water
- 4. Demonstrate the concepts of artificial recharge and quality analysis of ground water
- 5. Apply the different principles to calculate the interface between saline water and fresh water in coastal aquifers

6. Recommend the various mathematical modeling techniques for effective management of ground water resources and for contaminant transport modeling

## 16CE005

## **Ground Improvement Techniques**

- 1. Interpret the concepts behind a range of ground improvement and soil remediation techniques
- 2. Find out the advantages, disadvantages, limitations for each ground improvement method discussed
- 3. Choose appropriate techniques for a range of ground and site conditions
- 4. Identify criteria to determine the applicability of each ground improvement method for a specific project and soil condition under consideration
- 5. Design a reinforced earth wall
- 6. Classify different geosynthetics and understand their field applications

# 16CE006 Traffic Engineering and Safety

- 1. Identify traffic stream characteristics and studies
- 2. Build knowledge on traffic capacity and level of service
- 3. Discover parking problems and manage traffic regulations
- 4. Design traffic signal cycle and Rotary Island capacity
- 5. Build knowledge on measures for Road safety
- 6. Discover traffic-environment problems

# 16CE007 Disaster Management (CE)

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and prepreparedness tools for natural and manmade disasters
- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

# 16CE607

# Environmental Engineering Lab

- 1. Demonstrate how to perform relevant tests in the laboratory to determine the major characteristics of water and wastewater
- 2. Make use of various equipment/methods available for examining water and wastewater
- 3. Identify the practical significance of the characteristics, the relevant codes of practice for examination and permissible limits for the characteristics of water and wastewater
- 4. Assess the pollutant concentration in water and wastewater
- 5. Choose various treatment techniques for water, wastewater and recycled water
- 6. Recommend the degree of treatment required for the water and wastewater

# 16CE701

# **Geospatial Techniques**

- 1. Demonstrate the basic concepts of spatial data acquisition techniques
- 2. Utilize different visual interpretation and digital image processing techniques to extract meaningful information from spatial data
- 3. Explain the geographic information system and its related concepts like database management and metadata

- 4. Illustrate the spatial data model and different file formats of spatial data
- 5. Analyze the geospatial data for different applications
- 6. Apply different analysis techniques on a varied range of applications in civil engineering

# 16CE008 EARTHQUAKE RESISTANT DESIGN

- 1. Analyze the free and forced vibration response of single-degree and multi-degree of freedom and continuous systems
- 2. Develop an understanding of structural dynamics of simple systems subject to harmonic, impulse and/or arbitrary loading
- 3. Distinguish between earthquake magnitude and earthquake damage (intensity)
- 4. Illustrate the measurement of earthquakes and their effect on engineering structures
- 5. Apply the Basic Principles of Conceptual Design for Earthquake resistant Buildings
- 6. Explain the concepts and implementation of IS codes in relation to earthquake design

# 16CE009 ENVIRONMENTAL POLLUTION AND SOLID WASTE MANAGEMENT

- 1. Explain air pollution and various types of sources and classification of air pollutants
- 2. Find effects of gaseous and particulate air pollutants on humans, plants and materials; Principles of air pollution control and various control equipment's at source
- 3. Identify the sources of noise pollution and their adverse impacts, methodologies to control noise pollution and their limits
- 4. Outline sources, types and composition of solid waste and its implications of the production
- 5. Appraise the current practices available and methods of handling, sampling and disposal of solid waste
- 6. Identify the importance of environmental impact assessment and its statement

# 16CE011 REPAIR AND REHABILITATION OF STRUCTURES

- 1. Identify the probable reasons for the deterioration of various structural members
- 2. Able to assess the severity of damage in the structural members
- 3. Choose materials and appropriate technologies for repair
- 4. Identify the appropriate method for strengthening of existing members
- 5. Plan for the monitoring of the new buildings by using Sensor technology
- 6. Planning & Preparing report for forensic assessment of deteriorated concrete structures

# 16CE012 WATER RESOURCES SYSTEMS PLANNING AND MANAGEMENT

- 1. Apply optimization methods to solve problems related to water resource systems
- 2. Apply basic economic analysis to evaluate the economic feasibility of water resources projects
- 3. Formulate optimization models for decision making in water resources systems
- 4. Explain Linear Programming and Dynamic Programming techniques
- 5. Apply simulation models for planning and design of Water Resources Systems
- 6. Make use of various concepts of water resources economics for effective management

### 16CE012 BRIDGE ENGINEERING

1. Demonstrate different types of Bridges with diagrams

- 2. Demonstrate different IRC Loading standards
- 3. Develop procedures for inspections and maintenance of bridges
- 4. Analyze and design Slab and T Beam bridge
- 5. Analyze and design Box culvers with structural detailing
- 6. Analyze and design alternate material bridges

## 16CE013 PRESTRESSED CONCRETE

- 1. Explain the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing
- 2. Evaluate the short-term and long-term losses in prestressing and design prestressed structures considering these losses
- 3. Analyse the stresses in a prestressed concrete member
- 4. Analyse the flexural behaviour and effect of shear in prestressed concrete member
- 5. Design the prestressed concrete members for flexure and shear
- 6. Calculate the short term and long term deflection in prestressed members

## 16CE014 WATERSHED MANAGEMENT

- 1. Analyze the characteristics of watershed
- 2. Summarize the various types of Erosion and Sedimentation process
- 3. Choose the underlying principles or measures to control Erosion
- 4. Analyze the various Water Harvesting methods
- 5. Evaluate Ecosystem Management and its practical implications
- 6. Assess the current status of the watershed at field, by taking up accurate investigation measures and conduct survey

## 16CE015 URBAN TRANSPORTATION PLANNING

- 1. Interpret urban transportation issues and learn the solution generation
- 2. Develop Knowledge on Origin and Destination Surveys and Analysis of surveydata
- 3. Build knowledge data inventory for efficient transportation planning
- 4. Build knowledge on requirement of four stages of transportation planning
- 5. Model the land utilization for urban transport planning
- 6. Interpret the Traffic and Transportation Problems in Indian towns/cities

# 16CE704 Structural Modeling and Design Lab

- 1. Define the various loads acting on the structures
- 2. Model the structures for Load combinations
- 3. Analyze the structures for various load combinations
- 4. Compare the Results given by software with Manual Calculations
- 5. Design the structural members for governing loading case
- 6. Examine the design results obtained from software with relevant IS codeprovisions

# 16CE705 GIS Lab

- 1. Summarize the working environment of ArcGIS
- 2. Make use of different steps to do Georeferencing, Projection and Digitization of Map/Toposheet
- 3. Create Digital Elevation Model and delineate watershed
- 4. Create thematic map and estimation of its features
- 5. Apply different analysis techniques involving with geospatial data to solve various problems
- 6. Apply the spatial analysis technique to solve road network problems

## 16CE801 Construction Costing and Management

- 1. Identify, analyze and solve the complex problems that deal with estimation of buildings and pavements
- 2. Estimate cost of Civil Engineering projects
- 3. Estimate the detailed and abstract quantities of items for construction
- 4. Identify relationship between cost and quality of the construction process
- 5. Develop and administer construction contracts
- 6. Estimate the value of existing infrastructure
- 7.

## 16CE802 Professional Ethics in Civil Engineering

- 1. Explain the importance of ethics and qualities of etiquette
- 2. Explain how to communication at workplace, response to co-employee
- 3. Outline the structure of safety & Risk management
- 4. Illustrate various aspects of Organizational Communication
- 5. Illustrate the basic of minutes of meeting, protocol, agenda and chairing a meeting
- 6. Outline the social responsibilities in corporate societies

## 16CE016 ADVANCED REINFORCED CONCRETE DESIGN

- 1. Design & Detail the reinforcement in cantilever and counterfort retaining walls
- 2. Design & Detail Flat slab as per the recommendations of code IS: 456:2000
- 3. Design & Detail stair case as per the recommendations of code IS: 456:2000.
- 4. Design & Detail the combined and pile footings as per the recommendations of IS: 456:2000
- 5. Design cross section of concrete and reinforcement in circular and rectangular underground and overhead water tanks.
- 6. Apply the principles, procedures and current Indian code requirements to the analysis and design

### 16CE017 DESIGN AND DRAWING OF IRRIGATION STRUCTURES

- 1. Analyze the data given related to design of irrigation structures
- 2. Design the Components of Irrigation Structures
- 3. Create the Drawings of various Irrigation Structures
- 4. Outline the Importance of Irrigation Structures
- 5. Determining the effect of water pressure in designing the Bed Protective works
- 6. Assess the effect of Soil Erosion on the Irrigation structures

### **16CE018 PAVEMENT MANAGEMENT SYSTEMS**

- 1. Extend Knowledge on fundamental issues in pavement management system
- 2. Illustrate structural and functional evaluation of pavements
- 3. Distinguish distress and surveys done on the pavement
- 4. Dissect design strategies and economic evaluation
- 5. Make use of expert systems in pavement management systems
- 6. Build knowledge on project appraisal and its elements

# 16CE019 SOIL DYNAMICS

- 1. Identify scope and significance of soil dynamics
- 2. Explain the basic dynamic properties of soils
- 3. Summarize the dynamics of Continuous system (Wave Propagation)
- 4. Analyze the dynamic Response Analysis
- 5. Demonostrate liquefaction of soils and related phenomena
- 6. Explain the basic theory of vibrations

## 16CE020 PROJECT MANAGEMENT

- 1. Develop a project schedule using PERT/CPM.
- 2. Differentiate between different types of time-cost tradeoffs.
- 3. Construct a resource usage profile for any schedule in a project.
- 4. See the importance of team building and leadership in project management.
- 5. Conduct the financial evaluation of production related decisions in terms of NPV, IRR, and payback and debt service coverage ratio.
- 6. Develop familiarity with Aggregate Production Planning and the various solution procedures likelinear programming, transportation and the shortest path on a network.

## 16CE021 GREEN BUILDINGS

- 1. Apply the knowledge in development of green field infrastructure in relation to sustainable environment
- 2. Learn about Green Building specifications and various ecofriendly materials
- 3. Choose and size building components, as well as energy and environmental systems suitable for different categories of buildings to achieve the smallest feasible life-time environmental impact
- 4. Utilize a variety of tools and methodologies suitable for evaluating the resource consumption and overall environmental performance of buildings in different stages of their life cycles
- 5. Summarize importance of solar energy in green buildings.
- 6. Demonstrate the passive energy system and components of building fabrics and materials

# lectrical & Electronics Engineering

### 16MA303 Engineering Mathematics III

- 1. Utilize numerical techniques to find approximate solutions of non-linear Algebraic equations
- 2. Outline the concepts of interpolation, extrapolation to estimate the unknown functional values
- 3. Make use of method of least squares to fit a best curve for the given data
- 4. Find approximate values of derivatives and finite integrals using numerical techniques
- 5. Comprehend basic probability axioms and apply Baye's theorem related to engineering problems
- 6. Identify the suitable distribution among Binomial, Poisson, normal to compute probabilities

#### 16EE302 Circuit

#### **Course Outcomes**

- 1. Outline the time / frequency domain response of RLC circuit
- 2. Solve the three phase balanced and unbalanced circuits
- 3. Apply various network theorems for simplifying both AC and DC circuits
- 4. Illustrate transient response of a series RL/RC/RLC circuits for DC and AC excitations
- 5. Find various network parameters for a given two port network
- 6. Recall the properties of driving point and transfer functions

#### **16EE303 DC Machines**

**Course Outcomes** 

- 1. Illustrate the constructional details and principle of operation of DC Machine
- 2. Summarize armature reaction and commutation in DC machines
- 3. Demonstrate the performance characteristics of various DC generators
- 4. Demonstrate the performance characteristics of various DC motors
- 5. Outline various speed control methods of DC motors
- 6. Summarize testing methods of DC machines

#### **16EE304 Electromagnetic Field Theory**

#### **Course Outcomes**

- 1. Recall the concepts of vector calculus and coordinate systems
- 2. Summarize the laws of static electric fields
- 3. Solve the field quantities in static electric field
- 4. Illustrate the laws of steady magnetic field
- 5. Solve the field quantities in steady magnetic field
- 6. Summarize the Maxwell's equations in static and time varying fields

### **16EC302 Digital Electronics**

#### **Course Outcomes**

- 1. Illustrate the conversion of a number from one number system to another
- 2. Identify Boolean algebra and K-map as a tool to simplify and design logic circuits
- 3. Implement combinational circuits using gates
- 4. Design PLDs and Flip-flops
- 5. Implement various types of counters and shift registers
- 6. Attribute innovative designs by modifying the traditional design techniques

### **16EC303 Electronic Devices & Circuits**

- 1. Recall the properties of semiconductor materials in the formation of PN diode and Zener diode
- 2. Classify the V-I characteristics of CB & CE configurations
- 3. Design various biasing circuits to achieve the required stability in transistor amplifiers
- 4. Illustrate the operation of FETs and special diodes for different applications
- 5. Design half wave, full wave rectifiers with and without filters for different applications
- 6. Design regulated power supply using Zener diode and transistors

### **16EC307 Digital Electronics lab**

#### **Course Outcomes**

- 1. Implement the Universal gates using logic gates
- 2. Implement the logic circuits using Universal gates
- 3. Design and analyze combinational logic circuit
- 4. Design flip-flop using gates and ICs
- 5. Design and analyze synchronous and asynchronous counter
- 6. Implement shift registers using flip-flops and design an application using registers and counters

#### **16EC308 Electronic Devices and Circuits Lab**

Course Outcomes

- 1. Demonstrate various electronic components and test equipment like multimeter, function generator, and CRO in order to measure passive components and observe the waveforms
- 2. Predict the V-I characteristics of PN junction and Zener diodes
- 3. Compare the operation of BJT and FET through their V-I characteristics
- 4. Compare half wave and full wave rectifiers with and without filters
- 5. Implement D.C. Regulated power supplies circuits using Zener and BJT
- 6. Design and verify the self-biasing CE configuration circuit

#### 16EE309 Electrical Engineering Lab

**Course Outcomes** 

- 1. Demonstrate the fundamentals of various electrical gadgets, their working and troubleshooting
- 2. Construct residential wiring and various types of wiring schemes
- 3. Classify different types of fuses and MCBs
- 4. Find various electrical quantities
- 5. Demonstrate various types of earthing
- 6. Apply various network reduction methods for simplifying both AC and DC circuits

### **16EEI01** Automotive Electrical and Electronics

**Course Outcomes** 

- 1. Classify types of batteries
- 2. Demonstrate various battery charging techniques
- 3. Develop battery charging techniques to various types of batteries
- 4. Illustrate voltage and current regulation schemes
- 5. Outline various types of cut-out relays
- 6. Outline various types of regulators

### **16EC503 Linear IC Applications**

Course Outcomes

- 1. Describe various stages of operational amplifier
- 2. Explain the characteristics of op-amps and its compensation techniques
- 3. Implement linear and non-linear applications of op-amp using IC741
- 4. Design Active filters, PLL and timers
- 5. Construct different types of voltage regulators and multipliers
- 6. Analyze different ADCs and DACs

#### **16EE402 Control Systems**

- 1. Develop mathematical models of control systems in continuous time
- 2. Outline the system using block diagram and signal flow graph techniques
- 3. Analyze the transient and steady state performances of a control system
- 4. Contrast the stability of a system using time domain and frequency domain techniques
- 5. Develop different compensators and controllers in time/frequency domain
- 6. Illustrate state space modelling and compute the controllability and observability for the given system

## 16EE403 Network Analysis & Synthesis

### **Course Outcomes**

- 1. Interpret state variable models for various electrical circuits
- 2. Develop the solution of state equation for the given state model
- 3. Illustrate the response of various electrical networks using Laplace transform
- 4. Assess the response for different electrical networks using Fourier transform
- 5. Outline Hurwitz polynomial and Positive real functions to realize the network
- 6. Develop the networks by using synthesis methods for the given transfer function

### **16EE404 Transformers & Induction Machines**

**Course Outcomes** 

- 1. Illustrate the operation of transformer and analyze its performance
- 2. Outline parallel operation of transformer to improve the load sharing capabilities and reliability
- 3. Interpret the usage of three phase transformer in electrical applications
- 4. Illustrate the operation of three phase induction motor and analyze its performance
- 5. Apply different speed control methods of three phase induction motors essential for industrial drives
- 6. List the application of single phase machines for different industrial needs

### **16EE405** Power Plant Engineering & Economics

**Course Outcomes** 

- 1. Illustrate the concepts of power generation from thermal energy
- 2. Outline the concepts of power generation from diesel and gas plant
- 3. Illustrate the concepts of power generation from nuclear energy
- 4. Make use of renewable energy sources for electrical power generation
- 5. Summarize economic aspects of power generation
- 6. Classify tariff methods

### **16EE406 Electrical Measurements & Instrumentation**

Course Outcomes

- 1. Outline the basic working principles of MC&MI instruments
- 2. Identify a suitable instrument transformer for the measurement of high voltage and current
- 3. Illustrate the usage of wattmeter and energy meter in electrical field of application
- 4. Find unknown electrical parameters using appropriate methods
- 5. Demonstrate the suitable method of measuring non-electrical parameters in various applications
- 6. Select the proper digital instruments to measure electrical quantities

# **16EC607** Linear IC Applications lab

- 1. Design op-Amp circuits for various applications
- 2. Demonstrate the practical usage of various linear ICs
- 3. Design and implement the pulse generator using 555 timer
- 4. Design and construct the various filters like LPF, HPF, BPF, BRF
- 5. Design a function generator
- 6. Design a converter which converts analog signal to Digital signal and vice versa

#### 16EE408 Electrical Measurements & Instrumentation Lab

**Course Outcomes** 

- 1. Apply suitable method for measuring R, L and C parameters in an electric network
- 2. Make use of calibration system for various metering equipment
- 3. Test for dielectric strength of various fluids
- 4. Measure various non-electrical parameters using transducers
- 5. Interpret the characteristics of various sensors
- 6. Measure various non-electrical parameters using sensors

#### **16EE409 DC Machines Lab**

**Course Outcomes** 

- 1. Identify the practical methods to evaluate the performance of DC shunt machines.
- 2. Apply various methods to find the efficiency of DC series machines.
- 3. Find the efficiency of DC compound machine at different loads.
- 4. Analyze various losses of DC machine by performing indirect tests.
- 5. Find stray losses of a dc shunt machines using two similar machines
- 6. Apply speed control techniques of DC motors to industrial applications.

#### **16EEI02 Solid State Lighting**

**Course Outcomes** 

- 1. Classify basics of Light Source
- 2. Demonstrate various concepts of LED Luminaire & their characteristics
- 3. Apply appropriate design for LED luminaire
- 4. Illustrate & select appropriate driver for LED
- 5. Interpret thermal characteristics of LED luminaire
- 6. Outline mechanical design aspects of LED luminaire

#### 16CS307 Object Oriented Programming

**Course Outcomes** 

- 1. Implement object oriented concepts to real world problems
- 2. Plan applications using different types of inheritances
- 3. Produce and use user defined packages
- 4. Attribute and recover runtime exceptions arise in the applications
- 5. Execute parallel processing applications using threads
- 6. Generate internet based interactive applications using peripheral functions

#### **16EE502** Power Electronics

- 1. Summarize the operation of various power semiconductor devices.
- 2. Outline the control and protection methods for power semiconductor devices.
- 3. Analyze the performance of phase controlled rectifiers for various loads.
- 4. Demonstrate the operation of AC-AC converters.
- 5. Analyze the performance of DC-DC converters.
- 6. Outline the performance of inverters.

## **16EE503** Power Transmission and Distribution

**Course Outcomes** 

- 1. Illustrate the working of cables and insulators.
- 2. Analyze the parameters of overhead line conductors for various configurations.
- 3. Outline the performance of short, medium and long transmission lines.
- 4. Develop mechanical design parameters for transmission lines.
- 5. Analyze power system transients.
- 6. Summarize the operation of various distribution systems.

#### **16EE504 Signals and Systems Theory**

**Course Outcomes** 

- 1. Classify the signals and perform the basic operations
- 2. Analyze linear time invariant systems
- 3. Make use of various transform techniques for analyzing signals and systems
- 4. Find correlation, auto-correlation and power spectral density for signals
- 5. Identify the characteristics of noise signals
- 6. Summarize the concepts of Weiner and Kalman filters

#### **16EE505 Synchronous & Special Machines**

#### **Course Outcomes**

- 1. Demonstrate the construction & working of synchronous machine
- 2. Apply various regulation methods to analyze the performance of synchronous machine
- 3. Illustrate synchronization of a synchronous machine connected to an infinite bus
- 4. Make use of starting methods of synchronous motors
- 5. Analyze the performance of synchronous motor for various operating modes
- 6. Outline the operating principles of various special electrical machine

### **16EE001 Electrical Machine Design**

**Course Outcomes** 

- 1. Classify the electrical materials as per IS standards
- 2. Outline the basic design concepts of DC machines and transformers based on magnetic, thermal and electric loadings
- 3. Illustrate the various cooling methods for transformers
- 4. Examine the design concepts of stator of induction machines
- 5. Examine the design concepts of rotor of induction machines
- 6. Analyse the design concepts of stator and rotor of synchronous machines

### **16EE002** Automotive Electrical Engineering

**Course Outcomes** 

- 1. Identify automotive wiring harness and circuits
- 2. Outline the working of automotive lighting systems and accessories
- 3. Compare and contrast between charging, starting & ignition system of auto motives
- 4. Interpret the working of various sensors and actuators used in automotives
- 5. Outline the principles of vehicle electronic control
- 6. Summarize vehicle security systems

#### 16EE003 Advanced Control Systems

#### **Course Outcomes**

- 1. Apply z-transforms and block-diagram reduction techniques to discrete time systems
- 2. Asses the pulse transfer function of a discrete time system
- 3. Assess controllability, observability and stability of a given system
- 4. Design state feedback controller, full order observer and reduced order observer
- 5. Analyze different types of non-linearities
- 6. Analyze non-linear systems using describing function and phase plane analysis

#### 16EE507 AC Machines Lab

Course Outcomes

- 1. Examine performance of alternators using various methods
- 2. Examine the efficiencies of single phase transformer
- 3. Inspect the parameters of single phase transformer
- 4. Examine the efficiencies of induction motors
- 5. Analyze the performance of synchronous motors
- 6. Assess direct and quadrature axes' reactance for a given synchronous machine

### 16EEI02 Air field Ground Lighting System

**Course Outcomes** 

- 1. Classify basics of Light Source
- 2. Demonstrate various concepts of Aeronautical Ground Lighting System & their characteristics
- 3. Apply appropriate design for air field ground lighting system
- 4. Illustrate & select appropriate installation procedure of various lighting schemes
- 5. Outline mechanical design aspects of air field ground lighting system
- 6. Outline various backup systems

### **16EE601 Discrete Signal Processing**

#### **Course Outcomes**

- 1. Classify Discrete time signals and systems
- 2. Relate discrete Fourier transform on time domain signals
- 3. Contrast the signals in Time and Frequency domain through its respective tools
- 4. Build the FIR and IIR digital filters with given specifications
- 5. Examine the frequency response characteristics of FIR and IIR digital filters
- 6. Apply adaptive filters for various circuits or systems

#### **16EE602 Electrcal Drives**

Course Outcomes

- 1. Summarize the speed torque characteristics of different motors and justify their applications.
- 2. Analyze speed control and braking methods of converter fed drives.
- 3. Develop speed torque characteristics of chopper dc drives under motoring & braking conditions
- 4. Summarize the performance of converter fed induction motor from stator side.
- 5. Analyze the performance of induction motor using slip power recovery scheme.
- 6. Demonstrate the operation of converter fed synchronous motor drives

#### **16EE603** Power System Analysis

**Course Outcomes** 

1. Illustrate the given power system network in per-unit representation

- 2. Build nodal admittance and impedance matrices for the power system network
- 3. Make use of load flow studies to evaluate power system networks
- 4. Construct positive, negative and zero sequence networks for a given system
- 5. Analyze power system behavior under short circuit analysis
- 6. Outline the basic concepts of steady state and transient stabilities and their improvement methods

## **16EC603 Microprocessors and Microcontrollers**

**Course Outcomes** 

- 1. Explain the concept of microprocessor and Memory organization
- 2. Implement basic assembly level programming with 8086 microprocessor
- 3. Execute interfacing concepts through programming for I/O Devices
- 4. Differentiate the peripheral interfacing chips for 8086 microprocessor
- 5. Explain the concept of microcontroller and its addressing modes
- 6. Implement assembly level programming and interfacing with 8051 microcontroller

### **16IT504 Computer Networks**

**Course Outcomes** 

- 1. Propose appropriate network model for data communication
- 2. Analyze various protocols in data link layer.
- 3. Analyze IEEE 802 series protocols.
- 4. Develop web applications for sending E-mail.
- 5. Propose and implement appropriate routing algorithm for data routing.
- 6. Extend the Internet connection to a given system and trouble shoots the same.

#### 16CS304 Database Management Systems

**Course Outcomes** 

- 1. Understand data models to design a database
- 2. Illustrate the conceptual design for large enterprises
- 3. Formulate SQL queries and integrity constraints over relations
- 4. Apply normalization on database for eliminating redundancy
- 5. Summarize transaction properties, concurrency control and recovery techniques
- 6. Understand the OODBMS concepts and design

### 16CSX15 Fundamentals of Software Engineering

#### **Course Outcomes**

- 1. Illustrate the need of Software Life Cycle Models
- 2. Demonstrate the Requirements of the Software Systems process
- 3. Summarize the system models of software engineering
- 4. Choose appropriate software architecture style for real-time software projects
- 5. Analyze Risk management and Software quality of the software products
- 6. Identify the Illustrate Find quality assurance techniques.

### 16CE007 Disaster Management (Open Elective)

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and

pre-preparedness tools for natural and manmade disasters

- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

### 16EE004 Renewable Energy Sources (Open Elective)

Course Outcomes

- 1. Summarize the principles of solar energy systems
- 2. Demonstrate the applications of solar energy system
- 3. Illustrate the working principles of wind and biomass energy systems
- 4. Interpret working principles of geothermal energy system
- 5. Summarize operation and classification of ocean , tidal, fuel cells, small hydro and magneto hydro energy system
- 6. Extend renewable energy sources to distributed generation & micro grids

### 16ME009 Principles of Entrepreneurship (Open Elective)

**Course Outcomes** 

- 1. Explain the role of entrepreneur in economic development
- Demonstrate methods of generating ideas
- 3. Develop the business plan to start their own enterprise
- 4. Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- 5. Make financial plan for enterprise
- 6. Find the institutional support entrepreneurship

#### 16EC004 Fundamentals of Global Positioning System (Open Elective)

**Course Outcomes** 

- 1. Summarize the history of GPS, NAVSTAR GPS
- 2. State the working principle of GPS, GNSSs
- 3. Outline GALILEO, GLONASS signal constellation details
- 4. Conclude about GPS segments, signal components, IRNSS specifications
- 5. Demonstrate GPS coordinate systems
- 6. Classify various datums and map projections

### 16CS006 Computational Intelligence (Open Elective)

**Course Outcomes** 

- 1. Identify and describe Soft Computing Techniques and their roles in building Intelligent Machines
- 2. Apply Supervised Learning Networks in Machine Learning Problems
- 3. Illustrate the working of Associative memory networks
- 4. Apply Unsupervised Learning Networks in Machine Learning Problems
- 5. Apply Fuzzy Logic and Reasoning to handle Uncertainty and Solve Engineering Problem
- 6. Apply Genetic Algorithms to solve Optimized Problems

### 16CS007 IoT for Engineering Applications (Open Elective)

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things.
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem
- 6. Apply IoT for various engineering applications

# 16CH007 Industrial Safety and Hazard Management (Open Elective)

### **Course Outcomes**

- 1. Demonstrate the safety and ethical issues that may arise from industrial processes
- 2. Explain industrial hygiene practices and its procedures
- 3. Illustrate the toxic pathways and elimination of toxicity on bio organisms
- 4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them.
- 5. Choose a suitable method for prevention of fires and explosions
- 6. Evaluate the process and able to do Hazards Identification and risks Risk Assessment

## 16IT005 Fundamentals of Cloud Computing (Open Elective)

### **Course Outcomes**

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions.
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
- 4. Analyze cloud provider for a defined environment and to a specific platform in a cost effective way.
- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications
- 6. Build a virtual machine with a machine image

# 16PE007 Smart Grid Technology (Open Elective)

**Course Outcomes** 

- 1. Compare the basic difference between existing grid and smart grid
- 2. Explain perfect power system network (Including distributed and fully integrated systems)
- 3. Explain the importance of renewable energy systems and distributed energy resources in smart grid
- 4. Summarize the wide area monitoring system and advanced measuring technologies
- 5. Recall the technologies like Zigbee, HAN and NAN in smart grids
- 6. Explain SCADA technology in modern power systems and to analyze the micro grid systems

### 16MA001 Computational Mathematics (Open Elective)

**Course Outcomes** 

- 1. Apply the knowledge of finding roots of nonlinear equations and different errors inseries approximations
- 2. Understand the consistency and inconsistency of linear system of equations
- 3. Evaluate the solution of Initial and Boundary value problems
- 4. Perform numerical differentiation and integration
- 5. Analyze the solution of PDEs under given conditions
- 6. Apply Knowledge of numerical techniques to Engineering problems

### 16CY001 Nano Science and Technology (Open Elective)

- 1. Apply various chemical and physical methods for the synthesis of nanomaterials
- 2. Understand the properties of nano-materials and their applications in relation to

bulk materials

- 3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
- 4. Characterize nano materials by powder XRD and microscopy techniques.
- 5. Understand structure, properties and applications of Fullerenes and Carbon nanotubes.
- 6. Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis

## **16EE607** Power Electronics Lab

Course Outcomes

- 1. Choose suitable power electronic switches based on their characteristics for given application
- 2. Evaluate the performance of various firing circuits of SCR.
- 3. Compare commutation techniques for SCR
- 4. Analyze various thyristor controlled rectifier
- 5. Make use of simulation tools for analyzing power converters
- 6. Analyze various thyristor controlled inverter

#### **16HSX04 Engineering Economics and Project Management**

**Course Outcomes** 

- 1. Explain basic principles of engineering economics
- 2. Apply cost-volume-profit (CVP) analysis in their business decision making
- 3. Evaluate investment proposals through various capital budgeting methods
- 4. Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- 5. Analyze key issues of organization, management and administration
- 6. Evaluate project for accurate cost estimates and plan future activities

#### **16EE005 Flexible AC Transmission Systems**

**Course Outcomes** 

- 1. Outline the importance and scope of FACTS controllers
- 2. Classify FACTS controllers
- 3. Analyze the performance of shunt controllers and reactive power injection
- 4. Analyze the performance of series controllers and current injection.
- 5. Analyze combined series and shunt controllers for the given power system network
- 6. Analyze the performance of UPFC and Interline Power Flow Controller

### 16EE006 High Voltage DC Transmission

**Course Outcomes** 

- 1. Compare HVDC and HVAC Transmission systems
- 2. Analyze the operation of 6 and 12 pulse converters
- 3. Illustrate various control characteristics and strategies of HVDC link
- 4. Develop power flow analysis in HVDC Transmission system
- 5. Classify the faults and identify suitable protective schemes
- 6. Analyze harmonics and select suitable filters for reduction

### **16EE007 Power System Deregulation**

- 1. Compare the regulated and deregulated electricity market systems
- 2. Illustrate the structure of deregulated system
- 3. Interpret various issues in electricity transmission
- 4. Outline various electricity trading instruments

- 5. Identify various issues in electricity pricing.
- 6. Summarize ancillary services of deregulated systems.

## **16EE008 Power System Operation and Control**

**Course Outcomes** 

- 1. Outline the concepts of economic operation of power plants
- 2. Interpret the concepts of Hydro-thermal scheduling
- 3. Illustrate the operation of speed-governing system
- 4. Inspect single area power system for change in frequency
- 5. Inspect two area power system for change in frequency and change in tie-line power
- 6. Apply various control strategies for reactive power control

### **16EC023 Communication Systems**

**Course Outcomes** 

- 1. State the basic definitions of probability and functions of communication system
- 2. Summarize the noise characteristics in communication system
- 3. Conclude continuous modulation techniques and pulse modulation schemes
- 4. Demonstrate the sampling process and pulse code modulation techniques
- 5. Classify the shift keying techniques
- 6. Outline the coding techniques for information theory

### **16EE009 Electric Locomotives, Traction & Vehicles**

**Course Outcomes** 

- 1. Distinguish different traction systems and latest trends in traction systems.
- 2. Identify and understand the working of various locomotive equipment.
- 3. Differentiate services of traction system based on speed time curves.
- 4. Analyze motor characteristics for application in electric vehicles.
- 5. Outline the architecture of hybrid electric vehicles
- 6. Compare various battery technologies for application in electric/hybrid electric vehicles.

### 16EE010 PLCs & SCADA

**Course Outcomes** 

- 1. Identify basic components of PLCs, their architecture & programming
- 2. Exemplifying different levels of File I / O& Ladder Logic diagram of PLCs
- 3. Apply PLCs for different real time applications
- 4. Contrast the interface of PLCs & SCADA for Industrial Automation.
- 5. Summarize various animations, alarming functions, data logging and event detection in SCADA
- 6. Develop real time platform for various process applications.

### 16EC505 VLSI Design

- 1. Explain the operation and characteristics of MOS transistor
- 2. Interpret various MOS transistor fabrication techniques
- 3. Implement Boolean functions in CMOS technology and realize the same in layout diagrams
- 4. Summarize the effects of parasitics and scaling
- 5. Classify various programmable ASICs

6. Interpret different levels of testing of IC

## **16EE704 Electrical Systems and Simulation Lab**

**Course Outcomes** 

- 1. Inspect time domain specifications and frequency response of a given electrical circuit.
- 2. Analyze the performance of an AC circuit during resonance conditions.
- 3. Assess the transient and steady state behavior of electrical machines.
- 4. Model power electronic systems for given specifications.
- 5. Examine load flow in a power system network.
- 6. Develop controller for AGC of a thermal power plant.

### 16PE704 Power Systems Lab

**Course Outcomes** 

- 1. Interpret various characteristics of over current and voltage relays
- 2. Interpret various characteristics of distance relays
- 3. Inspect the breakdown strength of the oil
- 4. Assess the characteristics of the fuse
- 5. Evaluate the performance of long transmission lines
- 6. Summarize compensation techniques

#### **16EE801 Ethics for Electrical Engineers**

**Course Outcomes** 

- 1. Interpret the core values and awareness on professional ethics and human values
- 2. Interpret engineering as social experimentation
- 3. Identify the responsibilities of an engineer for safety, risk benefit analysis and professional rights
- 4. Summarize the role of electrical engineers in assessing industrial safety
- 5. Outline the operational issues of Electrical Apparatus
- 6. Outline the operational issues of power grid

#### **16EE802** Power System Protection

**Course Outcomes** 

- 1. Interpret the terminology of power system protection
- 2. Demonstrate the operation of various circuit breakers
- 3. Demonstrate the operation of different types of relays
- 4. Identify suitable protection schemes for various power system equipments
- 5. Outline the operation of electrostatic and digital relays
- 6. Apply digital logic in relay communications

#### 16EE011 Artificial Intelligence Applications to Power Systems

**Course Outcomes** 

- 1. Interpret the soft computing techniques applications in power systems
- 2. Summarize different fuzzification and defuzzification techniques
- 3. Illustrate various mathematical models of artificial neural networks
- 4. Explain application of genetic algorithm in power system optimization
- 5. Develop various load forecasting techniques using ANN
- 6. Select appropriate AI technique for power system applications

### 16EE012 Design and layout of Power Systems

#### **Course Outcomes**

- 1. Summarize the power equipment used in transmission and distribution networks
- 2. Identify appropriate locations for installing power equipment
- 3. Identify the parameters and layout for designing substations based on power and service requirement.
- 4. Analyze the parameters for transmission line design
- 5. Evaluate the parameters for distribution line design
- 6. Select the layout for installing transmission and distribution lines

#### 16EE013 Electrical Installation, Design & Estimation

Course Outcomes

- 1. Summarize the concepts of estimation and costing
- 2. Select a suitable wiring system based upon the cost and application
- 3. Develop a wiring system for domestic and industrial applications
- 4. Estimate the cost of erecting an overhead line and service connections for different ratings
- 5. Estimate the cost of erecting an underground distribution line
- 6. List the various materials required with specifications for erecting a substation

#### 16EE014 Energy Audit, Conservation & Management

**Course Outcomes** 

- 1. Outline the energy demand and supply, energy crisis and future energy scenario.
- 2. Summarize energy auditing techniques
- 3. Develop cash flow models
- 4. Interpret the requirement for the efficient use of energy in electrical systems.
- 5. Outline the need for demand side management.
- 6. Identify various energy management measuring devices and tools.

### **16EE015** Power Quality

**Course Outcomes** 

- 1. Classify the power quality problems in power system
- 2. Identify power quality issues in power system
- 3. Select suitable device for power quality measurement
- 4. Interpret the harmonic distortion for various loads
- 5. Choose the devices for controlling the harmonics distortion.
- 6. Analyze power quality bench marking and monitoring

### 16EC011 Embedded Systems

- 1. Summarise embedded system life cycle and components involved in design
- 2. Explain the differences between embedded system with general purpose systems
- 3. Organize the embedded system design with respect to quality attribute for real time application
- 4. Implement an application on embedded system with the help of hardware and firmware
- 5. Resolve the issues related to implementation of real time applications
- 6. Differentiate various IDEs to implement embedded system for real time applications
#### THIRD SEMESTER

#### **19IT306 FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING Course Outcome(s)**

- 1. Implement object-oriented concepts to the problems
- 2. Implement applications using different types of inheritances
- 3. Develop user defined packages
- 4. Identify and recover runtime exceptions arise in the applications
- 5. Demonstrate parallel processing applications using threads
- 6. Design interactive applications using Hibernate and spring Framework

#### **19ME301 COMPUTER AIDED MACHINE DRAWING**

#### Course Outcome(s)

- 1. Apply the principles of engineering drawing in machine drawing using a 2D CAD software
- 2. Understand and construct the sectional views of the given isometric view of an object or machine element using a 2D CAD software
- 3. Construct computer aided fasteners namely screwed fasteners and key joints drawings using a 2D CAD software
- 4. Construct computer aided fasteners namely shaft couplings and riveted joints using a 2D CAD software
- 5. Develop assembly drawings from the given part drawing and vice versa using a 3D CAD software
- 6. Produce component drawings suitable for manufacturing using a 3D CAD software

#### **19ME302 ENGINEERING MECHANICS**

#### **Course Outcome(s)**

- 1. Compute the resultant of forces and moments using free body diagrams and able to apply the concepts of friction
- 2. Identify the centroid of composite figures and bodies
- 3. Determine the area and mass moment of inertia of composite figures and bodies
- 4. Analyze plane truss (frame) by method of joints and method of sections
- 5. Apply the fundamental concepts of Kinematics and kinetics of particles to the analysis of simple, practical problems
- 6. Understand the fundamental concepts of kinematics and kinetics of rigid body and able to apply the work- energy and impulse momentum principle to analyze the simple, practical problems

#### 19ME303 FLUID MECHANICS& HYDRAULIC MACHINES

#### Course Outcome(s)

- 1. Define the fluid properties and explain the measurement of fluid pressure
- 2. Apply the laws of conservation of mass, momentum and energy to fluid flow problems
- 3. Explain the losses and measurement of flows in pipes
- 4. Explain the procedure of dimensional analysis and boundary layer theory
- 5. Analyze the impact of jet on the vanes
- 6. Explain the performance of hydraulic turbines and pumps

#### **19ME304 MANUFACTURING TECHNOLOGY** Course Outcome(s)

- 1. Interpret proper moulds and gating system design
- 2. Choose proper melting furnace for pure metal and alloys
- 3. Identify and distinguish the process details of metal joining processes
- 4. Explain the characteristics of cold/warm/hot working processes

- 5. Understand the principles of bulk material processing methods
- 6. Outline the various rapid prototyping techniques

# **19ME305 THERMODYNAMICS**

# Course Outcome(s)

- 1. Understand the thermodynamic systems, energy interaction and laws of gas
- 2. Analyze the flow and non-flow thermodynamic processes
- 3. Apply zeroth and first law of thermodynamics to various thermodynamic systems
- 4. Understand the concept of second law of thermodynamics and the gaseous mixtures
- 5. Understand the properties of the steam
- 6. Assess the performance of Otto, diesel and dual cycles

#### **19ME306** FLUID MECHANICS & HYDRAULIC MACHINES LAB Course Outcome(s)

- 1. Solve the co-efficient of discharge from experimental data by utilizing Venturi, Orifice and Rota meters
- 2. Recognize the friction factor decreased as the Reynolds number of the fluid increased due to increasing velocity of the fluid
- 3. Identify & Calculate the Reynold's number for transition from laminar to turbulent flow
- 4. Accuracy of Bernoulli's assumptions and theorem by experimentally proving that the sum of the terms in the Bernoulli equation along a streamline always remains a constant
- 5. Make them understand the relation between force and rate of momentum flow in the jet on vanes
- 6. Impart knowledge for calculating performance analysis in turbines and pumps and can be used in power plants

# 19ME307 MANUFACTURING TECHNOLOGY LAB

# Course Outcome(s)

- 1. Identify the various tools used in the Foundry and Welding shops
- 2. Prepare a green sand mould cavity for split and solid models
- 3. Make Lap and T-joints using arc welding
- 4. Make simple component using injection moulding equipment
- 5. Interpret blanking and piercing operations
- 6. Design and fabricate a simple product

# **19BEA01 ENVIRONMENTAL SCIENCES**

# Course Outcome(s)

- 1. Translate the learner's attitude to think globally and act locally
- 2. Motivate environmental organizations to create a concern about our present state of Environment
- 3. Find solutions for conservation of natural resources
- 4. Identify the benefits of ecosystem conservation, biodiversity protection, implement pollution prevention and control measures
- 5. Illustrate social issues of environmental protection and adopt sustainable developmental practices
- 6. Perceives the basic structure of environmental policy and law pertaining to specific environmental issues (water quality, air quality, biodiversity protection, Forest, etc.)

# FOURTH SEMESTER

# 19MA302 ENGINEERING MATHEMATICS III

# Course Outcome(s)

1. Utilize numerical methods to find approximate solutions of equations and to find the best fit curve for given data

- 2. Make use of the concepts of interpolation to estimate the unknown functional values
- 3. Find approximate values of finite integrals and solution of ODE using numerical techniques
- 4. Interpret Baye's theorem and probability distribution functions to solve engineering problems
- 5. Identify the suitable distribution among Binomial, Poisson and Normal in engineering applications
- 6. Apply the concept of correlation between the variables and also construct the regression lines

# 16ME401 APPLIED THERMODYNAMICS

# Course outcome(s)

- 1. Understand the construction and working principle associated with SI and CI Engines
- 2. Elaborate the working of IC engine auxiliary systems
- 3. List the stages of combustion in IC engines and analyze the engine combustion process
- 4. Evaluate the performance of IC engines
- 5. Categorize the effects of emission and its control
- 6. Estimate the various efficiencies of air compressors

# **19ME402 KINEMATICS OF MACHINERY**

# Course Outcome(s)

- 1. Understand the concept of mechanism and its inversions
- 2. Demonstrate the straight line motion mechanisms
- 3. Determine velocity and acceleration of simple mechanisms
- 4. Summarize the importance of steering gears and Hooke's joint
- 5. Develop the profile of a cam for a given follower motion
- 6. Analyze kinematics of gears and gear trains

# **19ME403 MATERIAL SCIENCE**

# Course Outcome(s)

- 1. Understand the crystal structure of materials, Co-ordination Number and Mechanical behaviour of materials
- 2. Explain the concept of Alloying and phase diagrams
- 3. Understand the concept of allotropy and solid-state transformation reactions
- 4. Assess the various Iron-Carbon alloys and heat treatment methods different heat treatment methods
- 5. Understand the TTT diagram and various surface hardening methods
- 6. Differentiate various non-ferrous alloys, Newer class materials-Composite materials and ceramic materials

# **19ME404 MECHANICS OF SOLIDS**

# Course Outcome(s)

- 1. Understand the fundamental concepts of stress, strain and principle stresses
- 2. Calculate and represent the shear force and bending moment in various beams under different loading conditions
- 3. Analyze flexural and shear stresses in beams
- 4. Understand the concepts of torsional stresses
- 5. Understand the concepts of slope and deflection and able to solve deflection in beam members
- 6. Perform the stress analysis of thin and thick cylinders

#### **19ME405** APPLIED THERMODYNAMICS LAB Course outcome(s)

- 1. Understand the valve timing diagram of IC engine
- 2. Perform experiments to determine air fuel ratio and volumetric efficiency of engine

- 3. Determine the performance of IC engines
- 4. Evaluate the energy distribution by conducting heat balance test on IC engines
- 5. Assess the efficiency of reciprocating air compressor
- 6. Determine the performance of refrigeration system

# **19ME406 MECHANICS OF SOLIDS LAB**

#### Course Outcome(s)

- 1. Evaluate the strength of various engineering materials
- 2. Calculate young's modulus of wood/steel materials
- 3. Find the stiffness and rigidity modulus of spring
- 4. Estimate the impact resistance of steel used in various engineering applications
- 5. Compare the compressive strength of wood/Concrete/Brick materials along and across the grains
- 6. Measure the deformations in various beam members

#### **16ME406 MANUFACTURING PROCESSES LAB**

#### **Course Outcomes**

- 1. Identify the use of various tools used in the Foundry, welding and metal forming processes
- 2. Develop moulds of simple objects and understand role played by various elements of moulds such as cope, drag, riser etc.,
- 3. Explain various operations for Arc welding so as to produce Lap and T-joints etc.,
- 4. Illustrate the various gas welding operations and other processes such as spot welding etc.,
- 5. Apply die design and manufacturing for forming operations
- 6. Design and fabricate a simple product

#### 16ME407 THERMAL ENGINEERING LAB

#### **Course Outcomes**

- 1. Interpret valve timing diagram of IC engine
- 2. Find air fuel ratio and volumetric efficiency of CI engine
- 3. Evaluate the performance of IC Engines and vapor compression refrigeration system.
- 4. Estimate the efficiency of reciprocating air compressor
- 5. Study the various parameters of boilers 6. Analyze and fabricate simple thermal systems.

#### FIFTH SEMESTER

# 16ME501 ELEMENTS OF MACHINE DESIGN

#### **Course Outcomes**

- 1. Explain the design procedure and selection of materials for specific application
- 2. Analyse the component subjected to static loads based on strength and stiffness criteria
- 3. Design a component based on strength when it is subjected to variable load
- 4. Evaluate riveted, welded and bolted joints
- 5. Design transmission shafts, keys and shaft coupling
- 6. Interpret theory of columns

# 16ME502 DYNAMICS OF MACHINERY

- 1. Interpret static and dynamic force analysis of simpler planar mechanisms
- 2. Apply the principle of gyroscope and compute gyroscopic effect for aero planes and ships
- 3. Make use of the principle of gyroscope and interpret the stability for two wheelers and four wheelers

- 4. Summarize the working of important machine elements like clutches, brakes, flywheels and governors
- 5. Examine the balancing of rotating and reciprocating masses
- 6. Summarize free and forced vibrations

#### 16ME503 METAL CUTTING AND MACHINE TOOLS

#### **Course Outcomes**

- 1. Explain cutting tool geometry; analyze mechanism of chip formation and forces in orthogonal cutting.
- 2. Explain tool failure and influence of various process parameters on tool life.
- 3. Illustrate basic parts and operations of machine tools including lathe, shaper, planer, drilling, boring, milling and grinding machine.
- 4. Select a machining operation and corresponding machine tool for a specific application in real time.
- 5. Identify the need of super finishing operations like honing, lapping and broaching.
- 6. Design locating and clamping devices to produce a component.

#### **16ME504 MECHANICAL MEASUREMENTS AND METROLOGY**

#### **Course Outcomes**

- 1. Explain the working of transducers measuring Displacement, Temperature, Level & Flow
- 2. Make use of different methods for measuring of pressure, speed, force, torque, power and humidity
- 3. Utilize appropriate instruments for measuring acceleration and vibrations
- 4. Apply and analyze the limits and tolerances for engineering components
- 5. Illustrate the different methods of measurement of angles and tapers
- 6. Infer the working of comparators, screw thread and gear teeth measuring instruments

#### **16ME505 STEAM AND GAS TURBINES**

#### **Course Outcomes**

- 1. Interpret Rankine cycle
- 2. Explain the working of boilers and its performance parameters
- 3. Estimate the performance of steam nozzles
- 4. Evaluate the performance of steam turbines
- 5. Explain the working of steam condensers and their performance parameters
- 6. Estimate the performance of gas turbines

#### **ELECTIVE I**

#### **16ME001 ADVANCED IC ENGINES**

#### **Course Outcomes**

- 44. Explain the parameters which will influence the operation and performance of an IC engine
- 45. Explain the practical engine cycles
- 46. Determine the parameters effecting the performance of superchargers and turbochargers
- 47. Explain the fuel spray behavior and ignition delay in an IC engine
- 48. Examine the performance and emissions of IC engines operated with Alternative fuels
- 49. Outline the recent trends to IC engines

#### **16ME002 ADVANCED MATERIALS**

- 73. Explain the need and applications different types of composite materials
- 74. Summarize the various methods of manufacturing composite materials
- 75. Outline different types of reinforcements used in the metal matrix and ceramic matrix composites with their properties and applications

- 76. Infer the principles, types and applications of different functionally graded materials
- 77. Interpret the shape memory effect and exemplify their properties and applications
- 78. Explain the properties and applicants of Nano and Bio materials

#### **16ME003 INDUSTRIAL ROBOTICS**

#### **Course Outcomes**

- 1. Explain fundamentals of the robotics, history, evolution, applications and anatomy
- 2. Infer basic configurations and components of robotic systems
- 3. Apply the basic transformations to robotic systems
- 4. Model the robot motion through forward kinematics and inverse kinematics
- 5. Develop mathematical models for dynamic motions and trajectory planning
- 6. Explain various actuators and feedback components in robotic systems

# 16ME004 NON-TRADITIONAL MACHINING AND FORMING PROCESSES

### **Course Outcomes**

- 1. Explain the need and applications of modern machining processes
- 2. Outline working principles of USM, AJM, WJM and AWJM techniques
- 3. Summarize working principles of CM, ECM and EDM processes
- 4. Select a suitable modern machining process for given applications
- 5. Explain working principles of EBM, LBM and PAM processes
- 6. Summarize the working principle of various Forming and finishing processes

# 16ME507 MACHINE TOOLS & DYNAMICS LAB

#### **Course Outcomes**

- 1. Build simple features by performing basic turning operations on lathe
- 2. Develop simple features by performing basic operations on shaper, planer and milling machines
- 3. Create features by making use of grooving, boring, reaming, thread cutting, knurling and grinding
- 4. Determine the critical speed using whirling of shaft
- 5. Test for balancing of rotating masses, gyroscopic couple and analysis of cam profile
- 6. Fabricate basic shapes using programmable machines

# SIXTH SEMESTER

# 16ME601 DESIGN OF MACHINE MEMBERS

### **Course Outcomes**

- 1. Design journal bearings, ball and roller bearings subjected to static and dynamic loads
- 2. Analyze curved beams subjected to static loads
- 3. Design engine parts including connecting rod, crank shaft, pistons and cylinders 4. Design power transmission systems including pulleys, spur and helical gears
- 5. Design Power screws and springs.
- 6. Apply the Knowledge of design theories on various machine members

### 16ME602 GEOMETRIC MODELING AND COMPUTER AIDED MANUFACTURING Course Outcomes

- 1. Explain the use of computers in product design and manufacturing
- 2. Perform basic 2D and 3D geometric Transformations
- 3. Interpret and develop parametric models of simple curves, surfaces and solids
- 4. Explain NC, DNC and CNC
- 5. Develop manual part programs for machining components on Milling and Turning machines
- 6. Summarize GT, CAPP, FMS, CAQC, CIM systems

- 1. Explain basic modes of heat transfer and compute temperature distribution in steady state and unsteady state heat conduction
- 2. Analyze heat transfer through extended surfaces
- 3. Interpret and analyze free & forced convection
- 4. Comprehend the phenomena and flow regimes of boiling and condensation
- 5. Apply LMTD and NTU methods to design heat exchangers
- 6. Explain the principles of radiation heat transfer

#### **16ME604 MECHATRONICS**

#### **Course Outcomes**

- 1. Explain different control methods used in the typical mechatronics systems
- 2. Infer signal condition and the hardware used for signal conditioning
- 3. Outline the use of common electrical and mechanical components to achieve precision in Mechanical, Electrical, Fluid & Thermal systems
- 4. Explain the need and working of interfacing circuits and their components
- 5. Illustrate the working principles of various electromechanical drives and micro controllers
- 6. Explain PLCs, PMCs and Feedback components and their applications in mechatronic systems

# Elective II 16ME005 ADDITIVE MANUFACTURING

#### **Course Outcomes**

- 1. Explain the importance of AM in Manufacturing
- 2. Distinguish different AM Technologies
- 3. Illustrate STL file processing
- 4. Select suitable materials for AM
- 5. Analyze different methods for Post-processing of AM parts
- 6. Explain the non-thermal and thermal AM techniques

#### **16ME006 AUTOMOBILE ENGINEERING** Course Outcomes

- 1. Explain different types of automobiles, engine construction, turbo charging and supercharging
- 2. Illustrate the necessity and working of elements of transmission system
- 3. Demonstrate the elements of vehicle control systems viz., steering, suspension, braking and electrical systems
- 4. Outline electrical systems, engine specifications and safety features of automobiles
- 5. Summarize the emission control methods used in automobiles
- 6. Identify different causes for engine failures and outline engine service

# **16ME007 CONTROL SYSTEMS**

#### **Course Outcomes**

- 1. Build mathematical models for controlling physical systems
- 2. Formulate a control system using block diagram and signal flow graph techniques
- 3. Analyze the transient and steady state performances of a control system
- 4. Contrast the stability of a system using time domain and frequency domain techniques
- 5. Design different compensators and controllers in time/frequency domain
- 6. Compute the controllability and observability of a given physical system

#### **16ME008 FATIGUE, FRACTURE AND CREEP**

- 1. Illustrate the characteristics of fracture surfaces and concept of energy release rate
- 2. Infer the modes of fracture and plastic zone at the crack tip
- 3. Outline linear elastic fracture mechanics and extend critical stress intensity factor as the failure prediction parameter
- 4. Summarize EPFM and extend CTOD as the failure prediction parameter
- 5. Explain high cycle fatigue and low cycle fatigue
- 6. Illustrate fatigue damage and micro mechanisms

#### ELECTIVE III 16CE007 DISASTER MANAGEMENT (OPEN ELECTIVE) Course Outcomes

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and prepreparedness tools for natural and manmade disasters
- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

#### 16EE004 RENEWABLE ENERGY SOURCES (OPEN ELECTIVE) Course Outcomes

- 1. Summarize the principles of solar energy systems
- 2. Demonstrate the applications of solar energy system
- 3. Illustrate the working principles of wind and biomass energy systems
- 4. Interpret working principles of geothermal energy system
- 5. Summarize operation and classification of ocean, tidal, fuel cells, small hydro and magneto hydro energy system
- 6. Extend renewable energy sources to distributed generation & micro grids

#### **16ME009 PRINCIPLES OF ENTREPRENEURSHIP (OPEN ELECTIVE)**

#### **Course Outcomes**

- 1. Explain the role of entrepreneur in economic development
- 2. Demonstrate methods of generating ideas
- 3. Develop the business plan to start their own enterprise
- 4. Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- 5. Make financial plan for enterprise
- 6. Find the institutional support entrepreneurship

#### 16EC004 FUNDAMENTALS OF GLOBAL POSITIONING SYSTEM (OPEN ELECTIVE)

#### **Course Outcomes**

- 1. Summarize the history of GPS, NAVSTAR GPS
- 2. State the working principle of GPS, GNSSs
- 3. Outline GALILEO, GLONASS signal constellation details
- 4. Conclude about GPS segments, signal components, IRNSS specifications
- 5. Demonstrate GPS coordinate systems
- 6. Classify various datums and map projections

#### **16CS006 COMPUTATIONAL INTELLIGENCE (OPEN ELECTIVE)**

#### **Course Outcomes**

- 1. Identify and describe Soft Computing Techniques and their roles in building Intelligent Machines
- 2. Apply Supervised Learning Networks in Machine Learning Problems
- 3. Illustrate the working of Associative memory networks
- 4. Apply Unsupervised Learning Networks in Machine Learning Problems
- 5. Apply Fuzzy Logic and Reasoning to handle Uncertainty and Solve Engineering Problem
- 6. Apply Genetic Algorithms to solve Optimized Problems

#### **16CS007 IOT FOR ENGINEERING APPLICATIONS (OPEN ELECTIVE)** Course Outcomes

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem
- 6. Apply IoT for various engineering applications

#### 16CH007 INDUSTRIAL SAFETY AND HAZARD MANAGEMENT (OPEN ELECTIVE) Course Outcomes

- 1. Demonstrate the safety and ethical issues that may arise from industrial processes
- 2. Explain industrial hygiene practices and its procedures
- 3. Illustrate the toxic pathways and elimination of toxicity on bio organisms
- 4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them
- 5. Choose a suitable method for prevention of fires and explosions
- 6. Evaluate the process and able to do Hazards Identification and risks Risk Assessment

# **16IT005 FUNDAMENTALS OF CLOUD COMPUTING (OPEN ELECTIVE)**

#### **Course Outcomes**

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems
- 4. Analyze cloud provider for a defined environment and to a specific platform in a costeffective way
- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloudbased applications
- 6. Build a virtual machine with a machine image

# 16PE007 SMART GRID TECHNOLOGY (OPEN ELECTIVE)

# **Course Outcomes**

- 1. Compare the basic difference between existing grid and smart grid
- 2. Explain perfect power system network (Including distributed and fully integrated systems)
- 3. Explain the importance of renewable energy systems and distributed energy resources in smart grids
- 4. Summarize the wide area monitoring system and advanced measuring technologies
- 5. Recall the technologies like Zigbee, HAN and NAN in smart grids
- 6. Explain SCADA technology in modern power systems and to analyze the micro grid systems

#### **16MA001 COMPUTATIONAL MATHEMATICS (OPEN ELECTIVE)**

#### **Course Outcomes**

- 1. Apply the knowledge of finding roots of nonlinear equations and different errors in series approximations
- 2. Understand the consistency and inconsistency of linear system of equations
- 3. Evaluate the solution of Initial and Boundary value problems
- 4. Perform numerical differentiation and integration
- 5. Analyze the solution of PDEs under given conditions
- 6. Apply Knowledge of numerical techniques to Engineering problems

#### 16CY001 NANO SCIENCE AND TECHNOLOGY (OPEN ELECTIVE) Course Outcomes

- 1. Apply various chemical and physical methods for the synthesis of nanomaterials
- 2. Understand the properties of nano-materials and their applications in relation to bulk materials 3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
- 4. Characterize nano materials by powder XRD and microscopy techniques.
- 5. Understand structure, properties and applications of Fullerenes and Carbon nanotubes.
- 6. Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis

# 16ME607 HEAT TRANSFER LAB

- 1. Find thermal conductivity of common metallic materials
- 2. Determine the amount of heat transfer between fluid and solid boundaries

- 3. Estimate the amount of heat exchanged between fluids in heat exchangers
- 4. Determine the emissivity and Stefan Boltzmann constant of radiative heat transfer
- 5. Evaluate heat transfer coefficient in natural and forced convection
- 6. Fabricate and analyze simple heat transfer systems

#### SEVENTH SEMESTER

# 16ME701 FINITE ELEMENT METHOD

#### **Course Outcomes**

- 1. Apply the concepts of minimum potential energy principles to solve structural mechanics problems
- 2. Find eigen values and eigenvectors of simple dynamic systems
- 3. Find weak form from strong form and total potential, and recognize similarities between such solutions, and those obtained by variational principles and principle of virtual work.
- 4. Find finite element solution and compare with exact solution of simple onedimensional problem
- 5. Apply the finite element procedure for stress analysis and design of load carrying structures
- 6. Apply the FE method for heat transfer problems

# ELECTIVE IV

#### 16ME010 DESIGN FOR MANUFACTURING Course Outcomes

- 1. Explain modern manufacturing operations, their capabilities and limitations
- 2. Analyze the process of design a criterion for material selection
- 3. Illustrate the process of analyzing products to improve their manufacturability with lower costs
- 4. Analyze the relationship between customer desires, functional requirements in product design and manufacturing
- 5. Explain design guidelines for manufacturing of products using extrusion process
- 6. Explain design guidelines for manufacturing of Plastics

#### **16ME011 INDUSTRIAL TRIBOLOGY**

#### **Course Outcomes**

- 1. Explain fundamentals of the tribology and its applications
- 2. Identify the materials used for bearings and types of bearing oil pads
- 3. Apply hydrostatic and hydrodynamic theory of lubrication in tribology
- 4. Analyze the friction and power losses in journal bearings
- 5. Explain the air lubricated bearings
- 6. Explain the concepts of boundary friction and dry friction

# 16ME012 REFRIGERATION AND AIR CONDITIONING

#### **Course Outcomes**

- 1. Apply the concept of refrigeration to various systems.
- 2. Explain the methods to improve performance of vapor compression systems.
- 3. Analyze steam jet, vapor absorption, thermoelectric and vortex tube systems.
- 4. Analyze air conditioning processes using principles of psychometry.
- 5. Find cooling and heating loads in an air conditioning system.
- 6. Identify eco-friendly refrigerants and use P-H charts to evaluate the performance of refrigeration systems.

#### **16ME013 SUPPLY CHAIN MANAGEMENT**

- 1. Explain the strategies and models of Supply Chain Management
- 2. Apply the forecasting techniques to assess the demand requirements
- 3. Choose the criteria for Supply Chain Management decisions
- 4. Explain the transportation techniques and network modeling
- 5. Explain the production planning and scheduling techniques
- 6. Apply the appropriate Information Technology in Supply Chain Management requirements and decisions

#### ELECTIVE V 16ME014 ALTERNATIVE SOURCES OF ENERGY Course Outcomes

- 1. Demonstrate the concept of different forms of alternative sources of renewable energy
- 2. Find the calculations on energy storage and thermal analysis
- 3. Develop the design parameters of wind energy and solar energy
- 4. Explain the environmental issues and economics
- 5. Interpret the direct energy conversion methods
- 6. Summarize the different aspects of fuel cells

# 16ME015 ENERGY AND ENVIRONMENTAL ENGINEERING Course Outcomes

- 1. Explain the pollution and its effects on living systems.
- 2. Outline meteorological aspects of air pollution
- 3. Explain the air pollution and its control
- 4. Interpret the water pollution, laws, sampling and analysis
- 5. Summarize the wastes and different energy generation processes
- 6. Explain the energy conservation in various systems of an industry

# 16ME016 JET PROPULSION AND ROCKET ENGINEERING

#### **Course Outcomes**

- 1. Illustrate the thermodynamic aspects of gas turbines
- 2. Analyze the performance of jet engines
- 3. Compare different aspects of thermal jet engines
- 4. Summarize the working of rocket engines
- 5. Apply thrust mechanics to determine forces in rockets
- 6. Contrast the aspects of electrical, nuclear and plasma arc propulsions

#### **16ME017 TOTAL QUALITY MANAGEMENT**

#### **Course Outcomes**

- 1. Demonstrate the demining philosophy as a frame work for TQM
- 2. Identify customer needs to enhance the quality management
- 3. Appraise the employee"s involvement critically for effective team work requirements
- 4. Describe several techniques of quality management tools
- 5. Apply benchmarking and FMEA processes for effective quality management.
- 6. Apply ISO standards for design and development of products and services.

#### 16ME704 ADDITIVE MANUFACTURING & MECHATRONICS LAB Course Outcomes

- 1. Create various mechanical components using 3D modelling software.
- 2. Select a suitable slicing tool for effective 3D printing
- 3. Build different mechanical components using a 3D printer.
- 4. Develop simple ladder logic programs to run basic components of pneumatic circuit
- 5. Learn operating various sensors and transducers using PLCs.
- 6. Write simple programs on microcontroller for operating different elements in an automatic system.

# 16ME705 COMPUTER AIDED ANALYSIS AND SIMULATION LAB

- 1. Determine the deflections and stresses in Trusses and Beams
- 2. Find the stresses through 2D Idealizations i.e., Plane stress, Plane strain and axis symmetry
- 3. Perform modal and harmonic analysis on variety of beams
- 4. Perform Heat transfer analysis involving conduction and convection
- 5. Perform thermal stress analysis

6. Simulate basic mechanical systems such as Air conditioning system, Cam and follower and Spring, mass and damper systems.

#### **EIGHTH SEMESTER**

#### **16ME801 INDUSTRIAL ENGINEERING & MANAGEMENT**

#### **Course Outcomes**

- 1. Design organization structure and implement management principles in real time business environment
- 2. Establish layouts for different types of industries, manufacturing, process and service sectors
- 3. Elaborate productivity and profitability by implementing work study and SQC
- 4. Select and maintain skilled and sufficient manpower for various business proposals
- 5. Find total production time and cost by using networking techniques
- 6. Enunciate a best method of making a product in the production process

#### **16ME802 OPERATIONS RESEARCH**

#### **Course Outcomes**

- 1. Formulate a real time situation into a mathematical model.
- 2. Assign a right job to a right person using job sequencing.
- 3. Make right decisions in operations management using game theory, queuing theory and replacement analysis.
- 4. Solve nonlinear problems using nonlinear programming techniques.
- 5. Perform optimum problem solving using dynamic programming and simulation techniques.
- 6. Distinguish the process of waiting lines and its applications.

#### **ELECTIVE VI**

#### **16ME018 COMPUTATIONAL FLUID DYNAMICS**

#### **Course Outcome**

- 1. To provide the students with sufficient background to understand the mathematical representation of the governing equations of fluid flow and heat transfer
- 2. To enable the students to solve one and two-dimensional ordinary and partial differential equations using traditional CFD tools
- 3. To teach students how to express derivatives and differential equations through discretization techniques
- 4. To help the students to understand the general transformation equations for grid generation
- 5. To teach students how to apply explicit, implicit and semi-implicit methods of finite differencing
- 6. To help the students solve fluid flow field using some popular CFD techniques

#### **16ME019 PROFESSIONAL ETHICS IN ENGINEERING**

#### **Course Outcomes**

- 1. Understand Human Values
- 2. Explain the use of Yoga and meditation for Professional excellence and stress management.
- 3. Discuss the Ethical issues related to Engineering
- 4. Infer the Engineering as the social experimentation
- 5. Realize the responsibilities and rights in the society
- 6. Outline the global issues and responsibilities of engineers in different roles

#### **16ME020 POWER PLANT ENGINEERING**

- 1. Explain the construction, working principles of steam and hydroelectric power plants
- 2. Demonstrate working principles of diesel and gas turbine power plants
- 3. Explain the concepts of non-conventional energy sources
- 4. Distinguish different technologies adopted in nuclear power plants
- 5. Outline the pollution effects of different types of power plants
- 6. Analyze economics of power plants

#### 16ME021 PRODUCTION PLANNING AND CONTROL Course Outcomes

- 1. Explain the features of the operations and production planning functions in an organization
- 2. Develop extrapolative forecasting models for demand
- 3. Explain productivity and quality and how it contributes to the competitiveness of firms
- 4. Compare different production aspects such as production control, quality control, manufacturing costs control, marketing management and waste reduction
- 5. Develop an aggregate and disaggregate production plan schedule into assembly quantities for end items
- 6. Explain the strategies of dispatching

#### **16ME022 PROJECT MANAGEMENT**

#### **Course Outcomes**

- 1. Recall the basics of project management
- 2. Explain the selection of projects and requirements
- 3. Explain the project planning and project scheduling
- 4. Apply the key tools and analytical frameworks of strategic management
- 5. Evaluate project for accurate cost estimates and plan future activities
- 6. Apply the Information Technology and Tools in Project Management.

#### **Electronics & Communication Engineering**

#### 16MA304 COMPLEX VARIABLES

#### **Course Outcomes**

- 1. Implement the knowledge of Z-Transformations in signal analysis and solve difference equations
- 2. Define and assess limits and continuity for complex variable functions as well as consequences of continuity
- 3. Identify the significance of differentiability and Analyticity for complex variable functions and be familiar with the Cauchy-Riemann equations
- 4. Compute integrals along a path in the complex plane using the Cauchy's theorem and Residue theorem
- 5. Classify the singularities of complex variable function by expanding them into Taylor's and Laurent's series
- 6. Interpret various types of transformations in complex plane

#### 16EC302 DIGITAL ELECTRONICS

#### **Course Outcomes**

- **1.** Illustrate the conversion of a number from one number system to another
- 2. Identify Boolean algebra and K-map as a tool to simplify and design logic circuits
- 3. Implement combinational circuits using gates
- 4. Design PLDs and Flip-flops
- 5. Implement various types of counters and shift registers
- 6. Attribute innovative designs by modifying the traditional design techniques

#### **16EC303 ELECTRONIC DEVICES AND CIRCUITS**

1. Explain the properties of semiconductor materials in the formation of PN diode and Zener diode

2. Classify the V-I characteristics of CB & CE configurations

3. Design various biasing circuits to achieve the required stability in transistor amplifiers

4. Illustrate the operation of FETs and special diodes for different applications

5. Design half wave, full wave rectifiers with and without filters for different applications

6. Design regulated power supply using Zener diode and transistors

## 16EC304 LINEAR CIRCUIT ANALYSIS

### **Course Outcomes**

- 1. Summarize the characteristics of RL, RC, RLC series and parallel circuits in both time and frequency domain.
- 2. Find the power and power factor of RL, RC, RLC series and parallel circuits.
- 3. Design resonant circuits which are used in wireless transmission and communication networks.
- 4. Implement the theorems to simplify complex networks
- 5. Outline the transient analysis in electrical circuits and to analyze the system stability
- 6. Determine the parameters of two port networks to analyze the performance of transmission lines.

### 16EC305 RANDOM VARIABLES & STOCHASTIC PROCESSES

### **Course Outcomes**

- 1. Illustrate probability concepts and Bayes theorem
- 2. Find the distribution and density functions of random variables
- 3. Compute various moments of random variables
- 4. Demonstrate vector random variables and their statistical averages
- 5. Outline the temporal and spectral characteristics of random processes
- 6. Summarize noise sources and characteristics

# 16EC306 SIGNALS & SYSTEMS

#### **Course Outcomes**

- 1. Interpret various types of signals and systems with the basic signal operations
- 2. Explain the concept of orthogonality for periodic signals approximation
- 3. Implement the various transform techniques for analyzing continuous time signals
- 4. Implement correlation and convolution techniques for various signals
- 5. Find the response of LTI system
- 6. Attribute the concept of sampling theorem and Laplace transform

#### 16EC307 DIGITAL ELECTRONICS LAB

- 1. Implement the Universal gates using logic gates
- 2. Implement the logic circuits using Universal gates
- 3. Design and analyze combinational logic circuit
- 4. Design flip-flop using gates and ICs
- 5. Design and analyze synchronous and asynchronous counter

6. Implement shift registers using flip-flops and design an application using registers and counters

## 16EC308 ELECTRONIC DEVICES AND CIRCUITS LAB

#### **Course Outcomes**

- 1. Demonstrate various electronic components and test equipment like multimeter, function generator, and CRO in order to measure passive components and observe the waveforms
- 2. Predict the V-I characteristics of PN junction and Zener diodes
- 3. Compare the operation of BJT and FET through their V-I characteristics
- 4. Compare half wave and full wave rectifiers with and without filters
- 5. Implement D.C. Regulated power supplies circuits using Zener and BJT
- 6. Design and verify the self-biasing CE configuration circuit

### 16EC309 SIGNALS AND SYSTEMS LAB

### **Course Outcomes**

- 1. Illustrate signal representation techniques and signal characteristics
- 2. Interpret the process of sampling and the effects of under sampling
- 3. Design suitable filters to process the analog signals
- 4. Contrast the signals in Time and Frequency domain through its respective tools
- 5. Determine the power content and power spectral density of the signal
- 6. Determine the Autocorrelation and power density spectrum of the processes

# 16EE410 LINEAR CONTROL SYSTEMS

#### **Course Outcomes**

- 1. Explain mathematical models of control systems in continuous time
- 2. Formulate a control system using block diagram and signal flow graph techniques
- 3. Find the transient and steady state performances of a control system
- 4. Contrast the stability of a system using time domain and frequency domain techniques
- 5. Design different compensators and controllers in time/frequency domain
- 6. Compute the controllability and observability of a given system

# 16IT306 OBJECT ORIENTED PROGRAMMING THROUGH JAVA

#### **Course Outcomes**

- 1. Apply object oriented concepts to real world problems
- 2. Develop applications using different types of inheritances
- 3. Create and use user defined packages
- 4. Analyze and recover runtime exceptions arise in the applications
- 5. Apply parallel processing applications using threads
- 6. Develop internet based interactive applications using peripheral functions

# 16EC403 ANALOG COMMUNICATIONS

- 1. Explain various blocks in communication systems
- 2. Compute modulation indexes for AM and FM modulation techniques

- 3. Illustrate the analog modulator and demodulator circuits
- 4. Implement different types of Pulse modulation techniques
- 5. Compare the noise level in Analog communication systems
- 6. Explain the operations of Transmitters and Receivers

### 16EC404 ELECTROMAGNETIC FIELDS AND WAVES

## **Course Outcomes**

- 1. Classify different coordinate systems
- 2. Execute the problems on different charge distributions using Coulomb's law & Gauss law
- 3. Assess the problems on current elements of electrostatics and magneto statics
- 4. Implement Maxwell's equations for plane waves and their propagation in different media
- 5. Predict the reflection and refraction of uniform plane waves in different media interfaces
- 6. Compare wave equations for uniform plane waves

# **16EC405 ELECTRONIC CIRCUIT ANALYSIS**

### **Course Outcomes**

- 1. Implement single stage amplifiers at low and high frequencies using transistors and FETs
- 2. Implement multistage amplifiers at low and high frequencies using transistors and FETs
- 3. Illustrate feedback amplifiers for different applications
- 4. Design sinusoidal Oscillators for a specified frequency
- 5. Design power amplifier for different applications
- 6. Assess tuned amplifiers for communication systems

# 16EC406 PULSE AND DIGITAL CIRCUITS

Course Outcomes

- 1. Design of linear wave shaping circuits for different applications
- 2. Construct nonlinear wave shaping circuits to remove undesired portion of input signal
- 3. Construct nonlinear circuits to clamp the input signal to desired level
- 4. Differentiate multivibrators for different applications
- 5. Design of Time base generators for different applications
- 6. Design of pulse generation circuits and sampling gates

# 16IT309 JAVA LAB

# **Course Outcomes**

- 1. Make use of JAVA SDK environment to create debug and run java programs
- 2. Create applications based on code reusability
- 3. Develop programs using threads
- 4. Develop and debug real time problems using exception handling
- 5. Create interactive applications using event handling mechanisms
- 6. Design Graphical User Interface using AWT components

# 16EC408 ANALOG COMMUNICATIONS LAB

- 1. Implement sampling theorem
- 2. Compute and simulate analog modulation & demodulation techniques
- 3. Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively
- 4. Construct diode detector and AGC circuit that are necessary for good reception of the signal
- 5. Assess the spectrum of modulating signal and modulated signal
- 6. Design and simulate the pulse modulation techniques

#### **16EC409 ELECTRONIC CIRCUITS LAB**

#### **Course Outcomes**

- 1. Design and verify linear and nonlinear wave shaping circuits
- 2. Parse the Mono stable Multivibrator and Schmitt trigger circuits
- 3. Implement the single stage amplifier circuits using BJT and FET for desired characteristics
- 4. Design of sinusoidal oscillations for the desired frequency
- 5. Check the output and efficiency of class-A power amplifier
- 6. Determine the gain and bandwidth of amplifiers

# **16EC501 ANTENNAS AND WAVE PROPAGATION**

#### **Course Outcomes**

- 1. Explain the concepts of radiation for an antenna
- 2. Explain the properties and parameters of an antenna
- 3. Implement antenna arrays
- 4. Design an antenna system for given specifications
- 5. Differentiate various modes of Helical and Horn antennas
- 6. Illustrate the mechanism of the atmospheric effects on radio wave propagation

#### **16EC502 DIGITAL COMMUNICATIONS**

#### **Course Outcomes**

- 1. Explain different base band modulation techniques, and provide tools to analyze the performance of the modulation techniques
- 2. Implement different pass band digital modulation and demodulation techniques (binary and M-level; ASK, PSK and FSK), and provide tools to analyze the performance in noise
- 3. Find the bandwidth and transmission power in terms of time and frequency domain spectra of signal required under various modulation schemes
- 4. Exemplify the channel performance using Information theory
- 5. Assess different error control coding schemes for the reliable transmission of digital information over the channel
- 6. Contrast the design issues in a digital communication system

#### 16EC503 LINEAR IC APPLICATIONS

#### **Course Outcomes**

- 1. Describe various stages of operational amplifier
- 2. Explain the characteristics of op-amps and its compensation techniques
- 3. Implement linear and non-linear applications of op-amp using IC741
- 4. Design Active filters, PLL and timers
- 5. Construct different types of voltage regulators and multipliers
- 6. Analyse different ADCs and DACs

#### 16EC504 STRUCTURED DIGITAL DESIGN

#### **Course Outcomes**

- 1. Interpret the concepts of Verilog HDL constructs
- 2. Implement gate level Verilog HDL models for combinational and sequential circuits
- 3. Execute dataflow and switch level models for combinational and sequential circuits
- 4. Organize behavioral level Verilog HDL models for combinational and sequential circuits
- 5. Choose appropriate Verilog HDL constructs for RTL coding
- 6. Implement the combinational and sequential circuits in FPGA

#### 16EC505 VLSI DESIGN

#### **Course Outcomes**

- 1. Explain the operation and characteristics of MOS transistor
- 2. Interpret various MOS transistor fabrication techniques
- 3. Implement Boolean functions in CMOS technology and realize the same in layout diagrams
- 4. Summarize the effects of parasitics and scaling
- 5. Classify various programmable ASICs
- 6. Interpret different levels of testing of IC

# 16EC507 DIGITAL COMMUNICATIONS LAB

#### **Course Outcomes**

- 1. Summarize the fundamentals of Digital communication systems
- 2. Implement different Baseband modulation techniques
- 3. Implement different passband modulation techniques
- 4. Outline Error correcting & detecting codes
- 5. Determine suitable modulation schemes and coding for various applications
- 6. Contrast the design issues in a digital communication system

# 16EC601 CELLULAR AND MOBILE COMMUNICATIONS

#### **Course Outcomes**

- 1. Summarize evolution, performance criteria of cellular systems
- 2. State the principles of handoff, frequency reuse, cell splitting and sectoring
- 3. Differentiate various types of interference, channel assignment and its allocation
- 4. Compute the phase difference, propagation effects in various cell coverage environments
- 5. Classify various cell site and mobile antennas
- 6. Outline the GSM digital cellular system and principle of OFDM

#### **16EC602 DIGITAL SIGNAL PROCESSING**

#### **Course Outcomes**

- 1. Classify Discrete time signals and systems
- 2. Execute Z transform on different systems and represent with realization technique
- 3. Implement discrete Fourier transform and Fast Fourier transform on time domain signals
- 4. Implement FIR and IIR digital filters with given specifications and find the frequency response
- 5. Demonstrate Multirate signal processing
- 6. Differentiate the architecture of Digital signal processors

16EC603 MICROPROCESSORS AND MICROCONTROLLERS Course Outcomes

- 1. Explain the concept of microprocessor and Memory organization
- 2. Implement basic assembly language programming with 8086 microprocessor
- 3. Execute interfacing concepts through programming for I/O Devices
- 4. Differentiate the peripheral interfacing chips for 8086 microprocessor
- 5. Explain the concept of microcontroller and its addressing modes
- 6. Implement assembly level programming and interfacing with 8051 microcontroller

#### **16EC604 MICROWAVE ENGINEERING**

#### **Course Outcomes**

- 1. Identify the need of microwaves
- 2. Differentiate rectangular and circular waveguides
- 3. Compute the S-parameters of waveguide components
- 4. Explain two cavity and reflex klystron
- 5. Explain Travelling Wave Tubes and magnetrons
- 6. Summarise operation of Gunn Diode and microwave measurements

# **16EC607 LINEAR IC APPLICATIONS LAB**

#### **Course Outcomes**

- 1. Design op-Amp circuits for various applications
- 2. Demonstrate the practical usage of various linear ICs
- 3. Design and implement the pulse generator using 555 timer
- 4. Design and construct the various filters like LPF, HPF, BPF ,BRF
- 5. Design a function generator
- 6. Design a converter which converts analog signal to Digital signal and vice versa

#### 16HSX04 ENGINEERING ECONOMICS AND PROJECT MANAGEMENT Course Outcomes

- 1. Explain basic principles of engineering economics
- 2. Predict cost-volume-profit (CVP) analysis in their business decision making
- 3. Check investment proposals through various capital budgeting methods
- 4. Implement the simple financial statements for measuring the performance of firm
- 5. Attribute key issues of organization, management and administration
- 6. Organise project for accurate cost estimates and plan future activities

#### 16EC703 DIGITAL SIGNAL PROCESSING LAB Course Outcomes

- 1. Classify different type of signals and perform linear operations on the signals
- 2. Compare the signals in Time and Frequency domain through its respective tools
- 3. Compute linear and circular convolution
- 4. Find the frequency response of IIR filters
- 5. Outline the frequency response of FIR filters
- 6. Compute Digital Filters on TMS processor

#### 16EC704 MICROWAVE ENGINEERING LAB Course Outcomes

- 1. Interpret the characteristics of Reflex Klystron, LED, GUNN diode and Laser diode
- 2. Recognize VSWR and Impedance of rectangular waveguide
- 3. Check attenuation of variable attenuator
- 4. Implement insertion and isolation loss of Circulator
- 5. Generate S matrix of Magic Tee
- 6. Differentiate frequency and wave length of waveguide

#### 16EC801 PROFESSIONAL ETHICS AND STANDARDS Course Outcomes

- 1. Interpret the core values and awareness on professional ethics and human values
- 2. Interpret engineering as social experimentation
- 3. Assess the responsibilities of an engineer for safety, risk benefit analysis and professional rights
- 4. Illustrate various roles of engineers in various global issues
- 5. Select ethical principles to resolve situations that arise in their professional lives
- 6. Attribute professional ethics and human values to address real time situations

#### **16EC802 WIRELESS SENSOR NETWORKS**

### **Course Outcomes**

- 1. Exemplify wired and wireless networks for real time applications
- 2. Summarise sensor network architectures for various application
- 3. Interpret various operations in sensor node and transceiver design
- 4. Classify suitable medium access protocols, routing protocols, security protocols and radio hardware
- 5. Implement Prototype sensor networks using commercial components
- 6. Differentiate various infrastructure management and sensor network platform tools

#### **16CS303 COMPUTER ORGANIZATION AND ARCHITECTURE**

#### **Course Outcomes**

- 1. Analyze the different components of the Computer System their functions and their interconnections.
- 2. Implement the various Instruction Formats that the processor follows
- 3. Implement the Control Unit to generate control signals to execute a particular Instruction
- 4. Apply the different operations like Addition-Subtraction-Multiplication and Division in hardware level
- 5. Analyze and implement suitable designed of the Memory systems for better performance of the computer
- 6. Implement on high speed Computers using the Pipelining & Multiprocessor concepts

#### **16EC001 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

#### **Course Outcomes**

- 1. Summarize the operation of basic meters for measuring electrical quantities
- 2. Implement the Bridge measurements for parameters like R, L, C, F
- 3. Differentiate Signal generators and Signal analyzers
- 4. Explain the basic design operation of different CRO's
- 5. Execute electrical quantities measurement using CRO
- 6. Differentiate various transducer's features and their principle of operation

#### **16EC002 TRANSMISSION LINES AND WAVEGUIDES**

- 1. Interpret the transmission line parameters
- 2. Explain various transmission line characteristics
- 3. Compute various transmission line parameters using Smith chart
- 4. Compare various circuit elements
- 5. Implement stub matching techniques
- 6. Differentiate various waveguides

#### **16IT404 COMPUTER NETWORKS**

#### **Course Outcomes**

- 1. Propose appropriate network model for data communication
- 2. Analyze various protocols in data link layer.
- 3. Analyze IEEE 802 series protocols.
- 4. Develop web applications for sending E-mail.
- 5. Propose and implement appropriate routing algorithm for data routing.
- 6. Extend the Internet connection to a given system and trouble shoots the same.

#### **16CS304 DATABASE MANAGEMENT SYSTEMS**

#### **Course Outcomes**

- 1. Identify and define the data models needed to design a database
- 2. Create conceptual and logical database design for Large enterprises
- 3. Demonstrate the relational data model
- 4. Apply Integrity constraints over the relations
- 5. Apply normalization process on existing database for eliminating redundancy
- 6. Apply the recovery techniques for managing the database effectively to avoid the data lose

#### **16EC003 OPTICAL COMMUNICATION AND NETWORKS**

#### **Course Outcomes**

- 1. Explain about optical fiber communication system and fiber optic devices
- 2. Illustrate the significance of various components involved in optical fiber communication system design
- 3. Attribute the various optical communication networks
- 4. Assess various Optical switching and Access Networks
- 5. Illustrate the multicasting and optical network simulators-
- 6. Explain various Optical Metro Networks and Network Routing

#### **16CE007 DISASTER MANAGEMENT**

#### **Course Outcomes**

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and prepreparedness tools for natural and manmade disasters
- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

#### **16EE004 RENEWABLE ENERGY SOURCES**

#### **Course Outcomes**

1. Summarize the principles of solar energy systems

- 2. Demonstrate the applications of solar energy system
- 3. Illustrate the working principles of wind and biomass energy systems
- 4. Interpret working principles of geothermal energy system
- 5. Summarize operation and classification of ocean , tidal, fuel cells, small hydro and magneto hydro energy system
- 6. Extend renewable energy sources to distributed generation & micro grids

# **16ME009 PRINCIPLES OF ENTREPRENEURSHIP**

#### **Course Outcomes**

- 1. Explain the role of entrepreneur in economic development
- 2. Demonstrate methods of generating ideas
- 3. Develop the business plan to start their own enterprise
- 4. Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- 5. Make financial plan for enterprise
- 6. Find the institutional support entrepreneurship

# 16EC004 FUNDAMENTALS OF GLOBAL POSITIONING SYSTEM Course Outcomes

- 1. Summarize the history of GPS, NAVSTAR GPS
- 2. State the working principle of GPS, GNSSs
- 3. Outline GALILEO, GLONASS signal constellation details
- 4. Conclude about GPS segments, signal components, IRNSS specifications
- 5. Demonstrate GPS coordinate systems
- 6. Classify various datums and map projections

# **16CS006 COMPUTATIONAL INTELLIGENCE**

#### **Course Outcomes**

- 1. Identify and describe Soft Computing Techniques and their roles in building Intelligent Machines
- 2. Apply Supervised Learning Networks in Machine Learning Problems
- 3. Illustrate the working of Associative memory networks
- 4. Apply Unsupervised Learning Networks in Machine Learning Problems
- 5. Apply Fuzzy Logic and Reasoning to handle Uncertainty and Solve Engineering Problem
- 6. Apply Genetic Algorithms to solve Optimized Problems

# 16CS007 IoT FOR ENGINEERING APPLICATIONS

#### **Course Outcomes**

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things.
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem
- 6. Apply IoT for various engineering applications

#### **16CH007 INDUSTRIAL SAFETY AND HAZARD MANAGEMENT**

#### **Course Outcomes**

- 1. Demonstrate the safety and ethical issues that may arise from industrial processes
- 2. Explain industrial hygiene practices and its procedures
- 3. Illustrate the toxic pathways and elimination of toxicity on bio organisms
- 4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them.
- 5. Choose a suitable method for prevention of fires and explosions
- 6. Evaluate the process and able to do Hazards Identification and risks Risk Assessment

#### **16IT005 FUNDAMENTALS OF CLOUD COMPUTING**

#### **Course Outcomes**

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions.
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
- 4. Analyze cloud provider for a defined environment and to a specific platform in a cost effective way.
- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications
- 6. Build a virtual machine with a machine image

#### **16PE007 SMART GRID TECHNOLOGY**

#### **Course Outcomes**

- 1. Compare the basic difference between existing grid and smart grid
- 2. Explain perfect power system network (Including distributed and fully integrated systems)
- 3. Explain the importance of renewable energy systems and distributed energy resources in smart grids
- 4. Summarize the wide area monitoring system and advanced measuring technologies
- 5. Recall the technologies like Zigbee, HAN and NAN in smart grids
- 6. Explain SCADA technology in modern power systems and to analyze the micro grid systems

# **16MA001 COMPUTATIONAL MATHEMATICS**

#### **Course Outcomes**

- 1. Apply the knowledge of finding roots of nonlinear equations and different errors in series approximations
- 2. Understand the consistency and inconsistency of linear system of equations
- 3. Evaluate the solution of Initial and Boundary value problems
- 4. Perform numerical differentiation and integration
- 5. Analyze the solution of PDEs under given conditions
- 6. Apply Knowledge of numerical techniques to Engineering problems

# **16CY001 NANO SCIENCE AND TECHNOLOGY**

#### **Course Outcomes**

1. Apply various chemical and physical methods for the synthesis of nanomaterials

- 2. Understand the properties of nano-materials and their applications in relation to bulk materials
- 3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
- 4. Characterize nano materials by powder XRD and microscopy techniques.
- 5. Understand structure, properties and applications of Fullerenes and Carbon nanotubes.
- 6. Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis

#### **16EC005 DIGITAL IMAGE PROCESSING**

#### **Course Outcomes**

- 1. Interpret fundamental concepts of digital image processing
- 2. Infer image transforms
- 3. Exemplify image enhancement and color image processing
- 4. Assess image restoration techniques
- 5. Summarize line, point, threshold and region based segmentation for digital images
- 6. Attribute various compression models and compression techniques for digital images

#### **16EC006 RADAR ENGINEERING**

#### **Course Outcomes**

- 1. Explain RADAR parameters and applications
- 2. Explain the principle and operation of CW and MTI RADARs
- 3. Exemplify the applications of CW and MTI RADAR
- 4. Differentiate the tracking techniques for RADARs
- 5. Find the target in the presence of noise
- 6. Justify the performance of RADAR using matched filter

#### **16EC007 SPEECH PROCESSING**

#### **Course Outcomes**

- 1. Summarize the mechanism of human speech production and articulation
- 2. Identify the time domain speech signal parameters
- 3. Differentiate time and frequency domain methods of speech processing
- 4. Attribute linear predictive analysis for speech signals
- 5. Explain the solutions for LPC equations
- 6. Implement the different algorithms and models involved for speaker and speech recognition systems

# **16EC008 WAVELET THEORY AND ITS APPLICATIONS**

#### **Course Outcomes**

- 1. Interpret fundamental concepts of Fourier series and Fourier transform
- 2. Explain Multiresolution analysis
- 3. Implement continuous wavelet transform with various wavelets
- 4. Exemplify discrete wavelet transform with its properties
- 5. Interpret the choice of various wavelet coefficients
- 6. Demonstrate various applications of wavelet transform

#### **16EC009 BIOMEDICAL SIGNAL PROCESSING**

#### **Course Outcomes**

- 1. Illustrate the waveform characteristics associated with various cardioencephalogram abnormalities
- 2. Explain the origin, properties and suitable models of important biological signals such as ECG, EEG and EMG
- 3. Implement the basic mathematical, scientific and computational skills necessary to analyze biomedical signals
- 4. Execute the suitable algorithms for analysis of biomedical signals
- 5. Attribute the bio-signals by diagnosis and classification
- 6. Explain the different analysis techniques used to automatically process and analyse these images, including different image representations

#### **16EC010 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY**

#### **Course Outcomes**

- 1. Identify real-world EMI/EMC design constraints
- 2. Explain the EMI testing procedures
- 3. Classify the sources of Electromagnetic Interference
- 4. Illustrate Radiated and Conducted interference measurements
- 5. Differentiate various reduction techniques of electromagnetic interference
- 6. Implement electronic systems that function without errors or problems related to electromagnetic compatibility

#### **16EC011 EMBEDDED SYSTEMS**

#### **Course Outcomes**

- 1. Summarise embedded system life cycle and components involved in design
- 2. Explain the differences between embedded system with general purpose systems
- 3. Organize the embedded system design with respect to quality attribute for real time application
- 4. Implement an application on embedded system with the help of hardware and firmware
- 5. Resolve the issues related to implementation of real time applications
- 6. Differentiate various IDEs to implement embedded system for real time applications

# **16EC012 RF CIRCUIT DESIGN**

#### **Course Outcomes**

- 1. Illustrate radio frequency components
- 2. Explain RF circuit characteristics using smith chart
- 3. Assess the performance of RF filters
- 4. Explain various active RF components
- 5. Implement the modeling of RF active components
- 6. Implement the RF transistor amplifier, oscillators and mixers

#### **16EE502 POWER ELECTRONICS**

- 1. Summarize the operation of various power semiconductor devices
- 2. Outline the control and protection methods for power semiconductor devices
- 3. Analyze the performance of phase controlled rectifiers for various loads
- 4. Demonstrate the operation of AC-AC converters

- 5. Analyze the performance of DC-DC converters
- 6. Outline the performance of inverters

#### **16CS004 REAL TIME OPERATING SYSTEMS**

#### **Course Outcomes**

- 1. Develop the mathematical model of the system and implement real time algorithm for task scheduling.
- 2. Explain capabilities Handling Resource Sharing and dependencies among Real-time Tasks
- 3. Explain and use of different protocols
- 4. Analyze Real-time tasks Scheduling in multiprocessor and distributed systems
- 5. Explain the working of real time operating systems and real time database.
- 6. Explain the working of real time operating systems and real time communication

#### **16EC013 ADAPTIVE SIGNAL PROCESSING**

#### **Course Outcomes**

- 1. Classify adaptive systems and its performance evaluation
- 2. Implement a linear adaptive processor
- 3. Compute mathematical models for error performance and stability
- 4. Design adaptive modeling systems using LMS algorithm
- 5. Design adaptive modeling systems using RLS algorithm
- 6. Outline the adaptive modeling systems for real time applications

#### **16EC014 ANALOG AND MIXED SIGNAL DESIGN**

#### **Course Outcomes**

- 1. Explain the mixed signal processing fundamentals
- 2. Outline the MOS models and differential amplifiers
- 3. Organize the Op-amp internal circuits using current mirrors
- 4. Demonstrate the switched capacitor circuits
- 5. Organize continuous and discrete time filters
- 6. Outline the data conversion circuits

# 16EC015 NEURAL NETWORKS AND FUZZY LOGIC Course Outcomes

- 1. Interpret the basic principles of neural networks fundamentals
- 2. Determine about the artificial neural networks and different learning networks
- 3. Illustrate the principles of single layer and multilayer feed forward neural networks and back
- propagation algorithm
- 4. Outline the functionalities of Associative Memory and Architecture of Hopfield Network
- 5. Implement the principles of fuzzy logic fundamentals
- 6. Generate the fuzzy if-then rule and different basic models along with fuzzy inference technique to design fuzzy based system

#### **16EC016 SATELLITE COMMUNICATION**

- 1. Illustrate the Location of satellite in the orbit and assess the orbital effects on satellite communications
- 2. Interpret the major subsystems of spacecraft
- 3. Compute satellite link budget
- 4. Attribute various multiple access techniques and spread spectrum techniques
- 5. Interpret the earth station technology
- 6. Exemplify the concepts of VSAT systems

#### **16EC017 ARM PROCESSOR ARCHITECTURE AND APPLICATIONS**

#### **Course Outcomes**

- 1. Explain the ARM Architecture
- 2. Implement simple programs using ARM instructions
- 3. Execute ARM instructions using assembly language
- 4. Implement different applications using high level language
- 5. Organize the memory hierarchy
- 6. Summarize the operating systems and co-processors

#### **16EC018 ASIC DESIGN**

#### **Course Outcomes**

- 1. Classify the various types of ASICs
- 2. Explain the basics of System Verilog
- 3. Execute Test Bench functionality for digital circuits
- 4. Explain the types of simulation and test pattern generation techniques
- 5. Differentiate various partitioning methods of ASIC construction
- 6. Demonstrate floor planning and placement concepts

#### **16EC019 SOFTWARE DEFINED RADIO**

#### **Course Outcomes**

- 1. Explain the Architecture of Software Defined Radio
- 2. Execute the concept of digital filters and multi rate processing
- 3. Attribute the transmitter and receiver architectures
- 4. Summarise the challenges in the maintenance of SDR
- 5. Implement SDR for a specific application
- 6. Attribute the parameters of smart antenna

#### **16EC020 TESTING OF VLSI CIRCUITS**

#### **Course Outcomes**

- 1. Identify various types of faults in digital circuits
- 2. Interpret the concepts of test generation for digital circuits
- 3. Implement testable digital logic circuits
- 4. Interpret system level DFT approaches
- 5. Explain self- test algorithms
- 6. Implement self -checking design

#### **16ECI01 MODELLING AND SIMULATION OF BASIC ELECTRONIC SYSTEM**

#### **Course Outcomes**

- 1. Design and implementation of Regulated Power Supply
- 2. Design and implementation of Power Amplifier
- 3. Design and implementation of Audio Amplifier

#### **16ECI02 EFFICIENT DESIGN OF RF TRANSCEIVER**

#### **Course Outcomes**

- 1. Design and implementation of RF Amplifier
- 2. Design and implementation of RF Transmitter and Receiver

#### **16ECI03 ANTENNA DESIGN**

#### **Course Outcomes**

- 1. Implement different types of antennas.
- 2. Differentiate different types of losses in Wireless Transmission
- 3. Check the Radiation Pattern and Gain of the Antenna.

#### **16ECI04 INTERNET OF THINGS**

#### **Course Outcomes**

- 1. Interpret the concept of device to smart device
- 2. Implement IoT for different applications

#### **16ECI05 FULL CUSTOM VLSI DESIGN**

#### **Course Outcomes**

- 1. Interpret the navigation of EDA tool
- 2. Analyze CMOS Inverter static behaviour
- 3. Analyze the dynamic behavior of CMOS Inverter
- 4. Implement layouts of various gate designs

#### **16AT003 INTELLECTUAL PROPERTY RIGHTS AND PATENTS**

#### **Course Outcomes**

- 1. Recognize the language of IP law
- 2. Explain the use of legal professionals involved in IPRs
- 3. Differentiate appropriate intellectual property strategy in a given market
- 4. Explain the registration procedures of trademark and copyrights
- 5. Check the competency in critical reasoning, problem solving and decision making
- 6. Explain the trade secrets

#### **Computer Science and Engineering (CSE)**

#### 16IT305 Data Structures

- 1. Explain basic operations of stacks, queues, and linked-lists
- 2. Understand various sorting and searching techniques
- 3. Choose an appropriate hashing technique for a given problem
- 4. Understand the basic operations of trees and its types
- 5. Explain the concept of height balancing in AVL and B trees
- 6. Demonstrate graph traversal algorithms

#### 16IT306 Object Oriented Programming through Java Course Outcomes

## 1. Summarize object oriented programming concepts

- 2. Develop applications using different types of inheritances
- 3. Create simple applications using Interfaces, packages and collections
- 4. Analyse and recover runtime exceptions arise in the applications
- 5. Apply parallel processing applications using threads
- 6. Develop Interactive applications for standalone and Internet (Applet)

# 16CS303 Computer Organization and Architecture

# **Course Outcomes**

- 1. Understand the basic operations of digital computer system to learn the integrated circuit logic families and its micro-operation
- 2. Analyze the machine instructions and codes to implement or translate the sequence of micro-operation
- 3. Apply the fundamental issues related to computer arithmetic operation and circuits to support the system computation
- 4. Understand the various components of memory system to organize the operational units of CPU
- 5. Analyze the data processing operations of central processing and control unit to design the CPU specification
- 6. Understand the concepts of pipeline design techniques to increase the execution rate of a processor

# 16CS304 Database Management Systems

### **Course Outcomes**

- 1. Understand data models to design a database
- 2. Illustrate the conceptual design for Large enterprises
- 3. Formulate SQL queries and integrity constraints over relations
- 4. Apply normalization on database for eliminating redundancy
- 5. Summarize transaction properties, concurrency control and recovery techniques
- 6. Understand the OODBMS concepts and design

# 16CS305 Digital Logic Design

# **Course Outcomes**

After undergoing the course students will be able to:

- 1. Recognize the conversion of one number system to other Number system
- 2. Classify different logic circuits by using Universal gates
- 3. Execute Boolean algebra and K-map as a tool to simplify and design logic circuits
- 4. Implement and analyze the operation of Combinational and Sequential Circuits
- 5. Check various types of sequential circuits like counters and universal Shift Registers
- 6. Differentiate between the Mealy and Moore machines

# 16CS306 Discrete Structures & Graph Theory

- 1. Understand mathematical logic and predicates
- 2. Explain set theory, functions and algebraic structures
- 3. Demonstrate the ability to describe computer programs using Recursive Functions
- 4. Apply basic Counting techniques to solve Combinatorial Problems

- 5. Utilize generating functions and substitutions to solve recurrence relations
- 6. Demonstrate the Graphs and Trees as tools to visualize and simplify situations

# 16IT308 Data Structures Lab

# **Course Outcomes**

- 1. Implement array stack and queue data structures to solve various computing applications
- 2. Implement linked list data structure to solve various computing problems
- 3. Apply the data structure array for various list processing operations such as searching and sorting
- 4. Design and develop applications using appropriate hashing method
- 5. Demonstrate and apply binary tree and its applications
- 6. Demonstrate and apply different methods for traversing graphs

# 16IT309 Java Lab

# **Course Outcomes**

- 1. Make use of JAVA SDK environment to create debug and run java programs
- 2. Create applications based on code reusability
- 3. Develop programs using threads
- 4. Develop and debug real time problems using exception handling
- 5. Using IDE, create interactive applications using event handling mechanisms
- 6. Design Graphical User Interface using AWT components and Applets

# 16CS309 Database Management Systems Lab

# **Course Outcomes**

- 1. Illustrate ER model and identify the roles and privileges of various users in a database
- 2. Apply common SQL statements including DDL, DML and DCL statements to perform different operations
- 3. Construct SQL Queries for various operations on database
- 4. Interpret Embedded and Nested Queries
- 5. Implement control statements in PL/SQL
- 6. Apply triggers and assertions to stop malicious operations on tables

# 16CSI01 Tibero ® DB

(Course designed and will be delivered by TMaxSoft, Bangalore) **Course Outcomes** 

- 1. Demonstrate and understanding of the relational data model
- 2. Performance analysis between Tibero® DB and Oracle DBMS

# 16CSI02 Data Modelling for Business Intelligence

# **Course Outcomes**

- 1. Understand DW architecture and different stages of data storage
- 2. Use normalization techniques to design OLTP and data warehouse
- 3. Design a data model for real life scenario

# 16MA405 Probability and Statistics

# **Course Outcomes:**

1. Understand basic probability axioms and apply Baye's theorem related to engineering problems.

- 2. Identify the suitable distribution among Binomial, Poisson, exponential, normal in engineering applications.
- 3. Make use of the sampling distribution of the sample mean in general situations, using the Central Limit Theorem.
- 4. Decide the null or alternative hypotheses using the suitable test statistic.
- 5. Apply the regression analysis to fit the curves.
- 6. Understand the methods and applications of Control charts like X-bar, p and R-charts

#### 16EC410 Microprocessors and Interfacing

#### **Course Outcomes**

- 1. Illustrate the internal working of a typical simple CPU including the utilization of the various hardware resources during the execution of instructions.
- 2. Implement memory chip and I/O chip interfacing to the 8086 microprocessor.
- 3. Interpret the architecture of 8086 processor, assembly language programming and interfacing with various modules.
- 4. Choose various I/O peripheral interfacing like ADC, DAC, Keyboard, stepper motor etc., with microprocessors using 8255 PPI.
- 5. Interface the 8086 interrupts and serial communication devices.
- 6. Use the concepts of microprocessors in real time and industrial applications.

### 16IT406 Operating Systems

#### **Course Outcomes**

- 1. Explain the concepts of process and implement CPU scheduling algorithms
- 2. Illustrate different problems and solutions related to process synchronization
- 3. Understand deadlock and use various algorithms to handle deadlocks
- 4. Understand various memory management mechanisms
- 5. Analyze various mechanisms used in virtual memory management
- 6. Analyze various file system and disk storage mechanisms

#### 16CS404 Software Engineering Course Outcomes

- 1. Understand the need of Software Life Cycle Models
- 2. Demonstrate the Requirements of the Software Systems process
- 3. Summarize the system models of software engineering
- 4. Choose appropriate software architecture style for real-time software projects
- 5. Analyze various testing techniques
- 6. Analyze Risk management and Software quality of the software products

#### 16CS405 Theory of Computation

#### **Course Outcomes**

- 1. Understand finite automata and regular expressions
- 2. Demonstrate the minimization of DFA, Mealy and Moore machines
- 3. Summarize context free grammar and construction of PDA
- 4. Understand Chomsky classification and design Turing machine
- 5. Summarize computability, decidability and complexity through problem solving
- 6. Apply working skills in theory and application of finite state machines in compiler design

16CS406 Web Technologies Course Outcomes

- 1. Understand HTML tags to design static web pages
- 2. Describe the basic concepts of Java Scripts to design dynamic web pages
- 3. Familiarize the concepts of PHP and AJAX
- 4. Develop interactive applications using Servlets and JSP
- 5. Demonstrate database connectivity
- 6. Select appropriate tools for designing dynamic and interactive web applications

### 16EC411 Microprocessors and Interfacing Lab

#### **Course Outcomes**

- 1. Illustrate the arithmetic operations, procedures and macros.
- 2. Design real time applications with microprocessors.
- 3. Design the PC based communication circuits using serial bus connection.
- 4. Explain the full internal workings of a typical simple CPU including the utilization of the various hardware resources during the execution of instructions.
- 5. Outline the design of basic I/O hardware and microprocessor interfacing: memory chip selection, memory expansion, I/O interfacing.
- 6. Use microprocessors chips to control Traffic lights signals

# 16CS408 Linux Programming Lab

#### **Course Outcomes**

- 1. Illustrate the knowledge of the basics of Unix/Linux commands
- 2. Apply the concepts of shell scripting on data and files
- 3. Understand the utility of SED to work on specific data
- 4. Apply the Inter Process Communication in Linux environment
- 5. Develop a simple communication application to communicate using TCP/UDP client server model
- 6. Develop solutions to real-world problems

# 16CS409 Web Technologies Lab

#### **Course Outcomes**

- 1. Create a static web pages using HTML and CSS
- 2. Develop JavaScript code for data validation
- 3. Integrate frontend and backend technologies in client-server systems
- 4. Demonstrate Servlet life cycle methods
- 5. Design dynamic web applications using PHP and JSP
- 6. Demonstrate database connectivity for developing web applications

#### 16IT404 Computer Networks

- 1. Understand the basic network infrastructure to learn the overall function of networking systems
- 2. Classify various wired and wireless transmission media for data communication networks
- 3. Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission
- 4. Compare various routing algorithm and select an appropriate one for a routing design
- 5. Design a network routing for IP networks
- 6. Understand the internal functionalities of main protocols such as HTTP, FTP, SMTP, TCP, UDP, IP

#### 16IT505 Object Oriented Analysis and Design

#### **Course Outcomes**

- 1. Understand Unified Modelling Language and Rational Rose for object oriented modelling
- 2. Illustrate the conceptual model of UML
- 3. Represent Behavioral diagrams in UML
- 4. Identify the basic and advanced structural diagrams
- 5. Relate forward and reverse engineering for a software system
- 6. Assess the architectural modelling of UML

# 16IT602 Artificial Intelligence

#### **Course outcomes**

- 1. Interprets different types of AI agents
- 2. Identify various AI search algorithms (Un-informed, Informed, Heuristic, Constraint Satisfaction, Genetic Algorithms) for e-domain application systems
- 3. Compare fundamentals of knowledge representation (Logic-based, Frame-based, Semantic Nets), Inference and Theorem proving
- 4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
- 5. Apply knowledge representation, reasoning and machine learning techniques to realtime application systems
- 6. Understand independent (or in a small group) research and communicate it effectively in a seminar setting

#### 16CS504 Compiler Design Course Outcomes

- 1. Explain different translators and acquire knowledge of compiler & its Phases
- 2. Identify formal grammars for specifying the syntax and Semantics of programming languages
- 3. Construct parse table for a given grammar
- 4. Generate symbol table and intermediate code for a given program
- 5. Apply code optimization techniques to improve the performance of a program
- 6. Identify tools to construct the machine independent code

#### 16CS505 Design and Analysis of algorithms Course Outcomes

- 1. Understand the fundamentals for analyzing time and space complexity of algorithms
- 2. Describe the basic principles of various algorithms and design techniques
- 3. Apply appropriate algorithm design technique to solve real time application
- 4. Identify suitable method to solve optimization problem
- 5. Understand P and NP problems
- 6. Analyze the performance of algorithm designed for real time application

# 16IT409 Computer Networks Lab

- 1. Demonstrate various networking devices to design a network
- 2. Examine various routing algorithms for reliable data communication networks
- 3. Categorize the algorithms for data link layer

- 4. Analyze the communication parameters of routing algorithms
- 5. Use TCP protocol to configure the network connection
- 6. Use internal modem and Wi-Fi to analyze the data communication

#### 16HSX04 Engineering economics and project management Course Outcomes

- 1. Explain the basic principles of engineering economics
- 2. Apply cost-volume-profit (CVP) analysis in their business decision making
- 3. Evaluate investment proposals through various capital budgeting methods
- 4. Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- 5. Analyze key issues of organization, management and administration
- 6. Evaluate project for accurate cost estimates and plan future activities

# 16CS602 Data Mining

#### **Course Outcomes**

- 1. Understand the stages of KDD process and detailed architecture of Data Warehouse and data preprocessing
- 2. Discover and measure interesting patterns from different kinds of databases
- 3. Use association rule mining algorithms to generate association rules
- 4. Choose appropriate classification technique for a given dataset
- 5. Analyze clustering techniques on a given dataset
- 6. Demonstrate capacity to perform a self-directed piece of practical work that requires the application of data mining techniques

#### 16CS603 Internet of Things

#### **Course Outcomes:**

On completion of this course the students are able to:

- **CO1:** Understand IoT framework, architecture and design principles of M2M Communication
- **CO2:** Understand the design principles of Web and Internet Connectivity and its protocols

CO3: Understand MAC and IP addressing in IoT, 6LowPAN and LoRaWAN protocols

- **CO4:** Identify the suitable sensor technology for data collection and how to store and use it for Computing
- **CO5:** Develop business models in IoT by identifying vulnerabilities and attacks involving in IoT

**CO6:** Demonstrate an application using IoT technology

#### 16CS604 Mobile Computing

- 1. Use wireless networking principles to understand the fundamentals of mobile telecommunication systems and standards
- 2. Illustrate the basic concepts, techniques, protocols related to GSM and GPRS architecture to perform requirements analysis
- 3. Explain major components of Mobile IP to improve the service qualities of a network
- 4. Analyze various ad hoc routing protocols to examine the performance of network.
- 5. Explain the architecture of Wireless Sensor Network and Wireless LAN to learn the key objectives of design issues and limitation.

**6.** Outline the basic knowledge in developing smartphone applications using various platforms, toolkits, APIs and third-party libraries

### 16CS607 IoT Lab

### **Course Outcomes:**

On completion of this course the students are able to:

**CO1:** Study of various sensory elements and the required hardware and software used in IoT

- **CO2:** Implement the interfacing methods with MCU
- **CO3:** Implement the communication techniques used for IoT
- **CO4:** Demonstrate the data acquisition by interfacing with various Sensors with MCU
- **CO5:** Develop WSN application with different network topologies
- **CO6:** Design and develop IoT application with/without the involvement of cloud computing

# 16IT001 Information System Design

#### **Course Outcomes**

- 1. Define the concepts and definition of the information systems
- 2. Differentiate between several types of information system
- 3. Identify the threats to information security
- 4. Show how to protect information recourses
- 5. Differentiate between transaction processing system and functional area information system
- 6. Show how to maintaining and protecting information system

# 16CS001 Computer Graphics & Multimedia

#### **Course Outcomes**

- 1. Demonstrate the contemporary graphics hardware-the actual methodology and techniques to draw computer graphics-animations etc. for the real world presentation and how it is implemented in Computer graphics software and various applications of computer graphics.
- 2. Apply algorithms for rasterization and clipping of 2D graphic primitives and filling of closed regions and understand the basic 2D and 3D Transformations such as translation-rotation and scaling.
- 3. Identify the usage of various clipping algorithms
- 4. Analyze algorithms for visible surface detection and various projection types.
- 5. Demonstrate the ability to develop an animation movie.
- 6. Summarize the introductory concepts in multimedia processing

# 16CS002 Software Design Patterns

- 1. Understand different phases in objective oriented paradigm
- 2. Illustrate software design and management for various life cycle models
- 3. Use object oriented design tools to design a projects based on object oriented software engineering
- 4. Represent software specification document to learn the importance of software modeling concepts
- 5. Use formal techniques to design a suitable usecase modeling system
- 6. Use software testing tools to develop an effective software engineering project

## 16CS003 Qualitative Data Analysis

#### **Course Outcomes**

- 1. Describe various styles of interpretation of qualitative data
- 2. Explain the relative appropriateness of different analysis approaches for a particular qualitative study
- 3. Apply one or more analytic approaches to data they have collected and write an analysis paper
- 4. Describe special issues in ethics for qualitative research
- 5. Develop qualitative data files effectively to ensure ease of use and participant confidentiality
- 6. Illustrate the basic and intermediate functions of software program for coding of textual data

# 16CS004 Real Time Operating Systems

#### **Course Outcomes**

- 1. Understand various real time application systems to learn the important aspects of safety and reliability
- 2. Explain the scheduling processes of real-time systems to learn resource handling, sharing and dependencies among real-time tasks
- 3. Use periodic scheduling to adopt the design objectives of real time platform
- 4. Analyze real-time tasks scheduling in multiprocessor and distributed systems
- 5. Explain features of real time operating system to study the importance of multitasking techniques
- 6. Use real time database and communication to review the basic concepts of real-time database

#### 16CS005 Service Oriented Architecture

#### **Course Outcomes**

- 1. Explain the fundamental process of service oriented architecture to analyze the importance of distributed internet architecture.
- 2. Analyze various web services to study the importance of business derivatives
- 3. Use service oriented design to develop an application specific system
- 4. Summarize SOA platform basics and SOA support
- 5. Apply various application packages to develop a better interoperable web platform
- 6. Understand web service enhancement to review the basic concepts of web security and policy

# 16CS006 Computational Intelligence (Open Elective)

- 1. Identify an appropriate soft computing technique to build an Intelligent Machine
- 2. Understand supervised learning methods for neural network models for pattern classification and regression problems
- 3. Demonstrate the use of back propagation algorithm to develop multi layer feed forward neural networks
- 4. Understand unsupervised learning methods for neural network models for storing and pattern classification
- 5. Determine the solutions of modeled networks using soft computing approaches for a given problem
- 6. Explain fuzzy logic to handle uncertainty

## 16CS007 IoT for Engineering Applications (Common to CH, CE, EE, EC, ME & PE) Course Outcomes

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things.
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem
- 6. Apply IoT for various engineering applications

## 16IT701 Big Data Analytics

## **Course Outcomes:**

- 1. Understand the limitations in SQL
- 2. Identify the concepts and advantages of DDBMS
- 3. Identify challenges of Big data and its existing technologies
- 4. Use UNIX and HDFS commands
- 5. Analyze data using Map-Reduce framework
- 6. Exemplify concepts of R Programming

## 16IT705 Big Data Analytics Lab

#### **Course Outcomes**

- 1. Demonstrate the HDFS commands
- 2. Implement HADOOP with Map-Reduce
- 3. Use Apache Pig for analytics framework
- 4. Demonstrate HIVE QL
- 5. Compute the Page-Rank using Pig
- 6. Implement Map-Reduce programs for data analysis

#### 16CS705 Mobile Application Development Lab Course Outcomes

- 1. Apply mobile application models/architectures and patterns to the development of a mobile software application.
- 2. Demonstrate the components and structure of a mobile development framework (Google's Android Studio).
- 3. Apply essential Android Programming concepts.
- 4. Develop various Android applications related to layouts & rich uses interactive interfaces
- 5. Develop Android applications related to mobile related server-less database like SQLITE
- 6. Apply a mobile development framework to the development of a mobile application.

#### 16EC602 Digital Signal Processing Course Outcomes

1. Classify Discrete time signals and systems

- 2. Execute Z transform on different systems and represent with realization technique
- 3. Implement discrete Fourier transform and Fast Fourier transform on time domain signals
- 4. Implement FIR and IIR digital filters with given specifications and find the frequency response
- 5. Demonstrate Multirate signal processing
- 6. Differentiate the architecture of Digital signal processors

## 16IT006 Human Computer Interaction

## **Course Outcomes**

- 1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
- 2. Interpret typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
- 3. Apply an interactive design process and universal design principles to designing HCI systems
- 4. Make use of HCI design principles, standards and guidelines.
- 5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
- 6. Analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

## 16IT003 Information Retrieval Systems

## **Course Outcomes**

- 1. Learn Classical and advanced techniques employed by Web Search engines
- 2. Know different ways of representation and retrieval of documents.
- 3. Apply techniques of preprocessing needed for IRS
- 4. Apply the techniques of clustering on unstructured data
- 5. Apply indexing methods for fast retrieval from Document data.
- 6. Develop an IRS by using different user search techniques and text search algorithms

## 16CS008 Software Project Management Course Outcomes:

- 1. Understand the concepts and issues of Software Project Management.
- 2. Explain various Software Architectures.
- 3. Analyze Software Risks and Risk Management Strategies.
- 4. Design effective software development model to meet organizational needs.
- 5. Apply appropriate methodologies to develop a project schedule.
- 6. Apply appropriate techniques to assess ongoing project performance

## 16IT002 Distributed Systems

- 1. Learn the core concepts underlying distributed systems designs.
- 2. Identify entities and resources in distributed systems
- 3. Examine the naming conventions in distributed systems

- 4. Apply and compare the various communication mechanisms in distributed systems.
- 5. Identify issues on how to coordinate multiple tasks in a distributed system.
- 6. Identify issues on how to synchronize multiple tasks in a distributed system

## 16IT007 Middleware Technologies Course Outcomes

- At the end of the course students are able to:
- 1. Choose appropriate client server computing model for given problem.
- 2. Interpret dynamic remote application with RMI and JDBC Connectivity.
- 3. Understand client server applications using C#.net
- 4. Select appropriate language for homogeneous and heterogeneous objects.
- 5. Apply the concept of CORBA and database interfacing in real time projects.
- 6. Analyze appropriate middleware technology to develop real time applications

#### 16IT009 Cryptography and Network Security Course Outcomes

- 1. Understand theory of fundamental cryptography, encryption and decryption algorithms
- 2. Understand the symmetric and public key cryptographic algorithms
- 3. Explain the various authentication applications
- 4. Comprehend different mechanisms related to network security
- 5. Interpret the functionalities of IP Security
- 6. Describe the functionalities of firewalls

## 16CS009 Social Network Analysis

#### **Course Outcomes**

- 1. Acquire Knowledge to analyze Social Networks
- 2. Model, Aggregate and Represent Knowledge for Semantic Web
- 3. Use Extraction and Mining tools for Social Networks
- 4. Apply Reality Mining to Predict Human Behaviour for Social Communities
- 5. Apply various Algorithms for Evolution and Opinion Mining in Social Networks
- 6. Write algorithms and systems for expert location in social networks

## 16IT802 Professional Ethics

## **Course Outcomes**

- 1. Understand the importance of ethics in person and IT environment
- 2. Infer the management of security vulnerabilities and action plan on security incident.
- 3. Identify the right of privacy and laws of protection for privacy of data.
- 4. Exemplify the intellectual property and rights.
- 5. Interpret the concepts of intellectual property and ethical issues of software manufacturers,
- 6. Summarize the key ethical issues with the use of social networking and impact of IT on living

## 16CS802 Machine Learning

#### **Course Outcomes:**

1. Understand a wide variety of learning algorithms.

- 2. Understand how to apply a variety of learning algorithms to data using various tools of Machine Learning.
- 3. Identify the strengths and weaknesses of many popular machine learning approaches.
- 4. Analyze the performance of learning algorithms and model selection.
- 5. Identify mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
- 6. Apply Artificial Neural Networks and Deep Neural Networks in solving complex real world problems

## 16EC005 Digital Image Processing

## **Course Outcomes**

- 1. Interpret fundamental concepts of digital image
- 2. Infer image transforms
- 3. Exemplify image enhancement and color image processing
- 4. Assess image restoration techniques
- 5. Summarize line, point, threshold and region based segmentation for digital images
- 6. Attribute various compression models and compression techniques for digital images

# 16IT010 Computer Forensics (Elective VI)

## **Course Outcomes**

- 1. Understand the real time computer forensic issue.
- 2. Understand data recovery, forensics lab certification and physical requirements.
- 3. Identify different storage formats for data acquisition.
- 4. Analyze various data acquisition tools for collecting digital evidence.
- 5. Apply various strategies to secure digital evidences.
- 6. Identify and apply various computer forensics tools to solve the computer forensic cases.

## 16IT011 E&M-Commerce (Elective VI)

## **Course Outcomes**

- 1. Identify E commerce principles in market place.
- 2. Understand different business models for e-commerce
- 3. Identify M commerce principles to various business domains
- 4. Understand the Framework Of Mobile Commerce
- 5. Get an exposure to current technological advancements in M-commerce.
- 6. Analyze security issues in E commerce business models.

#### 16IT504 Cloud Computing(Elective VI) Course Outcomes

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions.
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
- 4. Analyze cloud provider for a defined environment and to a specific platform in a cost effective way.

- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications
- 6. Build a virtual machine with a machine image

## 16CS010 Multimedia Databases (Elective VI) Course Outcomes

- 1. Analyse the issues and Apply techniques for building effective Multimedia Database Systems
- 2. Implement temporal database design techniques on past and current data
- 3. Apply Spatial Query Languages on Spatial databases
- 4. Analyze Text Types and Document Retrievals and Image DBs with Relations and R-Tree
- 5. Apply Handling techniques of Audio and video Databases
- 6. Apply Query Languages for Retrieving Multimedia Data with Multidimensional Data structures

#### 16CS011 Wireless Adhoc Network (Elective VI) Course Outcomes

- 1. Understand the various challenging issues of wireless Ad hoc networks
- 2. Apply the MAC protocols using reservation and scheduling mechanism
- 3. Apply the routing protocols and transport layer protocol using various TCS mechanism in wireless Ad hoc networks
- 4. Understand the issues of MAC and network layer solution to provide quality of service
- 5. Understand the significances of various battery management schemes for wireless Ad hoc networks
- 6. Analyze the security requirements and secure routing in wireless Ad hoc networks

## 16IT012 Data Analytics I (Contemporary Course)

## **Course Outcomes**

- 1. Identify R
- 2. Make use of function R
- 3. Summarize Data
- 4. Work on Probability.
- 5. Interpret NOSQL
- 6. Solve Engineering Issues and Create Business Models

#### 16IT013 Data Analytics-II (Contemporary Course) Course Outcomes

- 1. Design data architecture and familiarize various data sources and data management
- 2: Identify the export of data sources
- 3: Know the basics of Big Data Tools
- 4: Identify the standard reporting and compliance, decision Models
- 5: Identify the outlier and elimination
- 6: Prepare data for analysis.

#### 16IT014 Data Analytics-III (Contemporary Course) Course Outcomes

- 1. Describe the business processes involved in marketing and customer relationship management and explain the role of analytical and predictive tools in these processes.
- 2. Analyze the import of predictive analytics on the organization
- 3. Implement data mining and machine learning techniques using a high-level programming.
- 4. design and analyze appropriate predictive models
- 5. Understand how best to apply Analytics methods and techniques in addressing strategic business problems
- 6. Conduct an in-depth analysis of a strategic business problems

## 16CS013Security Analyst II (Contemporary Course)

## Prescribed by NASSCOM

## **Course Outcomes:**

At the end of the course students will be able to:

- 1. Suggest appropriatesecurity metrics used for individual/organization
- 2. Implement various security audit used to find vulnerabilities/threats.
- 3. Implementation of various vulnerability management methods.
- 4. Implementation of configuration reviews.
- 5. Propose and implement appropriate security policy for individual/organization

## 16CS014 Security Analyst III(Contemporary Course)

Prescribed by NASSCOM

## **Course Outcomes:**

At the end of the course students will be able to:

- 1. Suggest appropriate security management system for individual/organization
- 2. Outline various techniques for configuring network devices.
- 3. Explain various techniques for configuring router.
- 4. Examine different information security Incident management methods.
- 5. Investigate various data backup methods **& malicious code anomalies**.
- 6. Asses suitable method to handle network security & malicious code incidents

## 16IT016 Enterprise Application Development Using IBM RAD & Bluemix Course Outcomes

- 1. Master the fundamentals of website development, such as HTML5, Servlet,JSP with MVC Architecture
- 2. Use fundamental skills to maintain web server required to host a website
- 3. Build dynamic, database-driven web applications, such as use of a IBM RAD, to develop robust online programs
- 4. Implement core concepts of database connectivity
- 5. Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in the common web implementation
- 6. Design, code, publish, deployment of web applications on IBM Bluemix

## 16IT017 IBM's Big Data Analytics with Hadoop platform

- 1. Identify the concept and challenges of big data and its existing technologies.
- 2. Understand Big Data and Hadoop ecosystem
- 3. Understand Hadoop Distributed File System (HDFS)

- 4. Design and implement of Hive and Sqoop scripts
- 5. Apply and handle MapReduce programs and Pig Scripts
- 6. UseBig SQL and Big R Programming

#### 16IT018 Foundation course in Security Identity and Access management Course Outcomes

- 1. Identify the need of ISIM in Organization.
- 2. Manage users, accounts and resources in Organization
- 3. Create, Manage and configure services, policies and workflows as per business requirements.
- 4. The requirement of IBM security Access manager in the Organization
- 5. Describe the purpose of junctions, enable web protection and auditing and tracking of users
- 6. Manage users groups and Policies

## **Chemical Engineering**

#### **Course Outcomes**

#### Course name : 16CY303 Physical & Analytical Chemistry

#### **Course Outcomes**

- 1. Understand the principles and applications of distribution law
- 2. Explain the importance of colligative properties of dilute solutions
- 3. Apply the fundamental concepts of colloidal chemistry to industrial needs and process engineering
- 4. Evaluate the quality of products in industry by using spectroscopic principles
- 5. Select a chromatographic instrument and test a given sample
- 6. Utilize GC, HPLC and other chromatographic techniques in pharmaceutical industry & forensic industry for identification and isolation of products

#### **16CSX01 Object Oriented Programming**

#### **Course Outcomes**

- 1. Apply object oriented concepts to real world problems
- 2. Develop applications using different types of inheritances
- 3. Create and use user defined packages
- 4. Analyze and recover runtime exceptions arise in the applications
- 5. Apply parallel processing applications using threads
- 6. Develop internet based interactive applications using peripheral functions

#### **16CH303 Chemical Engineering Thermodynamics**

#### **Course Outcomes**

- 1. Explain the basic concepts and laws of chemical engineering thermodynamics
- 2. Make use of first law of thermodynamics to find heat, work & changes in internal energy and enthalpy
- 3. Apply the second law of thermodynamics & concept of entropy to analyze ideal & real systems
- 4. Compare and explain the different refrigeration and liquefaction processes
- 5. Apply equation of state to evaluate thermodynamic properties
- 6. Apply first and second law of thermodynamics to specific processes viz., pipe flow, nozzles, expansion and compression

#### **16CH304 Chemical Process Calculations**

#### **Course Outcomes**

- Make use of different methods expressing composition of mixture (molarity, normality, ppm, moles per volume and mass per volume) 2. Apply the behavior of ideal gas equation to bring the relation between temperature and pressure for pure component & solutions
- 2. Solve heating and cooling problems involving moist air
- 3. Analyze material balance calculations for steady state unit operations and process
- 4. Analyze enthalpy balance for a reactive and nonreactive systems
- 5. Make use of material & energy balance concept to combustion calculations

#### **16CH305** Introduction to Chemical Engineering

#### **Course Outcomes**

- 1. Identify and describe typical aspects within chemical engineering
- 2. Develop simple flow sheets, block diagrams of basic chemical processes along with material balance
- Explain fundamental laws and concepts transfer operations and reaction engineering
   Familiarize professional ethics and Human Values
- 4. Develop a set of beliefs, attitudes, and habits that engineers should display concerning morality
- 5. Understand the moral values that ought to guide the Engineering profession

#### **16CH306 Process Instrumentation**

#### **Course Outcomes**

- 1. Explain the functions of elements in measuring instruments
- 2. Illustrate the operation of temperature measuring instruments used in industries
- 3. Choose suitable pressure measuring devices for different ranges of pressure
- 4. Select the suitable level measuring devices for open and closed vessels
- 5. Classify the various flow measuring devices for industrial operations.
- 6. Illustrate the operation of flow measuring instruments used in industries

#### 16CH307 Computational Tools for Chemical Engineers

#### **Course Outcomes**

1. Illustrate the use of programming language in handling of arrays, matrices and plots

- 2. Demonstrate the use of scripts and functions
- 3. Execute the programs using relational and logical operators
- 4. Compute the properties of a given compound using any computational tool
- 5. Use any computational tool to solve equation of state
- 6. Use any computational tool to solve material balance and energy balance problems

## 16CH308 Instrumentation Lab

#### **Course Outcomes**

- 1. Evaluate the precision of pressure and temperature detectors
- 2. Appraise the sensors like pressure gauges, temperature detectors and LVDT
- 3. Explain the working and operation of the sensors
- 4. Demonstrate the analytical systems usage and estimate the process variables
- 5. Inspect the working of different signal receivers
- 6. Function effectively in both single-team and also able to communicate verbal, written and graphical

## 16CY304 Physical & Analytical Chemistry Lab

## **Course Outcomes**

- 1. Interpret the kinetics of reactions and thereby design the process
- 2. Interpret the dynamics of distribution process that will be applicable in manufacturing industries
- 3. Utilize the adsorption and gravimetric methods of analysis in industry
- 4. Experiment with modern analytical instruments which are used in industries for monitoring & process control, quality testing etc
- 5. Apply the knowledge of chromatographic techniques for isolation and identification of compounds
- 6. Determine the air quality at industrial/domestic areas

## 16MA303 Engineering Mathematics III

## **Course Outcomes**

- 1. Utilize numerical techniques to find approximate solutions of non-linear Algebraic equations
- 2. Understand the concepts of interpolation, extrapolation to estimate the unknown functional values
- 3. Make use of method of least squares to fit a best curve for the given data
- 4. Find approximate values of derivatives and finite integrals using numerical techniques
- 5. Understand basic probability axioms and apply Baye's theorem related to engineering problems
- 6. Identify the suitable distribution among Binomial, Poisson, normal to compute probabilities

## **16CY405 Organic Chemistry**

- 1. Understand the basic principles of organic chemistry
- 2. Differentiate between electrophilic and nucleophillic reactions
- 3. Apply the concepts of named reactions in synthetic organic chemistry
- 4. Understand the preparation and uses of various heterocyclic compounds including dyes
- 5. Familiarize with the preparation and application of important polymers and synthetic rubber

6. Outline the preparation and application of important industrial chemicals and synthetic drugs

## 16CH403 Mechanical Unit Operations

## **Course Outcomes**

- 1. Summarize the characterization of particulate solids and explain the phenomenon of screening
- 2. Identify physico-chemical methods for the separation of heterogeneous mixtures
- **3.** Determine the filter medium resistance and specific cake resistance 4. Select a suitable equipment for size reduction and mixing
- **4.** Select a dense media separation equipment for fluid-solid operations Estimate the power consumption of the equipments for mixing and size reduction operations

## 16CH404 Momentum Transfer

## **Course Outcomes**

- 1. Apply the principle of fluid statics to understand the working of manometers and decanters
- 2. Develop the continuity, momentum, and energy balance equations and to solve the fluid flow problems in pipes
- 3. Determine flow rates, pressure changes, minor and major head losses for viscous flows through pipes and channels.
- 4. Illustrate subsonic, sonic, supersonic, hypersonic flows with respect to Mach number
- 5. Explain the effect of forces acting on flow past immersed bodies and fluidization
- 6. Identify the appropriate fluid moving and metering machinery based on the process requirement

## 16CH405 Phase and Chemical Equilibria

## **Course Outcomes**

- 1. Estimate the thermodynamic properties, such as enthalpies, entropies, Gibbs energies, fugacity coefficients, and activity coefficients of pure fluids as well as fluid mixtures
- 2. Choose appropriate models for calculating phase equilibrium data
- 3. Estimate VLE data for ideal and non-ideal chemical mixtures
- 4. Solve VLE data using equation of state
- 5. Explain VLE diagrams for partially miscible and immiscible systems
- 6. Solve chemical reaction equilibrium related problems using thermodynamic principles

## 16CH406 Process Heat Transfer

## **Course Outcomes**

- 1. Solve steady state and Un-steady heat conduction problems in simple geometries
- 2. Find the rate of heat transfer in laminar and turbulent flow conditions without phase change
- 3. Illustrate the heat transfer processes involved in boiling and condensation
- 4. Explain the heat transfer by radiation between ideal, actual surfaces and enclosures 5. Illustrate the construction details for various types of heat exchangers
- 5. Outline the principles of evaporation and crystallization

## 16CH407 Mechanical Unit Operations Lab

## **Course Outcomes**

1. Analyze the basic methods of characterization of particles and bulk solids

- Determine various indices and verify the laws associated with various unit operations
   Calculate performance characteristics of a filter press, cyclones, flotation cells and clarifiers
- 3. Experiment the effectiveness of the crushers, mixers, sieves and filtration equipment
- 4. Examine the range of applicability of various unit operation equipment
- 5. Estimate the power consumption for various unit operation equipment

## 16CH408 Momentum Transfer Lab

#### **Course Outcomes**

- 1. Explain the Bernoulli's equation and its applications
- 2. Assess the rotameter with the actual discharge
- 3. Compare the variation in orifice and venturi coefficients
- 4. Examine the centrifugal pump about its efficiency
- **5.** Determine the frictional losses in flow through pipes by experiment and calculations
- **6.** Choose appropriate equipment both individually and in teams through proper communication

## 16CH409 Process Heat Transfer Lab

#### **Course Outcomes**

- 1. Apply Fourier's law of heat conduction in finding out the thermal conductivity of a given material
- 2. Compare the heat transfer coefficients and rate of heat transfer between natural and forced convection mechanism
- 3. Evaluate the efficiency of the pin fin in both natural and forced heat transfer operations
- 4. Apply Stefan–Boltzmann's law to find out Stefan Boltzmann constant & unknown body emissivity
- **5.** Identify different boiling regimes and evaluate the critical heat flux through pool boiling of water
- 6. Evaluate effectiveness of co-current and counter current heat exchanger

#### 16HSX04 Engineering Economics & Project Management

#### **Course Outcomes**

- 1. Explain basic principles of engineering economics
- 2. Apply cost-volume-profit (CVP) analysis in their business decision making
- 3. Evaluate investment proposals through various capital budgeting methods
- 4. Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- 5. Analyze key issues of organization, management and administration
- 6. Evaluate project for accurate cost estimates and plan future activities

## 16CH502 Chemical Technology

- 1. Demonstrate skills for the schematic representation of important unit operation/ unit processes
- 2. Illustrate chemical technologies used in the manufacturing of Chloro-alkalis & industrial gases
- 3. Interpret manufacturing process for sulfur, sulfuric acid and phosphoric acid
- 4. Explain organic chemical technologies involved in plant operations such as phenolformaldehyde and Styrene - Butadiene Rubber polymerizations
- 5. Construct flow diagram for the extraction and refining of vegetable oils and soaps

**6.** Explain the manufacturing operations for the production of natural products (sugar, pulp and paper)

## 16CH503 Homogeneous Reaction Engineering

## **Course Outcomes**

- 1. Classify various reaction types and understand fundamentals of kinetics including definitions of rate and forms of rate expressions
- 2. Analyze and interpret experimental data from batch reactors and determine the order of simple chemical reactions
- 3. Design and compare the performance of ideal reactors (batch, CSTR and PFR)
- 4. Develop skills to choose the right reactor among single, multiple, recycle reactor etc. schemes
- 5. Determine optimal ideal reactor design for multiple reactions for yield or selectivity
- 6. Predict reactor performance when the temperature is not uniform within the reactor

## 16CH504 Principles of Mass Transfer

## **Course Outcomes**

- 1. Identify the various modes of mass transfer and solve mass transfer rates in fluids
- 2. Compute diffusion coefficients fluids and solids
- 3. Formulate convective mass transfer coefficients & compute mass transfer rates
- 4. Interpret the equilibrium and construct operating line equations to steady state cascading system & compute number of theoretical plates by analytical solutions
- 5. Summarize construction, operation & differentiate various Gas–Liquid contacting equipment and estimate the number of transfer units/stages and height requirements for a packed/tray columns
- 6. Conclude investigations on diffusivity and mass transfer co-effients for fluids and interpret equilibrium data on solid liquid, liquid liquid & vapour liquid

## 16CH505 Process Dynamics & Control

## **Course Outcomes**

- 1. Explain the basic principles and elements of a process control system including digital controls
- 2. Implement dynamic mass and energy balance equations to find the transfer function of a system
- 3. Find the response of a first order, second order system to an input function
- 4. Predict the closed loop transfer function and its response with controllers like P, PI, PD and PID
- 5. Identify the stability of a control system by Routh test, Root locus and Bode criterion along with system tuning
- 6. Illustrate the importance and applications of advanced control strategies like cascade, smith predictor, feed forward control

## 16CH001 Elective I/CC Fertilizer Technology

## **Course Outcomes**

- 1. Elucidate type of fertilizer and raw materials available for fertilizer manufacturing.
- 2. Explain the various methods of ammonia synthesis.
- 3. Discuss the production methods for various Nitrogenous fertilizers with flow charts.
- 4. Explain the production methods for various Phosphatic fertilizers with flow charts.
- **5.** Explain the production methods for various Potassium fertilizers with flow charts.
- 6. Explain about various soil testing methods.

## 16CH002 Pharmaceutical Technology

#### **Course Outcomes**

- 1. Familiarize basic principles involved in the manufacturing of pharmaceuticals
- 2. Select the unit operations for the manufacturing of pharmaceutics
- 3. Illustrate hygiene and good manufacturing practices while preparing the final product stream
- 4. Summarize the aspects involved in the preparation of microbiological and animal products
- 5. Select analytical techniques for product analysis and quality control
- 6. Manage environmental impacts in the field of pharmaceuticals.

## 16CH003 Polymer Technology

#### **Course Outcomes**

- 1. Summarize the polymer classification and mechanism
- 2. Identify chemical formulas for common polymers and distinguish whether a polymer was likely synthesized via a condensation (step growth) or addition (chain) polymerization reaction
- 3. Calculate the extent of reaction required to reach a particular degree of polymerization reaction and the time required to reach that extent of reaction given appropriate rate constants
- 4. Determine the solubility of a polymer in a solvent given the Flory-Huggins interaction parameter
- 5. Identify and analyze data from experimental methods of measuring the radius of gyration, different molecular weight averages, and second virial coefficient for polymer solutions
- 6. Determine the volume fraction of crystallinity for a polymer sample and measure the glass transition temperature

## 16CH507 Process Control Lab

## **Course Outcomes**

- 1. Interpret the dynamic behavior of Physical systems and control systems
- 2. Evaluate the response and controllability of control systems
- 3. Select proper control valve to meet process needs
- 4. Make use of direct digital control systems and DCS systems in handling of industrial processes
- 5. Propose PID modes that effect controllability, speed of response the control systems
- 6. Function effectively in both single-team and also able to communicate verbal, written and graphical

## 16CH509/16CH510 Term Paper/Mini Project

#### **Course Outcomes**

- 1. Understand the need for switching systems and their evolution from analogue to digital.
- 2. Understand various signaling techniques used in telecommunication systems.
- 3. Familiarize with functions of OSI-ISO layers, switching at network layer, connecting devices at
- 4. physical layer.
- 5. Understand integrated networks and protocol frame formats of these networks

## 16CH601 Applications of Mass Transfer

#### **Course Outcomes**

- 1. Design humidifier& dehumidifier and classify humidification equipment
- 2. Design Absorption and stripping Columns by graphical and analytical methods
- 3. Design distillation column using McCabe–Thiele and Ponchon–Savarit methods and illustrate azeotropic& Extractive distillation
- 4. Evaluate number of theoretical stages for liquid–liquid and liquid-solid systems and classify the equipment used for unit operations
- 5. Estimate rate of drying and classify drying equipment Design steady state adsorber and its applications

#### 16CH602 Chemical Engineering Plant Design & Economics

#### **Course Outcomes**

- 1. Identify the general design considerations and steps in the process design, development of a successful project
- 2. Estimate fixed capital investment and total production cost
- 3. Make use of interests and taxes involved and ways and means of getting the capital requirements
- 4. Utilize different depreciation methods to find the present value of the equipment
- 5. Identify different profitability techniques and various alternatives for capital investments for important equipment in the project
- 6. Demonstrate the optimization techniques for process variables such as optimum pipe diameter, optimum production rates

#### 16CH603 Chemical Process Equipment Design

#### **Course Outcomes**

- 1. Develop a flow diagram and selection of materials for the for the given chemical process plant /equipment
- 2. Classify and design of internal and external pressure vessels
- 3. Design of heat exchangers using Kern and NTU method
- 4. Design of multiple effect evaporator system
- 5. Design of the plate and packed columns for the mass transfer operations
- 6. Identify suitable physical separation equipments e.g., Filters, cyclone separators

#### **16CH604 Heterogeneous Reaction Engineering**

#### **Course Outcomes**

- 1. Explain various non-idealities in reactor behavior and distinguish between various RTD curves
- 2. Predict the conversion in a non-ideal reactor using tracer information
- 3. Develop rate laws for heterogeneous reactions
- 4. Estimate the effects of diffusion, mass and heat transfer in catalyst pellet on reaction rate
- 5. Predict reactor performance when the observed reaction rate is significantly influenced by internal mass transfer in porous heterogeneous catalysis
- 6. Develop the rate-controlling model for heterogeneous non-catalytic reactions

#### 16CH004 Elective II Material Science and Engineering

- 1. Relate the structure-property of materials
- 2. Analyze structural defects and their effects on material properties
- 3. Interpret the phase diagram & phase transformation of steels and identify the appropriate material for process equipment
- 4. Summarize the strengthening mechanisms
- 5. Interpret the failure analysis and select appropriate materials or relevant corrosion protection schemes for corrosion resistance
- 6. Explain the basic aspects of engineering materials and their applications

#### **16CH005** Petroleum Refining and Petrochemicals

#### **Course Outcomes**

- 1. Outline the formation of crude oil and its pretreatment
- 2. Make use of the means of processing data including thermal properties
- 3. Compare the properties, tests and treatment methods for important petroleum products
- 4. Develop skills in drawing neat flow diagrams of different petroleum refining processes (cracking/reforming/alkylation/isomerization/hydrocracking etc.,) aimed at producing high value/demand products Illustrate detailed value addition process techniques using relavant flow diagrams. Develop skills in illustrating refinery value addition process techniques.
- 5. Outline and construct flow diagram for the manufacture of petrochemicals from methane
- 6. Describe the manufacturing operations for the production of petrochemicals from ethylene

#### **16CH006 Energy Engineering**

#### **Course Outcomes**

- 1. Explain the various conventional and non-conventional energy resources available, production and use
- 2. Discuss the sustainability in application of non-conventional energy resources
- 3. Identify the energy production from biological source
- 4. Elucidate the concept of fuel cells and future applications
- 5. Confer about the sources of Nuclear energy, production technology and its applications
- 6. Substantiate the Energy Storage and Distribution methodology for sustainability

#### **16CE007 Disaster Management**

#### **Course Outcomes**

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and prepreparedness tools for natural and manmade disasters
- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

#### 16EE004 Renewable Energy Sources

- 1. Summarize the principles of solar energy systems
- 2. Demonstrate the applications of solar energy system

- 3. Illustrate the working principles of wind and biomass energy systems
- 4. Interpret working principles of geothermal energy system
- 5. Summarize operation and classification of ocean , tidal, fuel cells, small hydro and magneto hydro energy system
- 6. Extend renewable energy sources to distributed generation & micro grids

## 16ME007 Principles of Entrepreneurship

#### **Course Outcomes**

- 1. Explain the role of entrepreneur in economic development
- 2. Demonstrate methods of generating ideas
- 3. Develop the business plan to start their own enterprise
- 4. Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- 5. Make financial plan for enterprise
- 6. Find the institutional support entrepreneurship

## **16EC004** Fundamentals of GPS

#### **Course Outcomes**

- 1. Summarize the history of GPS, NAVSTAR GPS
- 2. State the working principle of GPS, GNSSs
- 3. Outline GALILEO, GLONASS signal constellation details
- 4. Conclude about GPS segments, signal components, IRNSS specifications
- 5. Demonstrate GPS coordinate systems
- 6. Classify various datums and map projections

#### 16CS006 Computational Intelligence

#### **Course Outcomes**

- 1. Identify and describe Soft Computing Techniques and their roles in building Intelligent Machines
- 2. Apply Supervised Learning Networks in Machine Learning Problems
- 3. Illustrate the working of Associative memory networks
- 4. Apply Unsupervised Learning Networks in Machine Learning Problems
- 5. Apply Fuzzy Logic and Reasoning to handle Uncertainty and Solve Engineering Problem
- **6.** Apply Genetic Algorithms to solve Optimized Problems

#### **16CS007** IoT for Engineering Applications

#### **Course Outcomes**

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things.
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem
- 6. Apply IoT for various engineering applications

#### 16CH007 Industrial Safety and Hazard Management

- 1. Demonstrate the safety and ethical issues that may arise from industrial processes
- 2. Explain industrial hygiene practices and its procedures
- 3. Illustrate the toxic pathways and elimination of toxicity on bio organisms

- 4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them.
- 5. Choose a suitable method for prevention of fires and explosions
- 6. Evaluate the process and able to do Hazards Identification and risks Risk Assessment

## 16IT005 Fundamentals of Cloud Computing

#### **Course Outcomes**

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions.
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
- 4. Analyze cloud provider for a defined environment and to a specific platform in a cost effective way.
- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications
- 6. Build a virtual machine with a machine image

## 16PE006 Smart Grid Technology

#### **Course Outcomes**

- 1. Compare the basic difference between existing grid and smart grid
- 2. Explain perfect power system network (Including distributed and fully integrated systems)
- 3. Explain the importance of renewable energy systems and distributed energy resources in smart grids
- 4. Summarize the wide area monitoring system and advanced measuring technologies
- 5. Recall the technologies like Zigbee, HAN and NAN in smart grids
- **6.** Explain SCADA technology in modern power systems and to analyze the micro grid systems

## **16MA001** Computational Mathematics

## **Course Outcomes**

- 1. Apply the knowledge of finding roots of nonlinear equations and different errors in series approximations
- 2. Understand the consistency and inconsistency of linear system of equations
- 3. Evaluate the solution of Initial and Boundary value problems
- 4. Perform numerical differentiation and integration
- 5. Analyze the solution of PDEs under given conditions
- 6. Apply Knowledge of numerical techniques to Engineering problems

## 16CY001 Nano Science & Technology

- 1. Apply various chemical and physical methods for the synthesis of nanomaterials
- 2. Understand the properties of nano-materials and their applications in relation to bulk materials
- 3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
- 4. Characterize nano materials by powder XRD and microscopy techniques.

- **5.** 5. Understand structure, properties and applications of Fullerenes and Carbon nanotubes.
- **6.** Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis

## 16CH607 Chemical Reaction Engineering Lab

## **Course Outcomes**

- 1. Estimate rate constant by applying Arrhenius theorem
- 2. Estimate rate law parameters for a given reaction in a batch reactor by using two different methods
- 3. Determine the rate law parameters in a MFR&PFR for a given reaction
- 4. Estimate of residence time distribution in a MFR, PFR&PBR for a given reaction
- **5.** Find the residence time distribution by applying Non-ideal dispersion model in CSTRs in series
- **6.** Estimate mass transfer coefficients in mass transfer with and with-out chemical Reactions

## **16CH701 Process Modeling & Simulation**

#### **Course Outcomes**

- 1. Summarise the stages involved in the development of a process model
- 2. Construct and simulate a mathematical model for a simple flow systems
- 3. Construct and simulate mathematical models for various types of Heat exchange equipments
- 4. Construct and simulate mathematical models for various Mass transfer operations
- 5. Construct mathematical models for various types of reactors under specific conditions
- 6. Implement the simulation for the mathematical models developed for the CSTR and Batch reactors

## **16CH008 Elective IV Biochemical Engineering**

#### **Course Outcomes**

- 1. Illustrate the different cells and their use in biochemical processes
- 2. Explain the role of enzymes in kinetic analysis of biochemical reaction
- 3. Demonstrate the role of enzyme immobilization 4. Apply the basic concepts of thermodynamics, mass and energy balances, reaction kinetics and reactor design for biochemical processes
- **4.** Analyze bioreactors, upstream and downstream processes in production of bioproducts
- **5.** Demonstrate the fermentation process and its products for the latest industrial revolution

## 16CH009 Clean Process Technology

- 1. Summarize the concept of environmental sustainability, and the difference between pollution prevention vs. pollution control
- 2. Explain the concept of industrial ecology and its benefit
- 3. Describe cleaner production activities and its benefit
- 4. Describe the function of process internal solutions to minimize air pollution emissions (flue gas pollutants and VOC) and emissions through waste water discharges
- **5.** Explain the function of different process external methods to minimize pollutions to air or water.
- 6. Identify robust cleaner production procedures for the older and modern industries

#### **16CH010** Novel Separation Techniques

#### **Course Outcomes**

- 1. Explain different types of adsorptive separations and derive the equations for the same
- 2. Design the chromatographic columns
- 3. Classify and illustrate the pressure and concentration driven membrane processes
- 4. Illustrate the concepts of surfactant based separations
- 5. Examine physico-chemical aspects and applications of Super critical fluid extraction
- **6.** Explain the applicability of electric, magnetic and centrifugal separation processes for practical situations

#### **16ME011** Computational Fluid Dynamics

#### **Course Outcomes**

- 1. Define the basic principles of mathematics and numerical concepts of fluid dynamics.
- 2. Develop governing equations for a given fluid flow system
- 3. Adapt finite difference techniques for fluid flow models
- 4. Apply finite difference method for heat transfer problems
- 5. Solve computational fluid flow problems using finite volume techniques
- 6. Analyze complex fluid-flow systems using available modern CFD software's

#### **16CH011 Elective V Corrosion Engineering**

#### **Course Outcomes**

- 1. Summarize the electrochemical, environmental and metallurgical behavior of corroding systems
- 2. Justify electrochemical and metallurgical aspects in combating eight forms of corrosion
- 3. Choose the suitable testing procedures for corroding systems
- 4. Select suitable materials and methods to combat corrosion
- 5. Explain the polarization and the passivation behavior of corroding systems
- 6. Predict the corrosion behavior

## 16CH012 Fluidization Engineering

#### **Course Outcomes**

- 1. Explain the concept of fluidization behavior
- 2. Summarize the fluidization concept in process industries viz Drying and combustion
- 3. Compute pressure drop, bubble size, voidage, heat and mass transfer rates for the fluidized beds
- 4. Formulate suitable model equations for fluidized beds
- 5. Choose gas-solid fluidized bed reactors for given process
- 6. Use the heat and mass transfer concepts in fluidized bed

#### **16CH013 Fuel Technology**

#### **Course Outcomes**

- 1. Explain the various solid fuels available, its processing and storage
- 2. Illustrate the carbonization of coal and its by product recovery methods
- 3. Identify the liquid fuels and its purifications
- 4. Explain the various gaseous fuels, manufacturing and its properties
- 5. Summarize the Nuclear fuels and its applications
- 6. Enlist the components, types and applications of fuel cells

#### 16CH014 Introduction to Nanotechnology

- 1. Define the mechanism for stabilization of nano particles
- 2. Summarize various methods to synthesize nanoparticles
- 3. Exemplify one dimensional nanostructure
- 4. Summarize the fabrication of organic or inorganic-organic materials
- 5. 5. Summarize various methods to synthesize hybrid thin films
- **6.** Formulate carbon nanotubes

## 16CH704 Mass Transfer Operations Lab

## **Course Outcomes**

- 1. Justify Rayleigh's equation for a given batch distillation system
- 2. Compute the steam economy for immiscible system
- 3. Implement the cross current extraction process
- 4. Construct a batch drying curve
- 5. Demonstrate the principle of leaching
- 6. Select a suitable column for a given separation process

## **16CH705 Process Simulation Lab**

## **Course Outcomes**

- 1. Identify MATLAB/SCILAB as a simulating tool to solve chemical engineering problems
- 2. Execute steady state chemical engineering problems using MATLAB/SCILAB
- 3. Use the commercial simulation tools like ASPEN PLUS
- 4. Find the solutions using ASPEN/MATLAB for different ideal reactor systems
- 5. Demonstrate simulation for basic heat transfer equipment
- 6. Demonstrate simulation for basic mass transfer equipment

## 16CH801 Industrial Pollution Control Engineering

## **Course Outcomes**

- 1. Summarize different types of pollution viz. water and air
- 2. Assess the characteristics of wastewater viz. BOD and DO
- 3. Select a suitable wastewater treatment technique 4. Identify suitable sampling and control equipment for air pollutants
- **4.** Understand the safety and ethical issues that may arise from industrial processes and various methods available to study the accident and loss statistics
- 5. Understand the concepts of fires & explosions and associated terms

## 16CH802 Transport Phenomena

## **Course Outcomes**

- 1. Recognize the mechanisms of different transport processes
- 2. Use the equation of continuity, motion and energy 3. Implement the shell momentum balance equations for steady state flow problems
- 3. Use the time smoothed equation of continuity, motion and energy
- 4. Implement the shell energy balance equations for steady state heat transfer problems
- 5. Implement the shell mass balance equations for steady state mass transfer problems

## **16CH015 Elective VI/CC Chemical Engineering Mathematics**

- 1. Summarize the basic concepts in mathematical formulation of a model
- 2. Solve the ordinary differential and second order non linear qations
- 3. Formulate a chemical engineering problem as a mathematical model, and select an appropriate solution method

- 4. Use the knowledge of finite difference method to solve chemical engineering problems
- 5. Select a suitable iterative solution for algebraic equations
- 6. Select suitable statistical methods encountered in Heat and Mass Transfer

## 16CH016 Design and Analysis of Experiments

#### **Course Outcomes**

- 1. Predict how many numbers of experiments are to be carried out, given the number of important factors
- 2. Compute the factor levels that are used to optimize a given objective function
- 3. Demonstrate response surface methodology to optimize the process
- 4. Explain strategies in planning and conducting experiments
- 5. Choose an appropriate experiment to evaluate a new product design or process improvement
- 6. Use response surface methodology to optimize the process parameters

## 16CH017 Integrated Solid Waste Management

## **Course Outcomes**

- 1. Recognize the importance of integrated waste management and its legislations
- 2. Summarize physico-chemical & biologicaland hazardous waste characteristics and suggest suitable treatment methods
- 3. Implementengineered principles for handling and disposal ofsolid and hazardous wastes
- 4. Execute the principles of unit operations/process for the separation and processing of solid wastes for energy recovery and for producing biological products
- 5. Use scientific, engineering and economic principles in design of modern landfills
- 6. Generalise the current challenges mitigation associated with waste management in industrial settings

## **16CH018 Process Intensification**

## **Course Outcomes**

- 1. Explain the basic concepts involved in process intensification
- 2. Predict the model equations for spinning disc reactors
- 3. Construct the models for rotator and oscillatory systems
- 4. Choose most energy efficient and compact Heat Exchangers
- 5. Identify the rates of heat transfer, mass transfer and mixing applications in microreactors
- 6. Assess the value and limitations of process intensification, cleaner technologies and waste minimization options

## **16CH019 Process Optimization**

## **Course Outcomes**

- 1. Use the knowledge of optimization to formulate the problems
- 2. 2 Asses the optimization criterion for solving problems
- 3. 3 Implement different numerical methods for unconstrained optimization problems
- 4. 4 Execute simplex method for linear optimization problems
- 5. 5 Summarize advanced optimization techniques like Genetic algorithms
- 6. Formulate optimization problem for industrial case studies

## **16CH020 Scale-up Methods in Chemical Engineering**

#### **Course Outcomes**

- 1. Interpret any given chemical process and develop flow chart
- 2. 2 Formulate scale up equations to design appropriate equipment
- 3. 3 Select the scale up design based on flow concepts 4 Implement the scale up methods for a specific processviz homogeneous and solid-fluid reactor system
- 4. 5 Implement he scaleup concepts to design a specific unit operation viz mixing
- 5. Implement the scaleup concepts to design a specific unit operation vizcontinuous column

#### **Information Technology**

#### 16EC021 DATA COMMUNICATION SYSTEMS Course Outcomes

- 1. Illustrate fundamental concepts of data transmission and to understand the various modulation and demodulation techniques.
- 2. Outline the design, operation and capabilities of different transmission lines.
- 3. Interpret the technical specifications of electronic communication design.
- 4. Identify various Telephone instruments and their signaling systems.
- 5. Distinguish between various error detection and correction techniques.
- 6. Explain different synchronous and Asynchronous Data link protocols

#### 16CS304 Database Management Systems Course Outcomes

#### 1 Identify and define the data medal

- 1. Identify and define the data models needed to design a database
- 2. Create conceptual and logical database design for Large enterprises
- 3. Demonstrate the relational data model
- 4. Apply Integrity constrains over the relations
- 5. Apply normalization process on existing database for eliminating redundancy
- 6. Apply the recovery techniques for managing the database effectively to avoid the data lose

## 16CS305 Digital Logic Design

#### **Course Outcomes**

After undergoing the course students will be able to:

- 1. Recognize the conversion of one number system to other Number system
- 2. Classify different logic circuits by using Universal gates
- 3. Execute Boolean algebra and K-map as a tool to simplify and design logic circuits
- 4. Implement and analyze the operation of Combinational and Sequential Circuits
- 5. Check various types of sequential circuits like counters and universal Shift Registers
- 6. Differentiate between the Mealy and Moore machines

## 16CS306 Discrete Structures & Graph Theory

## **Course Outcomes**

1. Construct simple Mathematical proofs and possess the ability to verify them and comprehend Formal Logical Arguments via Propositional Logic and Predicate Logic

- 2. Identify the basic Mathematical objects such as sets-functions-and relations and also verify simple mathematical properties that these objects possess
- 3. Demonstrate the ability to describe computer programs in a Formal Mathematical manner using Recursive Functions
- 4. Apply basic Counting techniques to solve Combinatorial Problems
- 5. Apply various techniques of Mathematical Induction (weak strong and structural induction) to prove simple Mathematical properties of a variety of Discrete Structures
- 6. Demonstrate the Graphs and Trees as tools to visualize and simplify situations

#### 16IT305 Data Structures

#### **Course Outcomes**

- 1. Apply the data structure array for various list processing operations such as searching and sorting
- 2. Apply the data structures like arrays, linked structures, stacks, and queues to solve real world problems.
- 3. Explain the linked implementation, and its uses both in linear and non-linear data structure.
- 4. Design and implement an appropriate hashing function for an application.
- 5. Demonstrate and apply binary tree and height balanced binary trees to solve real world problems.
- 6. Demonstrate and apply different methods for traversing the graphs

#### 16IT306 Object Oriented Programming through Java Course Outcomes

- 1. Summarize object oriented programming concepts
- 2. Develop applications using different types of inheritances
- 3. Create and use user defined packages
- 4. Analyze and recover runtime exceptions arise in the applications
- 5. Apply parallel processing applications using threads
- 6. Develop interactive applications for standalone and Internet (applet)

#### 16CS309 Database Management Systems Lab Course Outcomes

- 1. Define the structure of SQL query
- 2. Experiment with different Data Base languages
- 3. Choose Database packages(Oracle/ MySql/ DB2/ etc)
- 4. Demonstrate the JDBC and ODBC Connections
- 5. Interpret Embedded and Nested Queries
- 6. Design and development of projects in DBMS

#### 16IT308 Data Structures Lab Course Outcomes

- 1. Apply the data structure array for various list processing operations such as searching and sorting
- 2. Implement array stack and queue data structures to solve various computing applications
- 3. Implement linked list data structure to solve various computing problems

- 4. Design and develop applications using appropriate hashing method
- 5. Demonstrate and apply binary tree and its applications
- 6. Demonstrate and apply different methods for traversing graphs

# 16IT309 Java Lab

## **Course Outcomes**

- 1. Make use of JAVA SDK environment to create debug and run java programs
- 2. Create applications based on code reusability
- 3. Develop programs using threads
- 4. Develop and debug real time problems using exception handling
- 5. Create interactive applications using event handling mechanisms
- 6. Design Graphical User Interface using AWT components

## 16CSI01 Tibero ® DB (One Credit Course)

(Course designed and will be delivered by TMaxSoft, Bangalore) **Course Outcomes** 

- 1. Demonstrate and understanding of the relational data model
- 2. Performance analysis between Tibero® DB and Oracle DBMS

## 16MA405 Probability and Statistics

#### **Course Outcomes**

- 1. Understand basic probability axioms and apply Baye's theorem related to engineering problems.
- 2. Identify the suitable distribution among Binomial, Poisson, exponential, normal in engineering applications.
- 3. Make use of the sampling distribution of the sample mean in general situations, using the Central Limit Theorem.
- 4. Decide the null or alternative hypotheses using the suitable test statistic.
- 5. Apply the regression analysis to fit the curves.
- 6. Understand the methods and applications of Control charts like X-bar, p and R-charts.

## 16CS404 Software Engineering

#### **Course Outcomes**

- 1. Understand the need of Software Life Cycle Models
- 2. Demonstrate the Requirements of the Software Systems process
- 3. Summarize the system models of software engineering
- 4. Choose appropriate software architecture style for real-time software projects
- 5. Analyze various testing techniques
- 6. Analyze Risk management and Software quality of the software products

## 16CS406 Web Technologies

- 1. Understand HTML tags to design static web pages
- 2. Describe the basic concepts of Java Scripts to design dynamic web pages
- 3. Familiarize the concepts of PHP and AJAX
- 4. Develop interactive applications using Servlets and JSP

- 5. Demonstrate database connectivity
- 6. Select appropriate tools for designing dynamic and interactive web applications

# 16IT404 Computer Networks

## Course Outcomes

- 1. Propose appropriate network model for data communication
- 2. Analyze various protocols in data link layer.
- 3. Analyze IEEE 802 series protocols.
- 4. Develop web applications for sending E-mail.
- 5. Propose and implement appropriate routing algorithm for data routing.
- 6. Extend the Internet connection to a given system and trouble shoots the same.

## 16IT405 Computer Organization

## **Course Outcomes**

- 1. Identify the different components of the computer system, their functions and their interconnections.
- 2. Demonstrate the various instruction formats that the processor follows.
- 3. How the control unit generates control signals to execute a particular instruction
- 4. How the memory system can be suitably designed to improve the performance of the computer.
- 5. Analyze how high speed computers can be designed by using the pipelining and multiprocessor
- 6. Illustrate data transfer between central computer and I/O devices may be handles in a variety of modes

## 16IT406 Operating Systems

#### **Course Outcomes**

- 1. Explain the concepts of process and implement CPU scheduling algorithms
- 2. Implement concurrency mechanisms
- 3. Implement various Algorithms to handle deadlocks
- 4. Design and analyze mechanisms used in memory management
- 5. Analyze and implement mechanisms used in virtual memory management
- 6. Analyze and implement various file system and disk storage mechanisms

## 16CS408 Linux Programming Lab

## **Course Outcomes**

- 1. Illustrate the knowledge of the basic principles of UNIX system calls
- 2. Illustrate the basic principles of UNIX IO system
- 3. Explain the concepts and principles and develop system-level software (e.g. compiler and networking software)
- 4. Apply the Inter Process Communication in UNIX Environment
- 5. Develop solutions to real-world problems
- 6. Develop a simple communication application to communicate with various systems in a LAN

# 16CS409 Web Technologies Lab

#### **Course Outcomes**

1. Create a static web pages using HTML and CSS

- 2. Develop JavaScript code for data validation
- 3. Integrate frontend and backend technologies in client-server systems
- 4. Demonstrate Servlet life cycle methods
- 5. Design dynamic web applications using PHP and JSP
- 6. Demonstrate database connectivity for developing web applications

## 16IT409 Computer Networks Lab

#### **Course Outcomes**

- 1. Demonstrate various networking devices to design a network
- 2. Examine various routing algorithms for reliable data communication networks
- 3. Categorize the algorithms for data link layer
- 4. Analyze the communication parameters of routing algorithms
- 5. Use TCP protocol to configure the network connection
- 6. Use internal modem and Wi-Fi to analyze the data communication

## 16ITI01 Ethical Hacking & Cyber Security (One Credit Course)

(Course designed and will be delivered by WebTek Labs, NewDelhi)

## **Course Outcomes**

- 1. Illustrate the ongoing developments in Computer and Ethical Hacking Basics related to information technologies
- 2. Explain cyber security and IT laws with related legislation relate to one another

## 16CS505 Design and Analysis of algorithms

## **Course Outcomes**

- 1. Understand the fundamentals for analyzing time and space complexity of algorithms
- 2. Describe the basic principles of various algorithms and design techniques
- 3. Apply appropriate algorithm design technique to solve real time application
- 4. Identify suitable method to solve optimization problem
- 5. Understand P and NP problems
- 6. Analyze the performance of algorithm designed for real time application

## 16CS604 Mobile Computing

## **Course Outcomes**

- 1. Use wireless networking principles to understand the fundamentals of mobile telecommunication systems and standards
- 2. Illustrate the basic concepts, techniques, protocols related to GSM and GPRS architecture to perform requirements analysis
- 3. Explain major components of Mobile IP to improve the service qualities of a network
- 4. Analyze various ad hoc routing protocols to examine the performance of network.
- 5. Explain the architecture of Wireless Sensor Network and Wireless LAN to learn the key objectives of design issues and limitation.
- **6.** Outline the basic knowledge in developing smartphone applications using various platforms, toolkits, APIs and third-party libraries

## 16IT503 Automata and Compiler Design

## **Course Outcomes**

1. Analyses and design finite automata, pushdown automata for the formal languages and grammars.

- 2. Apply working skills in theory and application of finite state machines in compiler design.
- 3. Demonstrate a compiler that includes all the phases of Compiler Design.
- 4. Show recursive descent-production rules-parsing-and language semantics in high level compilers.
- 5. Demonstrate the machine dependent and independent codes.
- 6. Judge the ideas-the techniques-and the knowledge acquired for the purpose of other software design

## 16IT504 Cloud Computing

#### **Course Outcomes**

- 1. Interpret the architecture and infrastructure models of cloud computing, strengths, and limitations of cloud computing.
- 2. Understand the virtualization concepts of machines and data centers.
- 3. Infer the design concepts of cloud ready applications
- 4. Compare different cloud centre's implementation
- 5. 5. Understand the concepts of cloud scaling and disaster recovery
- 6. 6. Interpret the security and risk issues in cloud computing

## 16IT505 Object Oriented Analysis and Design

#### **Course Outcomes**

- 1. Understand Unified Modelling Language and Rational Rose for object oriented modelling
- 2. Illustrate the conceptual model of UML
- 3. Represent Behavioral diagrams in UML
- 4. Identify the basic and advanced structural diagrams
- 5. Relate forward and reverse engineering for a software system
- 6. Assess the architectural modelling of UML

## 16IT507 Cloud Computing Lab

#### **Course Outcomes**

- 1. Demonstrate the types of cloud computing architecture
- 2. Create and Run virtual machines on open source OS
- 3. Implement Infrastructure as service using openStack
- 4. Implement storage as service using openStack
- 5. Study and Use of AWS
- 6. Study and Use of Microsoft Azure

#### 16ITI02 Ruby on Rails

(Course designed and will be delivered by Amzur technologies, Visakhapatnam) Intended Learning Outcomes

- 1. Illustrate different data types, packages and calling functions in Ruby on Rails
- 2. Analyze MVC framework and apply development best practices learning methods

## 16IT001 Information System Design (Elective I)

- 1. Define the concepts and definition of the information systems
- 2. Differentiate between several types of information system
- 3. Identify the threats to information security

- 4. Show how to protect information recourses
- 5. Differentiate between transaction processing system and functional area information system
- 6. Show how to maintaining and protecting information system

# 16CS001 Computer Graphics & Multimedia (Elective I)

## **Course Outcomes**

- 1. Demonstrate the contemporary graphics hardware-the actual methodology and techniques to draw computer graphics-animations etc. for the real world presentation and how it is implemented in Computer graphics software and various applications of computer graphics.
- 2. Apply algorithms for rasterization and clipping of 2D graphic primitives and filling of closed regions and understand the basic 2D and 3D Transformations such as translation-rotation and scaling.
- 3. Identify the usage of various clipping algorithms
- 4. Analyze algorithms for visible surface detection and various projection types.
- 5. Demonstrate the ability to develop an animation movie.
- 6. Summarize the introductory concepts in multimedia processing.

## 16CS004 Real Time Operating Systems

## **Course Outcomes**

- 1. Understand various real time application systems to learn the important aspects of safety and reliability
- 2. Explain the scheduling processes of real-time systems to learn resource handling, sharing and dependencies among real-time tasks
- 3. Use periodic scheduling to adopt the design objectives of real time platform
- 4. Analyze real-time tasks scheduling in multiprocessor and distributed systems
- 5. Explain features of real time operating system to study the importance of multitasking techniques
- 6. Use real time database and communication to review the basic concepts of real-time database

## 16HSX04 Engineering Economics and Project Management Course Outcomes

- 1. Explain basic principles of engineering economics
- 2. Apply cost-volume-profit (CVP) analysis in their business decision making
- 3. Evaluate investment proposals through various capital budgeting methods
- 4. Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- 5. Analyze key issues of organization, management and administration
- 6. Evaluate project for accurate cost estimates and plan future activities

## 16IT602 Artificial Intelligence

- 1. Interprets different types of AI agents
- 2. Identify various AI search algorithms (Un-informed, Informed, Heuristic, Constraint Satisfaction, Genetic Algorithms)

- 3. Compare fundamentals of knowledge representation (Logic-based, Frame-based, Semantic Nets), Inference and Theorem proving
- 4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
- 5. Apply knowledge representation, reasoning and machine learning techniques to realworld problems
- 6. Understand independent (or in a small group) research and communicate it effectively in a seminar setting

## 16CS602 Data Mining

## **Course Outcomes**

- 1. Understand the stages of KDD process and detailed architecture of Data Warehouse and data preprocessing
- 2. Discover and measure interesting patterns from different kinds of databases
- 3. Use association rule mining algorithms to generate association rules
- 4. Choose appropriate classification technique for a given dataset
- 5. Analyze clustering techniques on a given dataset
- 6. Demonstrate capacity to perform a self-directed piece of practical work that requires the application of data mining techniques

## 16CS603 Internet of Things

## **Course Outcomes:**

- 1. Understand IoT framework, architecture and design principles of M2M Communication
- 2. Understand the design principles of Web and Internet Connectivity and its protocols
- 3. Understand MAC and IP addressing in IoT, 6LowPAN and LoRaWAN protocols
- 4. Identify the suitable sensor technology for data collection and how to store and use it for Computing
- 5. Develop business models in IoT by identifying vulnerabilities and attacks involving in IoT
- 6. Demonstrate an application using IoT technology

## 16CS607 IoT Lab

## **Course Outcomes:**

On completion of this course the students are able to:

- 1. Study of various sensory elements and the required hardware and software used in IoT
- 2. Implement the interfacing methods with MCU
- 3. Implement the communication techniques used for IoT
- 4. Demonstrate the data acquisition by interfacing with various Sensors with MCU
- 5. Develop WSN application with different network topologies
- 6. Design and develop IoT application with/without the involvement of cloud computing

# 16IT002 Distributed System (Elective II)

- 1. Learn the core concepts underlying distributed systems designs.
- 2. Identify entities and resources in distributed systems
- 3. Examine the naming conventions in distributed systems

- 4. Apply and compare the various communication mechanisms in distributed systems.
- 5. Identify issues on how to coordinate multiple tasks in a distributed system.
- 6. Identify issues on how to synchronize multiple tasks in a distributed system

## 16IT003 Information Retrieval Systems (Elective II) Course Outcomes

- 1. Learn Classical and advanced techniques employed by Web Search engines
- 2. Know different ways of representation and retrieval of documents.
- 3. Apply techniques of preprocessing needed for IRS
- 4. Apply the techniques of clustering on unstructured data
- 5. Apply indexing methods for fast retrieval from Document data.
- 6. Develop an IRS by using different user search techniques and text search algorithms

#### 16IT004 Information Theory & Coding (Elective II) Course Outcomes

- 1. Demonstrate the basic concepts of information theory-source coding-channel and channel capacity-channel coding and relation among them.
- 2. Interpret the real life applications based on the fundamental theory.
- 3. Determine the entropy-channel capacity-bit error rate-code rate-steady-state probability and so on.
- 4. Compute the encoder and decoder of one block code or convolution code using any program language.
- 5. Conclude the information content of a random variable from its probability distribution.
- 6. Predict the efficient code for data on imperfect communication channels

## 16IT005 Fundamentals of Cloud Computing (Open Elective) Course Outcomes

- 1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- 2. Illustrate various problems and evaluate related cloud computing solutions.
- 3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
- 4. Analyze cloud provider for a defined environment and to a specific platform in a cost effective way.
- 5. Analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications
- 6. Build a virtual machine with a machine image

## 16CE007 Disaster Management (Open Elective)

- 1. Demonstrate the interdisciplinary nature of disaster management
- 2. Apply the knowledge to formulate different risk management frameworks and prepreparedness tools for natural and manmade disasters
- 3. Summarize the risk and vulnerability associated with disasters
- 4. Apply different technologies in the management of disasters
- 5. Outline the importance of education and preparedness in the management of disasters
- 6. Infer the role of different organizations in disaster management

# 16EE004 Renewable Energy Sources (Open Elective) Course Outcomes Course Outcomes

## **Course Outcomes**

- 1. Summarize the principles of solar energy systems
- 2. Demonstrate the applications of solar energy system
- 3. Illustrate the working principles of wind and biomass energy systems
- 4. Interpret working principles of geothermal energy system
- 5. Summarize operation and classification of ocean , tidal, fuel cells, small hydro and magneto hydro energy system
- 6. Extend renewable energy sources to distributed generation & micro grids

#### 16ME009 Principles of Entrepreneurship (Open Elective) Course Outcomes

- 1. Explain the role of entrepreneur in economic development
- 2. Demonstrate methods of generating ideas
- 3. Develop the business plan to start their own enterprise
- 4. Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- 5. Make financial plan for enterprise
- 6. Find the institutional support entrepreneurship

## 16EC004 Fundamentals of Global Positioning System (Open Elective) Course Outcomes

- 1. Summarize the history of GPS, NAVSTAR GPS
- 2. State the working principle of GPS, GNSSs
- 3. Outline GALILEO, GLONASS signal constellation details
- 4. Conclude about GPS segments, signal components, IRNSS specifications
- 5. Demonstrate GPS coordinate systems
- 6. Classify various datums and map projections

# 16CS006 Computational Intelligence (Open Elective)

## **Course Outcomes**

- 1. Identify an appropriate soft computing technique to build an Intelligent Machine
- 2. Understand supervised learning methods for neural network models for pattern classification and regression problems
- 3. Demonstrate the use of back propagation algorithm to develop multi-layer feed forward neural networks
- 4. Understand unsupervised learning methods for neural network models for storing and pattern classification
- 5. Determine the solutions of modeled networks using soft computing approaches for a given problem
- 6. Explain fuzzy logic to handle uncertainty

#### 16CS007 IoT for Engineering Applications (Open Elective) Course Outcomes

- 1. Understand the basic concepts of IoT
- 2. Summarize the structural knowledge of IoT
- 3. Explain M2M in the context of Internet of Things.
- 4. Describe the IoT Reference Architecture
- 5. Design the Internet of things systems for the given problem

6. Apply IoT for various engineering applications

## 16CH007 Industrial Safety and Hazard Management (Open Elective) Course Outcomes

- 1. Demonstrate the safety and ethical issues that may arise from industrial processes
- 2. Explain industrial hygiene practices and its procedures
- 3. Illustrate the toxic pathways and elimination of toxicity on bio organisms
- 4. Understand hazards arising from runaway reactions, explosions and fires, and how to deal with them.
- 5. Choose a suitable method for prevention of fires and explosions
- 6. Evaluate the process and able to do Hazards Identification and risks Risk Assessment

## 16PE007 Smart Grid Technology (Open Elective) Course Outcomes

- 1. Compare the basic difference between existing grid and smart grid
- 2. Explain perfect power system network (Including distributed and fully integrated systems)
- 3. Explain the importance of renewable energy systems and distributed energy resources in smart grids
- 4. Summarize the wide area monitoring system and advanced measuring technologies
- 5. Recall the technologies like Zigbee, HAN and NAN in smart grids
- 6. Explain SCADA technology in modern power systems and to analyze the micro grid systems

#### 16MA001 Computational Mathematics (Open Elective) Course Outcomes

- 1. Apply the knowledge of finding roots of nonlinear equations and different errors in
  - series approximations
- 2. Understand the consistency and inconsistency of linear system of equations
- 3. Evaluate the solution of Initial and Boundary value problems
- 4. Perform numerical differentiation and integration
- 5. Analyze the solution of PDEs under given conditions
- 6. Apply Knowledge of numerical techniques to Engineering problems

# 16CY001Nano Science and Technology (Open Elective)Course Outcomes

- 1. Apply various chemical and physical methods for the synthesis of nanomaterials
- 2. Understand the properties of nano-materials and their applications in relation to bulk materials
- 3. Describe the nano size effect on optical, electrical, magnetic and thermal properties
- 4. Characterize nano materials by powder XRD and microscopy techniques.
- 5. Understand structure, properties and applications of Fullerenes and Carbon nanotubes.
- 6. Review the applications of nanomaterials, specially semiconducting metal oxides for sensing and catalysis

#### 16IT012 Data Analytics I (Contemporary Course) Course Outcomes

- 1. Identify R
- 2. Make use of function R
- 3. Summarize Data
- 4. Work on Probability.

- 5. Interpret NOSQL
- 6. Solve Engineering Issues and Create Business Models

## 16CS014 Security Analyst I (Contemporary Course)

## To be prescribed by NASSCOM 3 1 0 3

## **Course Outcomes:**

At the end of the course students will be able to:

CCS317.1: Identify various viruses and worms infecting the system

- CCS317.2: Recall elements of information security
- CCS317.3: Understand the roles of Data Security Team and various access control methods
- CCS317.4: Develop websites free from SQL injection vulnerabilities
- CCS317.5: Analyze data leakage problem and suggest prevention mechanisms.
- CCS317.6: Determine appropriate Security Policies, Procedures, Standards and Guidelines.

## 16IT016 Enterprise Application Development Using IBM RAD & Bluemix Course Outcomes

- **1.** Master the fundamentals of website development, such as HTML5, Servlet, JSP with MVC Architecture
- 2. Use fundamental skills to maintain web server required to host a website
- 3. Build dynamic, database-driven web applications, such as use of a IBM RAD, to develop robust online programs
- 4. Implement core concepts of database connectivity
- 5. Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in the common web implementation
- 6. Design, code, publish, deployment of web applications on IBM Bluemix

## 16IT701 Big Data Analytics

## **Course Outcomes:**

- 1. Understand the limitations in SQL
- 2. Identify the concepts and advantages of DDBMS
- 3. Identify challenges of Big data and its existing technologies
- 4. Use UNIX and HDFS commands
- 5. Analyze data using Map-Reduce framework
- 6. Exemplify concepts of R Programming

# 16CS705 Mobile Application Development Lab

- 1. Apply mobile application models/architectures and patterns to the development of a mobile software application.
- 2. Demonstrate the components and structure of a mobile development framework (Google's Android Studio).
- 3. Apply essential Android Programming concepts.
- 4. Develop various Android applications related to layouts & rich uses interactive interfaces
- 5. Develop Android applications related to mobile related server-less database like SQLITE
- 6. Apply a mobile development framework to the development of a mobile application.

## **Course Outcomes**

- 1. Demonstrate the HDFS commands
- 2. Implement HADOOP with Map-Reduce
- 3. Use Apache Pig for analytics framework
- 4. Demonstrate HIVE QL
- 5. Compute the Page-Rank using Pig
- 6. Implement Map-Reduce programs for data analysis

## 16IT006 Human Computer Interaction (Elective IV)

## **Course Outcomes**

- 1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
- 2. Interpret typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
- 3. Apply an interactive design process and universal design principles to designing HCI systems
- 4. Make use of HCI design principles, standards and guidelines.
- 5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
- 6. Analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

## 16IT007 Middleware Technologies (Elective IV)

## **Course Outcomes**

At the end of the course students are able to:

- 1. Choose appropriate client server computing model for given problem.
- 2. Interpret dynamic remote application with RMI and JDBC Connectivity.
- 3. Understand client server applications using C#.net
- 4. Select appropriate language for homogeneous and heterogeneous objects.
- 5. Apply the concept of CORBA and database interfacing in real time projects.
- 6. Analyze appropriate middleware technology to develop real time applications

#### 16CS008 Software Project Management (Elective IV) Course Outcomes:

- 1. Understand the concepts and issues of Software Project Management.
- 2. Explain various Software Architectures.
- 3. Analyze Software Risks and Risk Management Strategies.
- 4. Design effective software development model to meet organizational needs.
- 5. Apply appropriate methodologies to develop a project schedule.
- 6. Apply appropriate techniques to assess ongoing project performance.

## 16CS003 Qualitative Data Analysis (Elective IV) Course Outcomes

- 1. Describe various styles of interpretation of qualitative data
- 2. Explain the relative appropriateness of different analysis approaches for a particular qualitative study
- 3. Apply one or more analytic approaches to data they have collected and write an analysis paper
- 4. Describe special issues in ethics for qualitative research
- 5. Develop qualitative data files effectively to ensure ease of use and participant confidentiality

6. Illustrate the basic and intermediate functions of software program for coding of textual data

#### 16EC005 DIGITAL IMAGE PROCESSING (Elective VI) Course Outcomes

- 1. Interpret fundamental concepts of digital image processing
- 2. Infer image transforms
- 3. Exemplify image enhancement and color image processing
- 4. Assess image restoration techniques
- 5. Summarize line, point, threshold and region based segmentation for digital images
- 6. Attribute various compression models and compression techniques for digital images

## 16EC602 Digital Signal Processing (Elective V)

#### **Course Outcomes**

- 1. Classify Discrete time signals and systems
- 2. Execute Z transform on different systems and represent with realization technique
- 3. Implement discrete Fourier transform and Fast Fourier transform on time domain signals
- 4. Implement FIR and IIR digital filters with given specifications and find the frequency response
- 5. Demonstrate Multirate signal processing
- 6. Differentiate the architecture of Digital signal processors

## 16IT008 Application Security (Elective V)

#### **Course Outcomes**

- 1. Demonstrate external and internal threats to an organization
- 2. Make use of information security awareness and a clear understanding of its importance
- 3. Infer fundamentals of secret and public cryptography
- 4. Develop the network security designs using available secure solutions (such as PGP, SSL, IPSec, etc)
- 5. Experiment with advanced security issues and technologies (such as DDoS attack detection and containment, and anonymous communications,)
- 6. Perceive importance of integrating people, processes and technology.

## 16IT009 Cryptography and Network Security (Elective V) Course Outcomes

- 1. Understand theory of fundamental cryptography, encryption and decryption algorithms
- 2. Understand the symmetric and public key cryptographic algorithms
- 3. Explain the various authentication applications
- 4. Comprehend different mechanisms related to network security
- 5. Interpret the functionalities of IP Security
- 6. Describe the functionalities of firewalls

## **Course Outcomes**

- 1. Acquire Knowledge to analyze Social Networks
- 2. Model, Aggregate and Represent Knowledge for Semantic Web
- 3. Use Extraction and Mining tools for Social Networks
- 4. Apply Reality Mining to Predict Human Behavior for Social Communities
- 5. Apply various Algorithms for Evolution and Opinion Mining in Social Networks
- 6. Write algorithms and systems for expert location in social networks

## 16IT013 Data Analytics-II

## **Course Outcomes**

- 1. Design data architecture and familiarize various data sources and data management
- 2: Identify the export of data sources
- 3: Know the basics of Big Data Tools
- 4: Identify the standard reporting and compliance, decision Models
- 5: Identify the outlier and elimination
- 6: Prepare data for analysis.

## 16CS013 Security Analyst II (Contemporary Course)

## To be prescribed by NASSCOM

## **Course Outcomes:**

At the end of the course students will be able to:

- 1. Suggest appropriate security metrics used for individual/organization
- 2. Implement various security audit used to find vulnerabilities/threats.
- 3. Implementation of various vulnerability management methods.
- 4. Implementation of configuration reviews.
- 5. Propose and implement appropriate security policy for individual/organization

## 16IT017 IBM's Big Data Analytics with Hadoop platform

## **Course Outcomes:**

- 1. Identify the concept and challenges of big data and its existing technologies.
- 2. Understand Big Data and Hadoop ecosystem
- 3. Understand Hadoop Distributed File System (HDFS)
- 4. Design and implement of Hive and Sqoop scripts
- 5. Apply and handle MapReduce programs and Pig Scripts
- 6. UseBig SQL and Big R Programming

## 16CS802 Machine Learning

## **Course Outcomes:**

- 1. Understand a wide variety of learning algorithms.
- 2. Understand how to apply a variety of learning algorithms to data using various tools of Machine Learning.
- 3. Identify the strengths and weaknesses of many popular machine learning approaches.
- 4. Analyze the performance of learning algorithms and model selection.
- 5. Identify mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
- 6. Apply Artificial Neural Networks and Deep Neural Networks in solving complex real world problems.

## 16IT802 Professional Ethics Course Outcomes
- 1. Understand the importance of ethics in person and IT environment
- 2. Infer the management of security vulnerabilities and action plan on security incident.
- 3. Identify the right of privacy and laws of protection for privacy of data.
- 4. Exemplify the intellectual property and rights.
- 5. Interpret the concepts of intellectual property and ethical issues of software manufacturers,
- 6. Summarize the key ethical issues with the use of social networking and impact of IT on living.

# 16EC005 DIGITAL IMAGE PROCESSING (Elective VI)

#### **Course Outcomes**

- 1. Interpret fundamental concepts of digital image processing
- 2. Infer image transforms
- 3. Exemplify image enhancement and color image processing
- 4. Assess image restoration techniques
- 5. Summarize line, point, threshold and region based segmentation for digital images
- 6. Attribute various compression models and compression techniques for digital images

# 16IT010 Computer Forensics (Elective VI)

#### **Course Outcomes**

- 1. Understand the real time computer forensic issue.
- 2. Understand data recovery, forensics lab certification and physical requirements.
- 3. Identify different storage formats for data acquisition.
- 4. Analyze various data acquisition tools for collecting digital evidence.
- 5. Apply various strategies to secure digital evidences.
- 6. Identify and apply various computer forensics tools to solve the computer forensic cases.

### 16IT011 E&M-Commerce (Elective VI)

### **Course Outcomes**

- 1. Identify E commerce principles in market place.
- 2. Understand different business models for e-commerce
- 3. Identify M commerce principles to various business domains
- 4. Understand the Framework Of Mobile Commerce
- 5. Get an exposure to current technological advancements in M-commerce.
- **6.** Analyze security issues in E commerce business models.

### 16CS010 Multimedia Databases

- 1. Analyse the issues and Apply techniques for building effective Multimedia Database Systems
- 2. Implement temporal database design techniques on past and current data
- 3. Apply Spatial Query Languages on Spatial databases
- 4. Analyze Text Types and Document Retrievals and Image DBs with Relations and R-Tree
- 5. Apply Handling techniques of Audio and video Databases
- 6. Apply Query Languages for Retrieving Multimedia Data with Multidimensional Data structures

# 16CS011 Wireless Ad hoc Networks (Elective VI)

### **Course Outcomes**

1. Understand the various challenging issues of wireless Ad hoc networks

- 2. Apply the MAC protocols using reservation and scheduling mechanism
- 3. Apply the routing protocols and transport layer protocol using various TCS mechanism in wireless Ad hoc networks
- 4. Understand the issues of MAC and network layer solution to provide quality of service
- 5. Understand the significances of various battery management schemes for wireless Ad hoc networks
- 6. Analyze the security requirements and secure routing in wireless Ad hoc networks

#### 16IT014 Data Analytics-III

#### **Course Outcomes**

- 1. Describe the business processes involved in marketing and customer relationship management and explain the role of analytical and predictive tools in these processes.
- 2. Analyze the import of predictive analytics on the organization
- 3. Implement data mining and machine learning techniques using a high-level programming.
- 4. design and analyze appropriate predictive models
- 5. Understand how best to apply Analytics methods and techniques in addressing strategic business problems
- 6. Conduct an in-depth analysis of a strategic business problems

#### 16CS014 Security Analyst III (Contemporary Course)

To be prescribed by NASSCOM

#### **Course Outcomes:**

At the end of the course students will be able to:

- 1. Suggest appropriate security management system for individual/organization
- 2. Outline various techniques for configuring network devices.
- 3. Explain various techniques for configuring router.
- 4. Examine different information security Incident management methods.
- 5. Investigate various data backup methods **& malicious code anomalies**.
- 6. Assess suitable method to handle network security & malicious code incidents.

## 16IT018 Foundation course in Security Identity and Access management Course Outcomes

- 1. Identify the need of ISIM in Organization.
- 2. Manage users, accounts and resources in Organization
- 3. Create, Manage and configure services, policies and workflows as per business requirements.
- 4. The requirement of IBM security Access manager in the Organization
- 5. Describe the purpose of junctions, enable web protection and auditing and tracking of users
- 6. Manage users groups and Policies

# Photo gallery of the display of POs and COs



#### Programme Educational Objectives

- Graduates will be engaged in ongoing learning and professional development through self-study, continuing education in mechanical engineering and also in other allied fields.
- Graduates will apply their engineering skills, exhibiting critical thinking and problem solving skills in professional engineering practices or tackle social, technical and business challenges.
- Graduates will adopt ethical attitude and exhibit effective skills in communication, management, teamwork and leadership qualities.

#### Programme Outcomes

At the end of the programme, a graduate will be able to:

- 1. Apply the knowledge of basic sciences and fundamental engineering concepts in solving engineering problems.
- Identify and define engineering problems, conduct experiments and investigate to analyze and interpret data to arrive at substantial conclusions.
- 3. Propose an appropriate solution for engineering problems complying with functional constraints such as economic, environmental, societal, ethical, safety and sustainability.
- Perform investigations, design and conduct experiments, analyze and interpret the results to provide valid conclusions.
- Select/develop and apply appropriate techniques and IT tools for the design & analysis of the systems.
- 6. Give reasoning and assess societal, health, legal and cultural issues with competency in professional engineering practice.
- Demonstrate professional skills and contextual reasoning to assess environmental/societal issues for sustainable development.
- 8. Demonstrate knowledge of professional and ethical practices.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary situations.
- Communicate effectively among engineering community, being able to comprehend and write effectively reports, presentation and give/receive clear instructions.
- Demonstrate and apply engineering & management principles in their own/team projects in multidisciplinary environment.
- 12. Recognize the need for, and have the ability to engage in independent and lifelong learning.

Fig : display of POs at Department office



Fig: display of POs on Laboratory notice boards



Fig : display of COs on Laboratory notice boards