CORENCRITERION FOR COMPUTER ENGINEERING

Criterion 1 - Programme Educational Objectives (PEOs)

a) State the vision and mission of the institution and/or faculty (School).

- **Aim and Motto of Enugu State University of Science and Technology**
  The university was conceived with the aim to establish an institution that must be closely related to society, its industry and above all, serve as a catalyst in the technological advancement of the people, irrespective of race, creed, gender or political affiliation hence the **University's Motto** remains **"Technology for Service".**

- **Vision of Enugu State University of Science and Technology**
  To be premier university in Africa in capacity development that promotes services to the society through quality teaching, research and community service.

- **Mission of Enugu State University of Science and Technology**
  To promote scholarship, especially in the areas of Science, Management and Technology, thereby ensuring the development of quality manpower that will utilize technology for the service of society.

- **The Objectives of Enugu State University of Science and Technology**

The following objectives are expected to shape the direction of the University's academic development and orientation:

O1: To encourage the advancement of all branches of learning and to avail to all persons without distinction an opportunity of acquiring higher education;
O2: To develop and offer academic and professional programmes leading to the award of degrees, diplomas, certificates and other distinctions to persons who attain the standards prescribed by the University and have in all respects satisfied the conditions and requirements laid down or otherwise approved by the University.
O3: To encourage and promote scholarship and to conduct research in scientific, technological, professional and other aspects of life;
O4: To relate its activities to the technological, cultural, social and economic needs of the people of Nigeria;
O5: To undertake any other activities appropriate to a University of the highest standard and such other activities as the University may decide in the furtherance of advancement of learning particularly the sciences, engineering and technology;
O6: To promote research and development directed towards the production of goods and the improvement of technological services;
O7: To disseminate scientific and technological knowledge among scientists, researchers, industries, trade services and other bodies which may benefit from such knowledge;
O8: To promote the growth and development of scientific and technological applications in the national economy through association with outside persons or bodies and through centers specially set up by the University in that behalf;
O9: To ensure that the subjects taught are oriented towards the immediate and long term needs of the country and that such subjects are also relevant to the needs of the Nigerian economy;

O10: To establish industrial centres in order to promote the acquisition of industrial expertise and the exchange of skills between the University and industry.

- **Description of the PEOs and where they are published.**

Programme Educational Objectives (PEOs) of Computer Engineering

Programme Educational Objectives (PEOs) of Computer Engineering in Enugu state university of science and technology published in the departmental handbook is to produce graduates that have the requisite knowledge, skills and emotional disposition needed for a 21st century world that increasingly demands greater, more advanced, efficient, sustainable and client-centric technological solutions. Apart from this Vision, Mission, motto, aim, objectives, PEOs and POs are disseminated to all the stakeholders of the program through faculty meetings, student awareness workshops, student orientation program, placement and training activities and relevant social media at regular intervals.

The PEOs include:

1. **PEO1**: Applying the knowledge gained from courses in mathematics, science (social and basic), computing, and algorithmic reasoning to resolve Computer Engineering challenges individually or within multidisciplinary groups/teams and understanding and applying discrete mathematics and computation;

2. **PEO2:** Analysing, designing and optimally managing the hardware/software computer system requirements of organisations with limited resources and solving complex engineering problems by collecting and analysing data as well as developing models and implementing solutions for engineering problems globally;

3. **PEO3:** Undertaking research, and laboratory and real-life and real-time experiments by using modern computer engineering models, tools, and information technologies to develop computer-based devices/systems

4. **PEO4:** Working on interdisciplinary and multidisciplinary concepts with teams as well as individually in developing new computer engineering knowledge, products, and services needed for the seamless functioning and wellbeing of society as well as appreciating and

5. **PEO5:** using life-long learning to improve self-employability as well as adapting to future professional and ethical responsibilities in an efficient, effective, fair, responsible and competitive manner;

PEO6: Practising in different roles as engineering managers, project managers, innovators, entrepreneurs, quality controllers, researchers/knowledge creators and managers in the computer engineering field; and having an understanding of contemporary as well as legal and ethical issues impinging on computer engineering solutions deployed in society

Criteria 2: Programme Outcomes (POs)

- **POs as defined by COREN**

PO1: Engineering Knowledge: apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems;

PO2: Problem Analysis: Identify, formulate, research literature and analyze developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;

PO3: Design/Development of Solutions: Proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs

with appropriate consideration for public health and safety, cultural, societal and environmental considerations;
PO4: Investigation: Conduct investigation into developmental or complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
PO5: Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations
PO6: The Engineer and Society: Apply reasoning informed by contextual knowledge including humanities and social sciences to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice
PO7: Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN engineers' codes of conduct
PO9: Individual And Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings
PO10: Communication: Communicate effectively on developmental or 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;
PO11: Project Management: Demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments demonstrate knowledge and understanding of engineering, management;
PO12: Lifelong Learning: Recognize the need for, and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

- **Programme Outcomes (POs) of Computer Engineering**

Programme Outcomes (POs) of Computer Engineering in Enugu State University of Science and Technology are published in the departmental handbook and also are disseminated to all the stakeholders of the program through faculty meetings, student awareness workshops, student orientation program, placement and training activities and relevant social media at regular intervals.

They include:

PO1: have adequate knowledge of computer engineering domain to become employable in Industry and ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

PO2: have strong fundamentals and problem solving skills to analyse, design and develop economically feasible solutions for technical and social problems with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

PO3: be aware of recent research trends, higher education and entrepreneurial opportunities, and will work ethically towards society.

PO4: be aware about the latest technology in software and hardware.

PO5: be exposed to industrial training giving hands on experience.

PO6: develop an ability to identify, formulate, and solve complex computer related engineering problems

PO7: an ability to function effectively in a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

PO8: an ability to effectively communicate computer engineering knowledge with a range of audiences in tandem with applying engineering design to produce solutions that meet specified needs

PO9: have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Criteria 3: Course Learning Outcomes (CLOs)

The CLOs are published in the department handbook.

100 Level Course Learning Outcomes
GST 111: Communication in English 1
First Semester, 2 Units

Course Learning Outcomes
At the end of this course, students should be able to:

1. Identify possible sound patterns in English Language;
2. List notable language skills;
3. Classify word formation processes;
4. Construct simple and fairly complex sentences in English;
5. Apply logical and critical reasoning skills for meaningful presentations;
6. Demonstrate an appreciable level of the art of public speaking and listening; and write simple and technical reports.

GST 113: Nigeria Peoples and Culture
First Semester, 2 Units
Course Learning Outcomes
At the end of this course, students should be able to:

1. Analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. Identify and list the major linguistic groups in Nigeria;
3. Explain the gradual evolution of Nigeria as a political entity;
4. Analyze the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;
5. Enumerate the challenges of the Nigerian state regarding nation building;
6. Analyze the role of the judiciary in upholding fundamental human rights
7. Identify the acceptable norms and values of the major ethnic groups in Nigeria; and list possible solutions to identifiable Nigerian environmental, moral and value

GST 121: Use of Library, Study Skills and Information Technology (ICT) First Semester, 2 Units

Course Learning Outcomes
At the end of this course, students should be able to:

1. Explain brief history of libraries, Library and education, University libraries and other types of Libraries, Study skills (reference services),
2. List types of library materials, using library resources including e-learning, e-materials, etc. Understanding library catalogues (card, OPAC, etc.) And classification,
3. Classify copyright and its implications, Database resources, Bibliographic citations and referencing.
4. Construct simple and fairly complex sentences in English;
5. Apply modern ICT, Hardware technology and Software technology: Input devices, Storage devices, Output devices, Communication and internet services, Word processing skills (typing etc.)

MAT 111: Elementary Mathematics I
First Semester, 3 Units
Course Learning Outcomes
At the end of the course students should be able to:
1. Define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams;
2. Solve quadratic equations;
3. Solve trigonometric functions;
4. Identify various types of numbers; and
5. Solve some problems using binomial theorem.

PHY 111: General Physics I
First Semester, 3 Units
Course Learning Outcomes
On completion, the students should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton's laws to describe and solve simp
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

PHY 197: General Practical Physics I
First Semester, 1Unit
Course Learning Outcomes
On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

ICH 111: General Chemistry I **First Semester, 3 Units**
Course Learning Outcomes
At the end of this course, the students should be able to:

1. Define atom, molecules and chemical reactions;
2. Discuss the modern electronic theory of atoms;
3. Write electronic configurations of elements on the periodic table;
4. Rationalize the trends of atomic radii, ionization energies, electronegativity of the elements, based on their position in the periodic table;
5. Identify and balance oxidation–reduction equation and solve redox titration problems;
6. Draw shapes of simple molecules and hybridized orbitals;
7. Identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. Apply the principles of equilibrium to aqueous systems using le-chatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium Mixtures;
9. Analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. Determine rates of reactions and its dependence on concentration, time and temperature.

ICH 197: General Practical Chemistry I
First Semester, 1 Unit
Course Learning Outcomes
At the end of this course, the students should be able to:
1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correct carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. State the differences between primary and secondary standards;
5. Perform redox titration;
6. Record observations and measurements in the laboratory notebooks; and
   Analyse the data to arrive at scientific conclusions.

CEE 121: Computer Programming First Semester, 3 Units
Course Learning Outcomes
At the end of this course, the students should be able to:
1. Describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. Develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language –preferable selected from Python, Java or C++;
3. Use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. Develop skills in eliciting user needs and designing an effective software solution;
5. Recognize human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalization of services; and
6. Acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas

GST 112: Communication in English II Second Semester, 2 Units
Upon completion of this course, students will be able to:
1. Advance paragraphs in a logical and coherent manner;
2. Change outlines and create supporting
3. Identify and write topic sentences and attain coherence in written English; sentences
4. Mark various forms of essays (narrative, descriptive, expository and argumentative/persuasive);
5. Distinguish and produce as accurately as possible, the English vowels and consonants;

6. Distribute an effective public speech

GST 114: Social Sciences
Second Semester, 2 Units

1. Understand the concepts of geography as a scientific discipline
2. Examine the sense of location specification, including an appreciation of forms and structure of Nigerian settlement pattern, economic activities and challenges
3. Provide understanding on the relationships in economic and political geography of both in history and in the contemporary with the aim of creating environmental consciousness

GST 118: Peace Studies and Conflict Resolution
Second Semester,2 Units

1. Define and explain the meaning and nature of conflict
2. Discuss the causes and types of conflicts
3. Discuss issues on conflict analysis, management, resolution and transformation
4. Explain the processes of conflict resolution –mediation negotiation, arbitration, litigation, conciliation and so on
5. Give detailed explanation of peace education
6. `` Examine the role of communication and language in conflicts
7. Explain the importance of the rules of conflict intervention
8. Determine the latent stage of conflict and possible responses
9. Discuss and be familiar with global issues and peace-building

MAT 112: Elementary Mathematics II
Second Semester, 3 Units
Upon completion of this course, students will be able to:

1. Identify the types of rules in differentiation and integration;
2 .Recognize and understand the meaning of function of a real variable, graphs, limits and continuity;
3. Solve some applications of definite integrals in areas and volumes;
4. Solve function of a real variable, plot relevant graphs, and identify limits and idea of continuity;
5. Identify the derivative as limit of rate of change;
6. Identify techniques of differentiation and perform extreme curve sketching;
7. Identify integration as an inverse of differentiation;
8. Identify methods of integration and definite integrals; and
9. Perform integration application to areas, volumes.

PHY 112: General Physics II
Second Semester, 3 Units
. **Upon completion of this course, students will be able to:**

1. Explain the general properties of waves.
2. Describe the general properties of sound.
3. Describe what static electricity is and how it originates.
4. Demonstrate an understanding of electrical potential.
5. Analyse electrical circuits. .
6. Define the properties of magnetic fields.
7. Clarify how light interacts with lenses and mirrors. .
8. Label optical phenomena associated with the wave properties of light.
9. Designate quantum theory and how it relates to the model of the atom

PHY 198: General Practical Physics II
Second Semester, 1 Unit
Course Learning Outcomes (CLO):
Upon completion of this course, students will be able to:

1. Be able to prepare a written laboratory report that effectively interprets and communicates their results.
2. Be able to effectively use computers as a tool for communication, data collection, data analysis.
3. Perform at least 10 laboratory activities where students collect, organize and analyse data demonstrating concepts from the 8 major objectives listed above

ICH 112: General Chemistry II Second Semester, 3 Units
Course Learning Outcomes (CLO):
Upon completion of this course, students will be able to:

1. State the importance and development of organic chemistry;
2. Define fullerenes and its applications;
3. Discuss electronic theory;
4. Determine the qualitative and quantitative of structures in organic chemistry;
5. State rules guiding nomenclature and functional group classes of organic chemistry;
6. Determine the rate of reaction to predict mechanisms of reaction;
7. Identify classes of organic functional group with brief description of their chemistry;
8. Discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. Describe basic properties of transition metals.

ICH 112: General Practical Chemistry II Second Semester, 1 Unit
Course Learning Outcomes (CLO):
Upon completion of this course, students will be able to:

1. State the general laboratory rules and safety procedures;
2. Collect scientific data and correctly carry out chemical experiments;
3. Identify the basic glassware and equipment in the laboratory;
4. Identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. Carry out solubility tests on known and unknown organic compounds;
6. Carry out elemental tests on known and unknown compounds; and
7. Carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

MEC 122: Basic Engineering Drawing
Second Semester, 2 Units
1. Elucidate drawing as a means of communication.
2. Construct borderlines and dimensioning.
3. Illustrate drawing, measuring, lettering and dimensioning of objects in various views/positions;
4. Identify the various types of lines, their applications and geometry;
5. Demonstrate the geometrical construction of parallel and perpendicular lines, bisection and division of lines,
6. Draw construction and bisection of angles.
7. Construct triangles, inscribed, ascribed and circumscribed circles of triangle, quadrilaterals, polygons, circle and geometrical construction on circle.

8. Demonstrate freehand sketching, symbols, conventions an scales

MME 122: Engineering Materials
Second Semester, 2 Units
Course Learning Outcomes (CLO):

Upon successful completion of the module, students should be able to:

1. Show a systematic understanding of the role that crystal structures play in material properties.
2. Evaluate critically the relevance of phase diagrams, isothermal transformation diagrams and continuous cooling transformation diagrams to understanding real alloys and their microstructure
3. Display a critical awareness of the relevance of key areas, e.g. diffusion, defects, transformation type, to current problems in designing, processing and exploiting real alloys.
4. Show a systematic understanding of the complex interplay between microstructure, processing and engineering properties in metallic materials.

200 Level Course Learning Outcomes

CEE 221: Introduction to Modeling and Simulation
First Semester, 2 Units
Learning Outcomes
Students should be able to:
1. Describe the fundamental concepts and principles of modeling and simulation;
2. Describe the MATLAB simulation environment, the MATLAB Desktop;
3. State MATLAB variables, arithmetic, logical, graphical, I/o operations;
4. Develop MATLAB scripts, MATLAB arrays, linear models;
5. Demonstrate graphing data in MATLAB, MATLAB array math, advanced graphing in MATLAB, nonlinear functions, nonlinear modeling, curve fitting examples;
6. Define the function, operating principle, management of Simulink;
7. Analyze and optimize simple designs using Simulink;
8. Implement a concept in modeling and simulation for creative innovation.

EEE 221: Applied Electricity I
First Semester, 3 Units
Course Learning Outcomes (CLO): Upon successful completion of the course, students will be able to:
1. Employ simple lumped circuit models for resistors, sources, inductors, capacitors, and transistors in circuits.
2. Analyze circuits made up of linear lumped elements. Specifically, circuits containing resistors and independent sources using techniques such as the node method, superposition and the Thevenin method
3. Calculate the frequency response of circuits containing resistors, capacitors and inductors.
4. Calculate the time behavior of first order and second order circuits containing resistors, capacitors and inductors
5. Carry out a small-signal analysis of an amplifier using small signal models for the circuit elements.

MEC 223: Engineering Drawing I
First Semester, 2 Units
At the end of the course, the students should be able to:

1. Apply multi-view representation techniques accurately to represent objects in different views, demonstrating proficiency in both first and third angle projection methods.
2. Create isometric drawings and simple pictorial assembly drawings, accurately representing the spatial relationship between components and assemblies.
3. Generate oblique drawings using different techniques such as cavalier, cabinet, and angles other than 45 degrees, effectively communicating the shape and features of objects.
4. Apply proper dimensioning techniques, including the selection and placement of dimension lines, the use of tolerances, and the application of GD&T symbols, ensuring clear and accurate communication of size and shape requirements.
5. Interpret and create sections and auxiliary views, correctly representing the internal features and hidden details of objects, and apply the appropriate conventions for representing threads, bolted joints, keys, cottered joints, and other mechanical components based on relevant standards such as BS 308

CHE 225: Fundamentals of Fluid Mechanics First Semester, 3Units
Course Learning Outcomes (CLO):
At end of the course, the students should be able to:

1. Demonstrate a solid understanding of fluid properties, including viscosity, density, and pressure, and apply this knowledge to analyse fluid statics and pressure distributions in various scenarios.
2. Apply the conservation laws of mass, energy, and momentum to analyze and solve problems related to fluid flow in pipes, ducts, and other hydraulic systems.
3. Analyse and quantify friction losses in laminar and turbulent flows, and utilize appropriate equations and models to calculate pressure drop and flow rates in fluid systems.
4. Utilize dimensional analysis techniques to establish dimensionless groups and scaling laws, and apply them to solve problems related to model testing and fluid system design.
5. Understand the construction and operation principles of hydraulic machinery, including pumps and turbines, and evaluate their performance characteristics and efficiency in different applications

CVE 227: Applied Mechanics First Semester, 3 Units
Course Learning Outcomes (CLO):
At the end of this Course, students should be able to:

1. Analyse the concepts of friction, wear and lubrication applications in kinematics;
2. Explain the principles of selection of power screws, belt, ropes and chains drives,
3. Explain the principles of selection clutches, brakes
4. Explain the principles of selection dynamometer and its application in torque
5. Differentiate between Hydrodynamics and hydrostatic lubrication;
6. Explain tribology and its associated problems

FEG 227: Engineering Mathematics I First Semester, 3 Units
Course Learning Outcomes (CLO):
At the end of the course, the students should be able to:

1. Solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. Describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. Solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. Describe the applications of double and triple integration in finding the area and volume

of engineering
solids, and explain the qualitative applications of Gauss, Stoke's and Green's theorem;

5. Explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations.

6. Analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

FEG 221: Engineer in Society First Semester, 2 Unit
Course Learning Outcomes (CLO):

At the end of this course, the students should be able to:

1. Differentiate between science, engineering and technology, and relate them to innovation;
2. Distinguish between the different cadres of engineering –engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. Identify and distinguish between the relevant professional bodies in engineering;
4. Categorise the goals of global development or sustainable development goals (SDGs); and
5. Identify and evaluate safety and risk in engineering practice.

FEG 293: Student Workshop Experience 1 FIRST Semester, 1 Unit
Course Learning Outcomes (CLO):
By the end of this course, students should be able to

1. Demonstrate practical knowledge and skills in general engineering, including the operation of hand and powered tools for wood and metal cutting and fabrication.
2. Demonstrate a strong understanding of safety protocols and guidelines for using tools and machines, ensuring a safe working environment for themselves and others.
3. Apply their knowledge and skills in using tools and machines to complete selected engineering tasks.
4. Develop familiarity with various techniques and practices involved in general engineering, demonstrating the ability to select appropriate tools, cut materials, and fabricate components.
5. Developed problem-solving abilities in real-world engineering scenarios.

ENS 222: Introduction to Entrepreneurship I
Second Semester, 2 Units

Course Learning Outcomes
At the end of this course, students should be able to:

1. Explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
2. State the characteristics of an entrepreneur;
3. Analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. Engage in entrepreneurial thinking;
5. Identify key elements in innovation;
6. Describe the stages in enterprise formation, partnership and networking, including business planning;
7. Describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and state the basic principles of e-commerce

EEE 222: Applied Electricity II Second Semester, 3 Units

Course Learning Outcomes (CLO):

At the end of this course, students should be able to:

1. Demonstrate the concept of electrical basic machines
2. Demonstrate DC, synchronous alternators, transformers, equivalent circuits.
3. Exhibit the understanding of converting electronic schematic circuit into printed circuit board (PCB) layout and vice versa using computer aided design (CAD) software.
4. Demonstrate the operation of three phase balanced circuits
5. Read and interpret and test various functional, PN junction Diode, transistors, FRTs, Zener, Rectifiers.
6. Demonstrate the skills to basic control systems, open/close loop systems...
7. Exhibit the understanding of the principles of electrical power generation, transmission, distribution as well as the utilization
8. Exhibit the understanding of the communications fundamentals, introduction of TV, Radio Telephone systems.

MEC 224: Engineering Drawing II Second Semester, 2 Units

Course Learning Outcomes (CLO):

At the end of the course, the students should be able to:

1. Apply projection techniques to accurately project points, lines, planes, and solids onto different views, demonstrating proficiency in graphical representation.
2. Analyze and determine intersections of solids, effectively representing complex geometric relationships and providing comprehensive engineering drawings.
3. Interpret and represent cam profiles, showcasing an understanding of cam mechanisms and their applications in mechanical systems.
4. Develop surfaces accurately, utilizing appropriate methods such as ruling and triangulation to represent curved and irregular shapes in engineering drawings.
5. Create detailed drawings of mechanical components, including belts, chains, gears, bearings, lubrication arrangements, couplings, brakes, flexible shafts, universal joints, etc., incorporating appropriate dimensions, tolerances, and annotations to convey design specifications

FEG 294: Student Work Experience Programme (SWEP) Second Semester, 1 Unit

Course Learning Outcomes (CLO):

At the end of the course, the students should be able to:

1. Demonstrate competency in operating hand and powered tools for wood and metal cutting and fabrication, ensuring accurate and efficient execution of engineering tasks.
2. Apply theoretical knowledge to practical scenarios, effectively utilizing tools and machines to accomplish selected engineering tasks with precision and attention to detail.
3. Exhibit proficiency in executing practical tasks related to general engineering, showcasing an understanding of fundamental principles and practices.
4. Adhere to safety protocols and practices when operating tools and machines, prioritizing personal and workplace safety in all engineering activities.
5. Collaborate effectively in a team environment, demonstrating problem-solving and communication skills through supervised hands-on experiences, fostering an environment of mutual support and s and shared learning.

CHE 226: Fundamentals of Thermodynamics Second Semester, 3 Units

Course Learning Outcomes for CHE 226: Fundamentals of Thermodynamics

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

1. Demonstrate a comprehensive understanding of the basic concepts and principles of thermodynamics, including the Zeroth, First, Second, and Third Laws of Thermodynamics.
2. Apply mathematical relationships and equations to solve thermodynamics problems, including calculations involving heat, work, energy, and entropy.
3. Analyze and predict the properties and changes in state of pure substances using thermodynamic principles, including phase diagrams, heat capacities, and enthalpy calculations.
4. Apply thermodynamic principles to analyze and predict the behavior of perfect gases, including the ideal gas law, specific heat capacities, and gas power cycles.
5. Analyze and evaluate the performance of ideal gas cycles, including efficiency calculations, optimization techniques, and the impact of different cycle parameters

CVE 228: Strength of Materials Second Semester, 3 Units

1. Recognise a structural system that is stable and in equilibrium;
2. Determine the stress-strain relation for single and composite members based on Hooke's law;
3. Estimate the stresses and strains in single and composite members due to temperature changes;
4. Evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
5. Determine bending stresses and their use in identifying slopes and deflections in beams;
6. Use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
7. Evaluate the stresses and strains due to torsion on circular members; and
8. Determine the buckling loads of columns under various fixity conditions at the ends.

FEG 228: Engineering Mathematics II Second Semester, 3 Units

Course Learning Outcomes (CLO):

At the end of the course, the students should be able to:

1. Describe physical systems using ordinary differential equations (ODEs);
2. Explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types;
3. Numerically solve differential equations using MATLAB and other emerging applications;
4. Perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
5. Solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;

FEG 290: SIWES I

Second Semester, 2 Units

On the job experience in the industry.

Learning Outcomes

SIWES I should provide opportunity for the students to:

1. Acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
2. Learn and practise basic engineering techniques and processes applicable to their specialisations;
3. Build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and
4. Acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

300 level Course Learning Outcomes

FIRST SEMESTER

ENS 311: Entrepreneurship Practicum

Course learning outcome

At the end of this course, students, through case study and practical approaches, should be able to:

1. Describe the key steps in venture creation;
2. Spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. State how original products, ideas and concepts are developed;
4. Develop a business concept for further incubation or pitching for funding;
5. Identify key sources of entrepreneurial finance;
6. Implement the requirements for establishing and managing micro and small enterprises;
7. Conduct entrepreneurial marketing and e-commerce;
8. Apply a wide variety of emerging technological solutions to entrepreneurship; and
9. Appreciate why ventures fail due to lack of planning and poor implementation.

FEG 321: Engineering Mathematics II

Course learning outcome

At the end of the course, the students should be able to:

1. Demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. Possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. Develop simple algorithms and use computational proficiency;
4. Write simple proofs for theorems and their applications; and
5. Communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

CEE 371: Digital Design

Course Learning Outcomes:

At the end of the course, Students will be able to

1. State the operations in Boolean algebra;
2. Write Boolean expressions in POS and SOP forms;
3. Minimize logic expressions using Karnaugh maps and Quine-McCluskey method;
4. Explain the functions, characteristics and operations of basic logic gates;

5 name and state the characteristics of, at least, two logic families;

5. Implement logic expressions using logic gates;
6. Define and differentiate between combinational and sequential circuits;
7. Describe the types, functions, characteristics, operations of flip-flops, counters, multivibrators, registers;
8. Design simple combinational and sequential circuits using logic gates, flip-flops, counters, multivibrators, registers.

CEE 333 Software Development Techniques 1

Course learning outcome

At the end of the study, the student should be able to:

. Illustrate and explain the software development life cycle;

2. Explain software Top-Down design approach;
3. Illustrate flowchart ANSI symbols and explain their usage;

4. Demonstrate program design using pseudo-code, flowchart;
5. Explain software debugging and documentation techniques;
6. Define structured programming, object-oriented programming;
7. Enumerate symbols, keywords, identifiers, data types, operators, write various statements, show operator precedence,using a structured language such as C;
8. Show examples of type conversion, conditional and control structures, function, recursive functions in the chosen structured programming language.

EEE 341: Electromagnetic Fields and Waves I
Course learning outcome
Upon successful completion of the course, students will be able to:
1. Students will enhance their skills in manipulating and analyzing vectors in the context of electromagnetic fields.
2. Students will learn and apply electromagnetic laws, such as Gauss's law and Ampere's law, to analyze electric and magnetic fields.
3. Students will study magnetic fields in and around current-carrying conductors, using principles like the Biot-Savart law and Ampere's law.
4. Students will explore the behavior of electromagnetic fields with time-varying phenomena and understand Maxwell's equations.
5. Students will learn about the Poynting vector, which represents the direction and magnitude of electromagnetic power flow, and gain insights into energy transmission and distribution.

EEE 343: Electrical Machines
Course learning outcome

Upon successful completion of the course, students will be able to:
1. Understand the principles of electromechanical devices.
2. Analyze the behavior and performance of electromechanical systems.
3. Apply mathematical modeling and analysis techniques.
4. Design and optimize electromechanical systems.
5. Develop skills in troubleshooting and diagnosing electromechanical faults.

EEE 313: Circuit Theory
Course learning outcome
Upon successful completion of the course, students will be able to:
1. Analytical Skills: Students will learn to analyze circuits using Kirchhoff's Laws and solve problems in steady-state and transient states. They will study network responses to different input signals.
2. Mathematical Modeling: Students will use Laplace transforms to mathematically model circuits and understand their behavior in both time and frequency domains.
3. Circuit Synthesis and Analysis: Students will learn advanced analysis techniques like pole-zero analysis, network synthesis, and resonance. They will also study ladder networks and the Star-Delta transformation method to simplify complex circuits.
4. Theorems and Principles: Students will understand important theorems such as Superposition, Reciprocity, Thevenin's, Norton's, and Maximum Power Transfer theorems, which will aid in simplifying circuit analysis and optimizing performance.
5. Practical Application: Students will apply Circuit Theory knowledge to real-world scenarios, designing and analyzing practical circuits. This enhances problem-solving skills and prepares students for electrical engineering careers.

CEE 391: Laboratory Practical I

Course learning outcome

At the end of the course, the students should be able to

(1) Illustrate hands-on, on the basic steps in software development and maintenance.
(2) Demonstrate writing codes and their executor for simple applications
(3) Write and execute codes for simple programming problems Testing and debug codes written for applications.
(4) Test and debug codes written for applications;
(5) Describe and demonstrate code reusability and software implementation.
(6) Develop simple software applications from scratch;

300 LEVEL SECOND SEMESTER

FEG 322: Engineering Mathematics IV

Course learning outcome

At the end of the course, the students should be able to

1. Solve Second Order Differential Equations;
2. Solve Partial Differential Equations;
3. Solve Linear Integral Equations;
4. Relate Integral Transforms to Solution of Differential and Integral Equations;
5. Explain and Apply Interpolation Formulas; And
6. Apply Runge-Kutta and other similar methods in solving ODE and PDEs.

EEE 332: Communication Principles

Course learning outcome

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

1. Understand and apply communication principles in engineering, including message encoding, decoding, effective listening, and non-verbal communication.

2. Develop clear and concise oral communication skills for engineering presentations, including organizing information, using visual aids, and adapting to diverse audiences.

3. Enhance written communication skills for technical documents in engineering, such as reports, proposals, and memos, focusing on coherence, structure, and professionalism.

4. Cultivate teamwork and interpersonal communication skills for successful collaboration in engineering projects, including conflict resolution, active listening, feedback, and effective group discussions.

5. Analyze and evaluate communication practices in engineering, considering ethics, cultural diversity, and the impact of communication technologies. Identify barriers and propose improvements to enhance communication effectiveness.

CEE 334 Software Development Techniques II

Course learning outcome

At the end of the course, the students should be able to

1. Use structures or Union to create file records.
2. Write C programs that accesses the content of files for processing.
3. Design data structures for use in digital control systems.
4. Use the C bitwise operators to manipulate devices
5. Design and implement an interface for a device connected to a PC port using C language.

EEE 334 Analogue Electronic Devices & Circuits

Course Learning Outcomes

At the end of the study, the student should be able to:

1. Understand The Basics of Semiconductor Devices and Their Applications in Different Areas;
2. Understand Different Biasing Techniques to Operate Transistor, FET, MOSFET and Operational Amplifier in Different Modes; And
3. Analyze Output in Different Operating Modes Of Different Semiconductor Devices.

CEE 336 Operating System

Course Learning Outcomes

At the end of the study, the student should be able to:

1. Characterize early operating systems, simple batch systems, multi-programmed and batched systems, time-sharing systems;
2. Describe computer system structures, computer system operation, i/o structures, computer storage structures and hierarchy;
3. Explain general system architecture and operating system structures;
4. Describe operating system components, operating system services, system calls, system programs, system structure, virtual machines, system design and Implementation, system generation;
5. Describe type conversion, conditional and control structures, function, recursive functions;
6. explain deadlock characterization, methods for handling Deadlocks - prevention, avoidance, detection, recovery, combined approaches, memory address space and management, paging, segmentation, virtual memory;

7 describe file systems, structures, management, implementation, recovery, and MS Windows and UNIX/LINUX architecture, applications, and programming.

CEE 372 Instrumentation Engineering 1

Course Learning Outcome

At the end of the course the student should be able to:

1. explain the features of the basic meters for DC and AC measurements;
2. describe and characterize a simple rectifier type voltmeter, electrodynamometer, Wattmeter;
3. draw and describe instrument transformers, DC and AC bridges, universal impedance bridges;
4. explain operation of electronic instrument for voltage, current, resistance measurements;
5. Explain operation and use of different types of signal/function generators, frequency counters/meters, signal analyzers;
6. Explain the basic features of oscilloscope and different types of oscilloscopes;
7. describe analog and digital data acquisition techniques, sample and hold circuits, D/A and A/D conversion methods;
8. Demonstrate use of various electronics instruments/transducers to measure the physical quantities in the field of science, engineering and technology..

FEG 390: SIWES II

Course Learning Outcomes

At the end of the SIWES, students should be able to:

1. Demonstrate proficiency in at least any three software in their chosen career choices;
2. Demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. Carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;
4. Demonstrate proficiency in generating data from laboratory analysis and

develop empirical models;
5. Demonstrate proficiency in how to write engineering reports from lab work;
6. Fill logbooks of all experience gained in their chosen careers; and
7. Write a general report at the end of the training.

400 Level Course Learning Outcomes

FIRST SEMESTER

CEE 431: Assembly Language Programming

Course Learning Outcomes

Upon successful completion of this course, the student will be able to:
(Knowledge Based)
1. Understand basic assembly language syntax;
2. Identify and use different 8086 addressing modes;
3. Create and use a stack to store data, addresses, or both; and
4. Highlight and know the uses of the different 8086 instruction groups.

(Skills)
a) Development of general programming skills; and
b) Be able to run assembly language code.

CEE 433 Database Design

Course Learning Outcomes

At the end of this course, the students should be able to:
1. State the basic concepts and principles of database systems.
2. Design and implement relational databases.
3. Manipulate data using SQL and illustrate the different data retrieval techniques.
4. Describe the basics of data security, privacy, and integrity in database systems.
5. State the various optimization techniques used in databases and the importance of backup and recovery strategies.
6. Apply the concepts and techniques learned in the course to real-world situations.
7. Explain the different approaches for data retrieval and data warehousing.
8. Explain physical storage media and tertiary storage devices, access and organization of records, data dictionary; explain storage structure of object oriented databases.
9. Explain the basic concepts of indexing and hashing, ordered indices, B+ and B– tree index files, explain the concept of static and dynamic hasting, multiple-key access.
10. Explain recovery system, explain log based recovery and shadow paging, recovery with concurrent transaction and DBMS applications.

CEE 445 Computer Architecture

Course Learning Outcomes

Upon completion of this course, the students will be able to:
1. describe the fundamental organization of a computer system;
2. explain the functional units of a processor;
3. explain addressing modes, instruction formats and programmed control statements;
4. identify the organization of various parts of a system memory hierarchy;
5. describe basic concept of parallel computing; and
6. describe fundamentals concepts of pipeline and vector processing.

CEE 451 Digital Computer Network

Course Learning Outcomes

At the end of this course, the students should be able to:

1. Identify the different types of computer networks and understand the components of a network.
2. Explain the different types of network topologies and describe the advantages and disadvantages of each.
3. Explain the role of network protocols and the differences between TCP/IP and UDP.
4. Discuss the purpose of IP addressing, the difference between IPv4 and IPv6 addressing, and the concept of subnetting and supernetting.
5. Identify the role of routing in computer networks, the different types of routing algorithms, and the routing protocols used in computer networks.
6. Explain the importance of network security, firewalls' role, and encryption's importance in computer networks.
7. Clarify the role of network services, the importance of DNS and DHCP, and how they are used in computer networks.
8. Simplify the purpose of WANs, the different types of WANs, and the different WAN technologies used in computer networks.
9. Explain the basics of wireless networks, the different types of wireless networks, and the importance of wireless security.
10. Clarify the importance of network management, the role of network monitoring and troubleshooting, and the steps to optimize network performance.

CEE 461: Introduction to Microprocessor

Course Learning Outcomes

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

1. Develop an ALP in 8085 microprocessor using the internal organization for the given specification;
2. Describe the architecture and functional block of 8051 microcontrollers;
3. Develop an embedded C and ALP in 8051 microcontroller using the internal functional blocks for the given specification;
4. Explain various peripheral devices such as 8255, 8279, 8251, 8253,8259 and 8237; and explain microcontroller application and basic architecture of PIC, ARM and ATMEGA processor

CEE 471: Control Systems

Course Learning Outcome

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

1. state examples of simple control systems;
2. state and explain different stability criteria and compensation methods for linear control systems; and discuss non-linear control systems and their characteristics

CEE 491: Laboratory Practical II

Course Learning Outcome

At the end of this course, the students should be able to:

(1) Illustrate hands-on, on the basic steps in software development and maintenance.
(2) Demonstrate writing codes and their executor for simple applications
(3) Implement codes and running of applications
(4) Testing and debug codes written for applications.
(5) Describe and demonstrate code reusability and software implementation.
(6) Develop from scratch programs

CEE493: Prototyping Techniques

Course Learning Outcome

Course Learning Outcomes

Students should be able to:

1. Identify different electronic and electrical components
2. Identify different computer aided design and modelling software
3. Model and simulate some projects
4. Connect circuits in breadboard
5. Prepare printed circuit board
6. Demonstrate connection of circuits using overboard
7. Explain and prepare documents on intellectual property.
8. Discuss techniques in marketing of products.

FEG 490: SIWES II

Course Learning Outcome

Students on Industrial Work Experience Scheme (SIWES) are expected to:

1. Be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. Bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human relations, key performance assessment methods, and ways of safeguarding the work environment –human and materials;
3. Experience/simulate the transition phase of students from school to the world of work and the environment seamlessly, and expose them to contacts for eventual job placements after graduation;
4. Be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. Exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

500 level Course Learning Outcomes

first semester

CEE 531: Cyberpreneurship & Cyberlaw

Course Learning Outcome

At the end of this course, the students should be able to:

1. State the fundamentals of cybersecurity and the various security threats faced by modern computer systems and networks.
2. Explain the different types of security controls and the ability to analyze security risks and recommend appropriate mitigation strategies.
3. Demonstrate hands-on skills with security tools and technologies, including virtualization, firewalls, and penetration testing.
4. Demonstrate Critical thinking skills and the ability to analyze security risks and recommend appropriate mitigation strategies.
5. Explain legal and ethical considerations involved in cybersecurity, including privacy, data protection, and intellectual property rights.
6. Trace current research trends in the field and the latest tools and technologies used to enhance cybersecurity.
7. Demonstrate skills needed to work effectively as part of a team, collaborating with others to solve complex security problems

CEE 553: Computer Security Techniques I

Course Learning Outcome

At the end of this course, the students should be able to:

1. State the fundamentals of cybersecurity and the various security threats faced by modern computer systems and networks.
2. Explain the different types of security controls and the ability to analyze security risks and recommend appropriate mitigation strategies.
3. Demonstrate hands-on skills with security tools and technologies, including virtualization, firewalls, and penetration testing.
4. Demonstrate Critical thinking skills and the ability to analyze security risks and recommend appropriate mitigation strategies.
5. Explain legal and ethical considerations involved in cybersecurity, including privacy, data protection, and intellectual property rights.
6. Trace current research trends in the field and the latest tools and technologies used to enhance cybersecurity.
7. Demonstrate skills needed to work effectively as part of a team, collaborating with others to solve complex security problems.

CEE 565: Digital Signal Processing

Course Learning Outcome

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

1. Understand analytical tools such as Fourier transforms, discrete Fourier transforms, fast Fourier transforms and Z-transforms required for digital signal processing;
2. Get familiarized with various structures of IIR and FIR systems;
3. Design and realize various digital filters for digital signal processing; and
4. Understand the applications of DSP in speech processing and spectrum

CEE 573: Microprocessor Based Real-Time Systems

Course Learning Outcome

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

1. describe Real-time control concepts
2. develop competence in Open loop and closed loop control, feedback sensors and feedback signal conditioning, controlling position, speed and acceleration in real-time.
3. Describe Remote control techniques. Optical isolation and touch-tone techniques. Multiplexing, Open loop control of several devices in real-time.
4. Discuss Interrupt-driven real-time events and physical systems:
5. Project through practical microcomputer-based motor control (stepper motors, DC motors and AC motors), traffic light control, software-based real-time element function programming, system monitoring and control
6. Develop skills in Operating system environment and Multiprocessor systems

CEE 575: Digital Systems Design with VHDL

Course Learning Outcome

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

1. Explain VHDL as a programming language;
2. Design the combinational and sequential logic circuits using VHDL;
3. Design programmable logic devices (PLDs) and networks of arithmetic operations;
4. Gain proficiency with VHDL software package and utilise software package to solve problems on a wide range of digital logic circuits.

CEE 583: Artificial Intelligence/Neural Network

Course Learning Outcome

At the completion of the course, the students are expected to be able:

a) Explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
b) Explain the fundamental concepts of machine learning, deep learning and convergent technologies;
c) Demonstrate the difference between supervised, semi-supervised and unsupervised learning;
d) Demonstrate proficiency in Design of ANN model, training sets for ANN, test sets for ANN, network testing and performance
e) Describe Classification of Artificial Neural Network
a) Explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing. Engineering applications. ANN programming.

CEE 597: Technical Communication in Computer Engineering

Course Learning Outcome

Learning Outcomes

At the end of the course, the student should be able to:

1. Demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. Demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection, and problems in engineering communication and presentation; and
3. Demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different socio cultural milieu for engineering designs, structural failure scenarios and presentation of reports.

CEE 535: Web Design

Course Learning Outcomes:

At the end of this course, the students should be able to:

1. Create basic HTML pages with proper semantic structure
2. Describe CSS selectors, properties, and layout techniques
3. Create simple JavaScript programs for adding interactivity to web pages
4. Analyze responsiveness to Web Design and how to create responsive layouts
5. Show knowledge of Server-side scripting and how to connect to databases
6. Integrate APIs in web applications and work with JSON and XML data formats
7. Demonstrate web Security best practices and implement secure login and session management.

CEE555: Design & Installation of Electrical & ICT Services

Course Learning Outcomes:

Students at the end of this course should be able to:

1. Design CCTV and other security systems

2. Install Solar Panel systems and other electrical installation.
3. Practice Wireless LAN design and installation.
4. Recognize ICT services, NCC and FCC codes of practice and standards.
5. Implement electrical installation design in domestic, commercial and industry.

CEE 585: Fuzzy Logic & Programming

Course Learning Outcomes

At the end of the course the student should be able to:

1. Explain: fuzzy set theory, knowledge base problem objective and subjective knowledge,
2. Explain crisp sets, fuzzy sets, linguistic variables, membership functions.
3. Interpret Set theoretic operations, comparison between crisp sets and fuzzy sets. Law of Contradiction and Law of Excluded Middle, fuzzy intersection, union and complement, and other fuzzy operators
4. Apply Fuzzy relations and compositions on the same and different product spaces.
5. Implement Max-Min composition, Max-Product composition, fuzzy relational matrix, sup-star composition Max-Product composition, fuzzy relational matrix, sup-star composition.
6. Demonstrate Fuzzy reasoning and implication, the fuzzy truth tables, traditional propositional logic and the rule of inference, the Modus Ponens and Modus Tollens, fuzzy modeling with causal IF-THEN statements
7. Apply Fuzzy Models, fuzzy logic systems, combination of fuzzy basis functions, universal approximator, fuzzy neural network, fuzzy associate memory matrix, self-learning fuzzy systems

CEE 572 Instrumentation Engineering

Course Learning Outcomes

At the end of the course the student should be able to

1. Apply the concepts of automatic control, including measurement, feedback and feed forward regulation for the operation of continuous and discrete systems.
2. Design and implement systems utilizing analog/digital control devices.
3. Apply the concepts of chemistry, physics & electric/electronics to measurement & control systems.
4. Apply the concepts of digital and microprocessor systems and functionality of system components/devices for the automation of processes.
5. Apply the concepts of measurements and sensor selection.
6. Communicate the technical details of control systems using current techniques and graphical standards.
7. Apply the concepts of mechanics, fluid mechanics, and heat transfer to the design of process control systems.
8. Understand and utilize programmable logic controllers (PLC), distributed control systems (DCS) and supervisory control systems for control of manufacturing and processing systems.
9. Demonstrate proficiency in the utilization of differential and integral calculus and ordinary differential equations in the design, analysis, and performance assessment of control systems.
10. Demonstrate the ability to utilize modern and effective management skills for performing investigation, analysis, and synthesis in the implementation of automatic control systems.

CEE 534: Computer Graphics & Animations

Course Learning Outcomes

At the end of the course the student should be able to:

Explain the basics of computer graphics.
Interpret essential mathematics in computer graphics.
Apply mathematics to graphics systems.
Implement common data structures to represent and manipulate geometry.
Demonstrate common approaches to model light and materials.
Apply basic shading techniques.
Apply basic image-processing techniques.
Explain how the human visual system plays a role in interpretation of graphics.
Perform color and light representation and manipulation in graphics systems

CEE 536: Software Engineering

Course Learning Outcomes

At the end of this course, the students should be able to:

1. State the fundamentals of software engineering Number representations. Data structure and algorithms, Abstraction, modules and objects.,
2. Explain the different types of Object oriented programming
3. Demonstrate hands-on skills on object oriented software design, implementation and testing.
4. Demonstrate Critical thinking skills and the ability to advanced software algorithms and architecture.
5. Explain team software specification and management, cross-platform tools and GUI development programming

CEE 556: Reliability and Maintainability

Course Learning Outcome

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

1. Apply engineering techniques to prevent or reduce frequency of failures;
2. Identify and correct the causes of the failures on engineering systems;
3. Apply engineering techniques to estimate the reliability of new designs and analyze reliability data;
4. Apply engineering techniques to predict expected life of the specific component, product or system; and establish risk analysis and quality control on engineering systems.

CEE 574: Embedded Systems Design

Course Learning Outcomes

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

1) Define what an embedded system and outline its features.
2) Analyze the major differences between microprocessor and microcontrollers
3) Describe the architecture and functional block of PIC Microcontroller, Arduino Microcontroller, Raspberry Pi, AVR and ESP32 microcontrollers
4) Develop an embedded C and ALP in PIC Microcontroller, Arduino Microcontroller, Raspberry Pi, AVR and ESP32 microcontrollers using the internal functional blocks for the given application.
5) Design and develop IOT and other embedded system projects using these microcontrollers

CEE 599: Project

Course Learning Outcomes

The student(s) will develop a technology and/or system to solve a known and significant computer engineering problem and design, and if possible/practicable, build/produce/ manufacture some relevant new hardware/device(s) representing the solution using the skills acquired in the computer engineering programme.

CEE 554: Computer Security Techniques II

Course Learning Outcomes

At the end of this course, the students should be able to:

1. State the fundamentals of cybersecurity and the various security threats faced by modern computer systems and networks.
2. Explain the different types of security controls and the ability to analyze security risks and recommend appropriate mitigation strategies.
3. Demonstrate hands-on skills with security tools and technologies, including virtualization, firewalls, and penetration testing.
4. Demonstrate Critical thinking skills and the ability to analyze security risks and recommend appropriate mitigation strategies.
5. Explain legal and ethical considerations involved in cybersecurity, including privacy, data protection, and intellectual property rights.
6. Trace current research trends in the field and the latest tools and technologies used to enhance cybersecurity.
7. Demonstrate skills needed to work effectively as part of a team, collaborating with others to solve complex security problems.

CEE 568: Digital Image Processing

Course Learning Outcomes

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

1) define digital image processing
2) get familiarized with problems, and applications of digital image processing
3) design and realize various Digital image acquisition devices. Digital image formats.
4) Understand Image restoration techniques. Image registration techniques Morphology. Fourier transform and Wavelet transform in image processing.
5) Explain Image understanding. Artificial neural network, Color representation standards, equations, processing, quantization, and dithering.
6) Analyze Case study in practical application of image processing to face recognition, fingerprint, iris, etc.
7) Discuss image compression techniques.

CEE 576: Robotics &Automation

Course Learning Outcomes:

At the end of this course, the students should be able to:

1. Apply a comprehensive understanding of fundamental principles and practices of robotics.
2. Develop practical skills in the design, construction, and programming of robots, using industry-standard tools and techniques.
3. Develop critical thinking skills, enabling them to analyze and solve real-world problems in robotics.
4. Apply their knowledge and skills to independent research projects, exploring new frontiers in robotics technology and applications.
5. Design projects for careers in the rapidly growing field of robotics, where they can make a positive impact on society by developing innovative solutions to real-world challenges