



**Annamacharya Institute of Technology and Sciences, Tirupati**  
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**Department of Civil Engineering**

**AK23 REGULATION COURSE OUTCOMES TILL III YEAR – II SEM**

COURSE NAME	CO	COURSE OUTCOMES
<b>ENGINEERING PHYSICS (23ABS9903)</b>	<b>CO1</b>	Understand the intensity variation of light due to interference, diffraction, and polarization
	<b>CO2</b>	Analyze the fundamentals of crystallography and X-ray diffraction.
	<b>CO3</b>	Apply the basic concepts of dielectric and magnetic materials for engineering applications.
	<b>CO4</b>	Analyze the fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.
	<b>CO5</b>	Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.
<b>LINEAR ALGEBRA AND CALCULUS (23ABS9904)</b>	<b>CO1</b>	Analyze the matrix algebraic techniques for engineering applications.
	<b>CO2</b>	Understand the concept of Eigen values, Eigen vectors and quadratic forms.
	<b>CO3</b>	Analyze the mean value theorems for real time applications.
	<b>CO4</b>	Apply the concepts of partial differentiation to functions of several variables.
	<b>CO5</b>	Apply the multivariable integral calculus for computation of Area and Volume.
<b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING (23AES0201)</b>	<b>CO1</b>	Understand the fundamental laws of A. C circuits and D. C circuits.
	<b>CO2</b>	Understand operating principles of motors, generators and measuring instruments.
	<b>CO3</b>	Understand the fundamentals of power generation, costing and safety measures.
	<b>CO4</b>	Understand the fundamental concepts of diodes, transistors and its applications.
	<b>CO5</b>	Analyze the concepts of rectifiers, power supplies and amplifiers in electronics.
	<b>CO6</b>	Analyze the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.
<b>ENGINEERING GRAPHICS (23AES0301)</b>	<b>CO1</b>	Apply the concepts of engineering curves and scales for technical drawing.
	<b>CO2</b>	Understand the quadrant system to locate the position of points, lines and planes.
	<b>CO3</b>	Analyze the projection of solids located in quadrant system.
	<b>CO4</b>	Analyze the sectional views and development of surfaces of regular solids.
	<b>CO5</b>	Apply orthographic and isometric projections concepts to construct the given object
<b>INTRODUCTION TO PROGRAMMING (23AES0501)</b>	<b>CO1</b>	Understand the computer Programming concepts and Algorithms.
	<b>CO2</b>	Analyze the control structures to implement basic programs.
	<b>CO3</b>	Understand the concept of Arrays and string to manipulate the stored data.



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	<b>CO4</b>	Create the dynamic memory allocation using pointers and structures.
	<b>CO5</b>	Create the user defined functions and files for modifying stored data.
<b>IT WORKSHOP (23AES0503)</b>	<b>CO1</b>	Understand The Process of Software Installation & Hardware troubleshooting.
	<b>CO2</b>	Analyze the network configurations for customizing web pages and search engines.
	<b>CO3</b>	Apply the basic editing function, formatting text & objects on a required content
	<b>CO4</b>	Apply the formulas, functions and visualizations to manage the data.
	<b>CO5</b>	Understand the libraries and models of chat GPT to generate information.
<b>ENGINEERING PHYSICS LAB (23ABS9908)</b>	<b>CO1</b>	Analyze the properties of light for engineering problems.
	<b>CO2</b>	Evaluate the crystallite size using X-ray diffraction.
	<b>CO3</b>	Analyze the basic properties of dielectric and magnetic behavior of the given material.
	<b>CO4</b>	Determine the mechanical behavior of a given material.
	<b>CO5</b>	Evaluate the basic parameters of a given semiconductor material.
<b>ELECTRICAL &amp; ELECTRONICS ENGINEERING WORKSHOP (23AES0202)</b>	<b>CO1</b>	Understand the Electrical circuit design, measurement of resistance, power, and power factor.
	<b>CO2</b>	Apply suitable methods to measure Resistance, power, energy and power factor.
	<b>CO3</b>	Design suitable methods for magnetization characteristics of D. C shunt generator.
	<b>CO4</b>	Understand the V-I Characteristics of diodes and its applications.
	<b>CO5</b>	Analyze the input and output characteristics of BJT and its applications.
	<b>CO6</b>	Analyze the truth tables of all logic gates and f/f's using IC's.
<b>COMPUTER PROGRAMMING LAB (23AES0502)</b>	<b>CO1</b>	Understand the basic syntax of C program to build applications.
	<b>CO2</b>	Create the control structure for solving complex problems.
	<b>CO3</b>	Apply the concepts of arrays, functions, basic concepts of pointers to organize the data.
	<b>CO4</b>	Apply the concepts of structures, unions and linked list to manage heterogeneous data
	<b>CO5</b>	Create the file applications for storing and accessing data.
<b>NSS/NCC/SCOUTS&amp;GUIDES/ COMMUNITY SERVICE</b>	<b>CO1</b>	Understand the importance of discipline, character and service motto of community.
	<b>CO2</b>	Analyze the activities need to be done for nature protection
	<b>CO3</b>	Analyze the social issues in a community and address it through the base camps.
	<b>CO1</b>	Understand reading / listening texts and to write summaries based on global comprehension of these texts. <b>(Listening &amp; Reading)</b>
	<b>CO2</b>	Apply grammatical structures to formulate sentences and correct word forms. <b>(Grammar)</b>



**Annamacharya Institute of Technology and Sciences, Tirupati**  
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<b>COMMUNICATIVE ENGLISH</b> <b>(23AHM9901)</b>	<b>CO3</b>	Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations. <b>(Speaking)</b>
	<b>CO4</b>	Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table <b>(Read &amp; Write)</b>
	<b>CO5</b>	Create a coherent essay, letter writing, report writing and design a resume. <b>(Writing)</b>
<b>ENGINEERING CHEMISTRY</b> <b>(23ABS9902)</b>	<b>CO1</b>	Understand the purification techniques to remove hardness of water
	<b>CO2</b>	Apply the electrochemical principles to the energy storage devices and corrosion prevention techniques
	<b>CO3</b>	Analyze the preparation of polymers, elastomers and fuels
	<b>CO4</b>	Analyze the properties of lubricants, Refractories, composites and cement.
	<b>CO5</b>	Analyze the properties of colloids and nano materials
<b>DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS</b> <b>(23ABS9905)</b>	<b>CO1</b>	Apply the concepts of ordinary differential equations of first order and first degree.
	<b>CO2</b>	Apply the methods of linear differential equations related to various engineering problems.
	<b>CO3</b>	Analyze the solutions of partial differential equations using Lagrange's method.
	<b>CO4</b>	Understand the different operators and identities in the vector calculus.
	<b>CO5</b>	Evaluate the surface integral and volume integral in the vector calculus using various theorems
<b>BASIC CIVIL &amp; MECHANICAL ENGINEERING</b> <b>(23AES0101)</b>	<b>CO1</b>	Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society
	<b>CO2</b>	Apply the methods of surveying in finding the measurements on Earth surface
	<b>CO3</b>	Understand the importance of transportation, water resources and environmental engineering
	<b>CO4</b>	Understand the applications and role of various materials in Mechanical Engineering.
	<b>CO5</b>	Understand the different manufacturing processes and the basics of thermal engineering with its applications.
	<b>CO6</b>	Understand the working of different mechanical power transmission systems, power plants and applications of robotics.
<b>ENGINEERING MECHANICS</b> <b>(23APC0101)</b>	<b>CO1</b>	Apply the concepts of system of forces and frictional forces for contact bodies
	<b>CO2</b>	Analyze the different force systems to calculate their resultant forces and moments.
	<b>CO3</b>	Apply the concepts of centroid and moment of inertia for different cross-sections.



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**(Autonomous)**  
**Department of Civil Engineering**

	<b>CO4</b>	Apply the principles of work-energy and impulse-momentum of rectilinear and curvilinear motion of a particle.
	<b>CO5</b>	Apply the principles of work-energy and impulse-momentum of rigid body motion of a particle
<b>COMMUNICATIVE ENGLISH LAB (23AHM9902)</b>	<b>CO1</b>	Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
	<b>CO2</b>	Apply communication skills through various language learning activities.
	<b>CO3</b>	Analyze the English speech sounds, for better listening and speaking.
	<b>CO4</b>	Evaluate and exhibit professionalism in participating in debates and group discussions.
	<b>CO5</b>	Analyze themselves to face interviews in future.
<b>ENGINEERING CHEMISTRY LAB (23ABS9907)</b>	<b>CO1</b>	Estimate the hardness of water.
	<b>CO2</b>	Prepare advanced polymer materials.
	<b>CO3</b>	Measure the strength of an acid present in secondary batteries.
	<b>CO4</b>	Estimate the Iron and Calcium in cement.
	<b>CO5</b>	Determine the physical properties like surface tension, adsorption and viscosity.
<b>ENGINEERING WORKSHOP (23AES0302)</b>	<b>CO1</b>	Apply the wood working skills to prepare different joints.
	<b>CO2</b>	Analyze the sheet metal and fitting operations to prepare various components
	<b>CO3</b>	Apply the basic electrical engineering knowledge for house wiring practice.
	<b>CO4</b>	Apply the Welding process for Lap and Butt Joints.
	<b>CO5</b>	Understand the various plumbing pipe joints
<b>ENGINEERING MECHANICS &amp; BUILDING PRACTICES LAB (23APC0102)</b>	<b>CO1</b>	Evaluate the forces, coefficient of friction between two different surfaces, inclined plane and the roller
	<b>CO2</b>	Analyze the Polygon law of forces and Law of Moment using bell crank lever.
	<b>CO3</b>	Evaluate the Centre of gravity for different cross-sections
	<b>CO4</b>	Understand the Quality Testing and principles of Non- Destructive Testing for building materials.
	<b>CO5</b>	Understand the tools, plumbing practices and safety measures in building construction.
<b>HEALTH AND WELLNESS, YOGA AND SPORTS (23AHM9903)</b>	<b>CO1</b>	Understand the health & fitness by diet
	<b>CO2</b>	Understand the importance of yoga.
	<b>CO3</b>	Apply The yoga practices including Surya Namaskar
	<b>CO4</b>	Understand the importance of sports.
	<b>CO5</b>	Analyze various activities that help enhance their health & Positive Personality
<b>NUMERICAL &amp; STATISTICAL METHODS</b>	<b>CO1</b>	Analyze relevant numerical techniques for interpolation and concepts of curve fitting
	<b>CO2</b>	Apply the different iteration methods to solve Algebraic, Transcendental and Simultaneous Equations



**Annamacharya Institute of Technology and Sciences, Tirupati**  
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**Department of Civil Engineering**

<b>(23ABS9909)</b>	<b>CO3</b>	Evaluate different numerical methods with accuracy and efficiency for ordinary differential equations.
	<b>CO4</b>	Analyze the techniques for testing of hypothesis for large samples
	<b>CO5</b>	Analyze the techniques for testing of hypothesis for small samples
<b>UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT (23AHM9905)</b>	<b>CO1</b>	Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.
	<b>CO2</b>	Analyze the harmony in the human being as sentient ‘I’ and the material ‘Body’ in various aspects.
	<b>CO3</b>	Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.
	<b>CO4</b>	Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.
	<b>CO5</b>	Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.
<b>SURVEYING (23APC0103)</b>	<b>CO1</b>	Understand the basics of linear and angular measurements using different methods
	<b>CO2</b>	Apply the concepts of leveling, contouring and computing of Areas and Volumes in earthworks
	<b>CO3</b>	Apply trigonometrical leveling techniques to determine elevations in field scenarios.
	<b>CO4</b>	Apply knowledge of curves and basic principles of modern surveying technologies.
	<b>CO5</b>	Understand the fundamentals of photogrammetry and its applications for surveying.
<b>STRENGTH OF MATERIALS (23APC0104)</b>	<b>CO1</b>	Analyze the behavior of composite bars under simple stresses and strains
	<b>CO2</b>	Apply concepts of shear force and bending moment for different load conditions on different types of beams
	<b>CO3</b>	Analyze the behavior of standard cross section subjected to bending, shear and torsional stresses
	<b>CO4</b>	Analyze the displacements of beams and springs using different methods
	<b>CO5</b>	Analyze the critical loads in columns and compound stresses in rigid bodies.
<b>FLUID MECHANICS (23APC0105)</b>	<b>CO1</b>	Understand the basic characteristics and behavior of fluids
	<b>CO2</b>	Apply the laws of fluid statics and concepts of Buoyancy
	<b>CO3</b>	Apply the law of conservation of mass to differentiate type of flow in a pipe
	<b>CO4</b>	Analyze the discharge of fluid flow in pipes using law of conservation of energy
	<b>CO5</b>	Analyze the energy losses and flow characteristics through closed conduits
<b>SURVEYING LAB (23APC0106)</b>	<b>CO1</b>	Apply surveying techniques (chain & compass) for road profiles, offsets & distances.
	<b>CO2</b>	Analyze the area of a defined boundary using the plane table radiation method
	<b>CO3</b>	Analyze the elevations on the surface of the ground by levelling methods



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**Department of Civil Engineering**

	<b>CO4</b>	Analyze the height, horizontal and vertical angles by theodolite on earth surface.
	<b>CO5</b>	Evaluate the elevations, depressions, distance, curves and contours on the ground surface for preparation of maps
<b>STRENGTH OF MATERIALS LAB (23APC0107)</b>	<b>CO1</b>	Apply the engineering principles to analyze the support reactions and bending behavior of beams under different support conditions
	<b>CO2</b>	Analyze the relationship between material elastic properties and the performance of mechanical components.
	<b>CO3</b>	Analyze the behavior of steel under impact load and couple acting on it.
	<b>CO4</b>	Analyze the load-deflection behavior of open-coiled and close-coiled springs under compression
	<b>CO5</b>	Evaluate the compressive strength and failure modes of wood and concrete specimens
<b>BUILDING PLANNING AND DRAWING (23ASC0101)</b>	<b>CO1</b>	Apply the sign conventions to represent various building materials
	<b>CO2</b>	Apply the distinct brickwork patterns used in construction
	<b>CO3</b>	Create the building elements as per building bye-laws
	<b>CO4</b>	Create the residential building as per building bye-laws
	<b>CO5</b>	Create the public and industrial buildings as per building bye-laws
<b>MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (23AHMMB01)</b>	<b>CO1</b>	Understand the fundamentals of managerial economics and Apply the forecasting techniques for estimation of demand.
	<b>CO2</b>	Understand the production and cost concepts to optimize the output
	<b>CO3</b>	Analyze the price output relationship in different markets.
	<b>CO4</b>	Evaluate the capital budgeting techniques to invest in various projects.
	<b>CO5</b>	Analyze the accounting statements to evaluate the financial performance of business entity.
<b>ENGINEERING GEOLOGY (23APC0108)</b>	<b>CO1</b>	Understand the importance of Geology in Civil engineering
	<b>CO2</b>	Understand the classification and properties of minerals and rocks
	<b>CO3</b>	Apply the structural geology in rocks
	<b>CO4</b>	Understand the concept of Ground water, Natural Disasters using Geophysical methods
	<b>CO5</b>	Understand the geological strata for construction of Dams, tunnels, and reservoirs
<b>CONCRETE TECHNOLOGY (23APC0109)</b>	<b>CO1</b>	Understand the basic ingredients of concrete
	<b>CO2</b>	Understand the manufacturing process and fresh properties of concrete
	<b>CO3</b>	Understand the concepts of strength gain and hardened properties of concrete
	<b>CO4</b>	Understand the engineering properties and special applications of concrete.
	<b>CO5</b>	Design concrete mix proportioning for economical and durable concrete
<b>STRUCTURAL ANALYSIS (23APC0110)</b>	<b>CO1</b>	Analyze the beams and trusses using Energy Theorems.
	<b>CO2</b>	Analyze indeterminate structures by using Castigliano's-II theorem
	<b>CO3</b>	Analysis of fixed and continuous beams
	<b>CO4</b>	Analyze continuous beams and portal frames by using slope-deflection method





**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

	<b>CO5</b>	Analyze continuous beams and portal frames by using moment distribution method
<b>HYDRAULICS &amp; HYDRAULIC MACHINERY (23APC0111)</b>	<b>CO1</b>	Apply the Laminar and Turbulent flow concept in pipes
	<b>CO2</b>	Analyze the uniform flows in open-channel flow systems.
	<b>CO3</b>	Analyze the uniform flows in open-channel flow systems.
	<b>CO4</b>	Evaluate the performance of impact of jets on plates and its application in different turbines.
	<b>CO5</b>	Analyze the performance of Centrifugal pumps
<b>CONCRETE TECHNOLOGY LAB (23APC0112)</b>	<b>CO1</b>	Evaluate the quality and suitability of cement for concrete production
	<b>CO2</b>	Evaluate the properties of fine aggregate for concrete production
	<b>CO3</b>	Evaluate the properties of coarse aggregate for concrete production
	<b>CO4</b>	Analyze the fresh properties of concrete by various test methods
	<b>CO5</b>	Analyze the hardened properties of concrete by various test methods
<b>ENGINEERING GEOLOGY LAB (23APC0113)</b>	<b>CO1</b>	Apply the physical properties of minerals and rocks to real world scenarios
	<b>CO2</b>	Evaluate the accuracy and limitations of geological maps based on the data used for their formation
	<b>CO3</b>	Analyze basic strike and dip problems using geological maps and sections
	<b>CO4</b>	Evaluate the Strength of rocks using laboratory equipment's
	<b>CO5</b>	Analyze the Bore Hole data and Field data
<b>SOFT SKILLS LAB (23ASC9901)</b>	<b>CO1</b>	Understand the various techniques of soft skills and communication skills.
	<b>CO2</b>	Analyze the listening and thinking skills to enhance professional development.
	<b>CO3</b>	Apply the critical thinking skills in problem solving and decision making through Discussions.
	<b>CO4</b>	Evaluate the emotional intelligence and stress management for individuals and groups.
	<b>CO5</b>	Apply the corporate etiquette atmosphere to enhance professional behavior in workplace environment.
<b>DESIGN THINKING &amp; INNOVATION (23AES0304)</b>	<b>CO1</b>	Understand the concepts and principles of design thinking process.
	<b>CO2</b>	Apply the design thinking techniques for solving problems in various sectors.
	<b>CO3</b>	Analyze the art of innovation & creativity in product development
	<b>CO4</b>	Apply the design guidelines for produced development.
	<b>CO5</b>	Analyze the design thinking strategies for solving real time business issues.
<b>ENVIRONMENTAL STUDIES (23AMC9901)</b>	<b>CO1</b>	Understand the multidisciplinary nature of environmental studies, various renewable and nonrenewable resources
	<b>CO2</b>	Understand the ecosystem and biodiversity to solve complex environmental problems
	<b>CO3</b>	Apply the various types of pollution, solid waste management, and related preventive measures
	<b>CO4</b>	Apply the rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation



**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

	<b>CO5</b>	Analyze the population explosion and impact of environmental health issues on human beings.
<b>WATER RESOURCES ENGINEERING (23APC0114)</b>	<b>CO1</b>	Understand the hydrologic cycle and analyze rainfall, evaporation, infiltration, and runoff data.
	<b>CO2</b>	Analyze hydrographs and groundwater properties for flood and aquifer assessment.
	<b>CO3</b>	Evaluate crop water requirements and irrigation efficiencies based on soil-water-plant relationships.
	<b>CO4</b>	Apply Kennedy's and Lacey's theories for channel design and assess water logging prevention methods.
	<b>CO5</b>	Design diversion head works and compute uplift pressures using Bligh's and Khosla's theories.
<b>DESIGN OF REINFORCED CONCRETE STRUCTURES (23APC0115)</b>	<b>CO1</b>	Design singly and doubly reinforced rectangular concrete beams using limit state methods in compliance with IS code guidelines.
	<b>CO2</b>	Design reinforced concrete flanged beams for flexure using Limit State Method using IS code provisions
	<b>CO3</b>	Design cantilever, one-way, two-way, and continuous slabs subjected to uniformly distributed loads under various boundary conditions using the Limit State Method.
	<b>CO4</b>	Design columns and Footings for various loading conditions in compliance with IS code guidelines
	<b>CO5</b>	Design dog legged staircase in compliance with IS code guidelines.
<b>GEOTECHNICAL ENGINEERING (23APC0116)</b>	<b>CO1</b>	Analyze the index properties for classification and examine the compaction of soils.
	<b>CO2</b>	Analyze the permeability and seepage problems using Darcy 's law and flow net concepts for soils.
	<b>CO3</b>	Analyze the consolidation and stress distribution theories under different loading conditions.
	<b>CO4</b>	Evaluate soil shear strength under various drainage conditions.
	<b>CO5</b>	Analyze slope stability of soils
<b>INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (23AES0504)</b>	<b>CO1</b>	Understand the transition from classical to quantum physics and quantum states.
	<b>CO2</b>	Understand qubits, quantum systems, and their philosophical significance.
	<b>CO3</b>	Analyze quantum computer requirements, system fragility, hardware platforms, and software roles.
	<b>CO4</b>	Analyze quantum information, communication, computing, and their future potential.
	<b>CO5</b>	Apply quantum applications, industry cases, challenges, and opportunities.
<b>COST EFFECTIVE HOUSING TECHNIQUES (23APE0101)</b>	<b>CO1</b>	Understand the current status of urban and rural housing and analyze the role of finance and planning in housing development.
	<b>CO2</b>	Understand cost-effective construction techniques, including prefabrication and innovative roofing/flooring systems
	<b>CO3</b>	Understand alternative building materials and infrastructure services for cost-effective housing solutions
	<b>CO4</b>	Understand rural housing techniques, including traditional mud housing, soil stabilization, and fire treatment for roofing





**Annamacharya Institute of Technology and Sciences, Tirupati**  
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**Department of Civil Engineering**

	<b>CO5</b>	Understand housing solutions for disaster-prone areas by incorporating earthquake, cyclone, and flood-resistant strategies
<b>EXPERIMENTAL STRESS ANALYSIS (23APE0102)</b>	<b>CO1</b>	Understand the principles and advantages of experimental stress analysis.
	<b>CO2</b>	Understand the strain measurement using various strain gauge techniques.
	<b>CO3</b>	Analyze strain rosettes using non-destructive testing methods for concrete.
	<b>CO4</b>	Understand the fundamental principles of photoelasticity and its applications.
	<b>CO5</b>	Apply two-dimensional photoelasticity methods for stress analysis in materials.
<b>ENVIRONMENTAL IMPACT ASSESSMENT (23APE0103)</b>	<b>CO1</b>	Understand the methodologies of EIA
	<b>CO2</b>	Understand the impact of development activities and land use
	<b>CO3</b>	Understand the risk and its impact on Vegetation and wild life
	<b>CO4</b>	Understand the preparation of Environment Audit
	<b>CO5</b>	Understand the various environmental acts
<b>ELECTRICAL SAFETY PRACTICES (23AOE0201)</b>	<b>CO1</b>	Understanding the Fundamentals of Electrical Safety
	<b>CO2</b>	Identifying and Applying Safety Components
	<b>CO3</b>	Analyzing Grounding Practices and Electrical Bonding
	<b>CO4</b>	Applying Safety Practices in Electrical Installations and Environments
	<b>CO5</b>	Evaluating Electrical Safety Standards and Regulatory Compliance
<b>SUSTAINABLE ENERGY TECHNOLOGIES (23AOE0301)</b>	<b>CO1</b>	Analyze solar radiation data, PV module characteristics, and the environmental impact of solar power systems.
	<b>CO2</b>	Evaluate the performance of various solar thermal collectors and select appropriate battery storage systems for PV applications.
	<b>CO3</b>	Apply the principles of wind and biomass energy conversion to analyze the performance of renewable energy systems.
	<b>CO4</b>	Analyze the operational principles and applications of geothermal, ocean energy, and fuel cell systems.
	<b>CO5</b>	Design an off-grid solar PV power plant considering component selection, system integration, and economic aspects
<b>ELECTRONIC CIRCUITS (23AOE0401)</b>	<b>CO1</b>	Understand the operation of various semiconductor diodes and their applications
	<b>CO2</b>	Analyze the BJT characteristics, biasing methods and stabilization techniques.
	<b>CO3</b>	Understand the single and multi-stage amplifiers using simplified hybrid model.
	<b>CO4</b>	Evaluate the parameters of feedback amplifiers and frequency of various oscillators.
	<b>CO5</b>	Analyze the characteristics, operation of Operational amplifier and it's applications
<b>JAVA PROGRAMMING (23AOE0501)</b>	<b>CO1</b>	Understand the Java language components and how to apply in applications
	<b>CO2</b>	Apply the concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications



**Annamacharya Institute of Technology and Sciences, Tirupati**  
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	<b>CO3</b>	Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications
	<b>CO4</b>	Evaluate the concepts of packages, file I/O, by using access control, and exception handling mechanisms to solve real world scenarios
	<b>CO5</b>	Create the GUI applications by using concepts like multi-threading, Java FX, JDBC
<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE (23AOE0502)</b>	<b>CO1</b>	Understand the foundational concepts and use the searching techniques for solving searching problems
	<b>CO2</b>	Apply the AI techniques to solve problems of game playing, theorem proving, and machine learning
	<b>CO3</b>	Understand the syntax and semantics of First-Order Logic (FOL) and differentiate it from propositional logic.
	<b>CO4</b>	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities
	<b>CO5</b>	Analyze the semantics and structure of Bayesian networks for efficient representation of conditional probabilities.
<b>QUANTUM TECHNOLOGIES AND APPLICATIONS (23AOE0503)</b>	<b>CO1</b>	Analyze basic quantum principles like qubits, superposition, and entanglement..
	<b>CO2</b>	Understand quantum computing concepts such as qubits, superposition, and entanglement.
	<b>CO3</b>	Apply quantum communication protocols for secure data transmission.
	<b>CO4</b>	Analyze quantum sensing technologies and their industrial applications.
	<b>CO5</b>	Evaluate quantum materials, devices, and global initiatives in emerging quantum technologies
<b>MATHEMATICS FOR MACHINE LEARNING AND AI (23AOE9901)</b>	<b>CO1</b>	Apply linear algebra concepts to ML techniques like PCA and regression
	<b>CO2</b>	Analyze probabilistic models and statistical methods for AI applications
	<b>CO3</b>	Apply optimization techniques for machine learning algorithms
	<b>CO4</b>	Apply vector calculus and transformations in AI-based models.
	<b>CO5</b>	Evaluate graph-based AI models using mathematical representations
<b>MATERIALS CHARACTERIZATION TECHNIQUES (23AOE9906)</b>	<b>CO1</b>	Understand the crystal structure and crystal size by using X-ray Diffraction (XRD) technique.
	<b>CO2</b>	Analyze the basic principles of Scanning Electron Microscopy (SEM).
	<b>CO3</b>	Analyze the fundamentals of Transmission Electron Microscope (TEM).
	<b>CO4</b>	Apply the various spectroscopic techniques for engineering applications.
	<b>CO5</b>	Analyze the electric and magnetic properties of a specimen using various characterization techniques.
<b>CHEMISTRY OF ENERGY SYSTEMS (23AOE9911)</b>	<b>CO1</b>	Understand the problems based on electrode potential and concept of batteries.
	<b>CO2</b>	Apply fuel technology in various energy and engineering contexts.
	<b>CO3</b>	Analyze the advantages of photoelectric catalytic process such as high efficiency, low environmental impact and renewable energy applications.
	<b>CO4</b>	Apply the electrochemical principles to photo voltaic cell, solar power and solar cells.
	<b>CO5</b>	Analyze various methods for storage of hydrogen fuel.
	<b>CO1</b>	Understand the basics of English grammar to develop proficiency in language skills



**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

<b>ENGLISH FOR COMPETITIVE EXAMINATIONS (23AOE9915)</b>	<b>CO2</b>	Apply the grammatical structures in sentences for an effective communication
	<b>CO3</b>	Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams
	<b>CO4</b>	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills
	<b>CO5</b>	Create effective writing forms like essays and precise writing by using grammar and structure rules.
<b>ENTREPRENEURSHIP AND NEW VENTURE CREATION (23AOEMB01)</b>	<b>CO1</b>	Understand the entrepreneurial mind – set for venture creation and Intrapreneurial Leadership.
	<b>CO2</b>	Analyze the process of problem-opportunity identification through design thinking, and validating with the potential customer.
	<b>CO3</b>	Understand Prototype Development and validate MVP of their venture idea.
	<b>CO4</b>	Evaluate the financial and market viability of a venture by conducting financial and marketing feasibility.
	<b>CO5</b>	Understand an investible pitch deck of their practice venture to attract stakeholders.
<b>GEOTECHNICAL ENGINEERING LAB (23APC0117)</b>	<b>CO1</b>	Analyze index properties of soils.
	<b>CO2</b>	Evaluate the field density, Optimum Moisture Content (OMC) and Maximum Dry Density (MDD) of soils
	<b>CO3</b>	Evaluate permeability characteristics of soil
	<b>CO4</b>	Analyze the shear strength and compressibility of soil
	<b>CO5</b>	Evaluate the bearing ratio by using CBR method for soil.
<b>FLUID MECHANICS HYDRAULIC MACHINES LAB (23APC0118)</b>	<b>CO1</b>	Analyze the behavior of fluid flow in pipes by Bernoulli's equation.
	<b>CO2</b>	Evaluate discharge coefficients for various flow measurement devices and analyze flow behavior.
	<b>CO3</b>	Evaluate head losses due to friction and minor losses in pipe flow systems.
	<b>CO4</b>	Analyze the impact of jets on vanes and its significance in hydraulic machinery.
	<b>CO5</b>	Analyze the performance of turbines and pumps under different conditions and recommend optimal operating parameters.
<b>ESTIMATION, SPECIFICATIONS, COSTING AND VALUATION (23ASC0102)</b>	<b>CO1</b>	Understand the types of estimates, estimation methods, and rate analysis through activity-based learning.
	<b>CO2</b>	Apply wall-to-wall and centre line methods to prepare detailed estimates for single and two-storied buildings including all components.
	<b>CO3</b>	Apply techniques to prepare abstract estimates and analyze data from detailed estimates of residential
	<b>CO4</b>	Analyze the preparation of measurement books and bill generation procedures as per AP State Government norms.
	<b>CO5</b>	Analyze valuation methods, cost escalation, and value analysis for civil engineering works through activity-based tasks.



**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

<b>TINKERING LAB</b> <b>(23AES0404)</b>	<b>CO1</b>	Develop arduino/ESP32 programming for basic circuits using breadboard/Tinkercad
	<b>CO2</b>	Analyze the LDR interfacing circuits with arduino / ESP32 controllers.
	<b>CO3</b>	Analyze the control of traffic light circuit, sensor-based servomotor and mobile app-based LED.
	<b>CO4</b>	Design a walking robot and rocket using 3-Dimensional (3D) printing Technology.
	<b>CO5</b>	Create a prototype for soil moisture monitor and redesign a motor bike using Design Thinking steps
<b>DESIGN OF STEEL STRUCTURES</b> <b>(23APC0119)</b>	<b>CO1</b>	Design of bolt, welded connections along with prying action according to IS Codes
	<b>CO2</b>	Design of Tension and Compression members according to IS Codes
	<b>CO3</b>	Design of Beams, Built Up members and Plate girders according to IS Codes
	<b>CO4</b>	Design of Industrial structural members according to IS codes
	<b>CO5</b>	Design of Continuous Beams and Portal Frames Using Plastic Design Approach.
<b>HIGHWAY ENGINEERING</b> <b>(23APC0120)</b>	<b>CO1</b>	Understand planning and alignment of highway.
	<b>CO2</b>	Apply concept of the geometric design for highway
	<b>CO3</b>	Understand concept of traffic Engineering and its regulations
	<b>CO4</b>	Understand the design principles of intersections.
	<b>CO5</b>	Design of pavements as per Indian Road Congress standards.
<b>ENVIRONMENTAL ENGINEERING</b> <b>(23APC0121)</b>	<b>CO1</b>	Understand the various sources of water, methods of demand estimation, and key quality parameters.
	<b>CO2</b>	Apply appropriate water treatment processes to ensure purification and safe supply of water.
	<b>CO3</b>	Analyze the components and functioning of water storage, distribution systems, and their operations.
	<b>CO4</b>	Design effective sewerage systems, stormwater drainage networks, and plumbing layouts.
	<b>CO5</b>	Evaluate sewage treatment methods, sludge management practices, and water reuse strategies.
<b>DESIGN OF EARTHQUAKE RESISTANT STRUCTURES</b> <b>(23APE0104)</b>	<b>CO1</b>	Understand the causes of earthquakes, seismic waves, and vibration characteristics of structures.
	<b>CO2</b>	Apply the concepts of conceptual design and seismic load evaluation using equivalent lateral force methods.
	<b>CO3</b>	Analyze earthquake-resistant design principles for RC frame buildings based on IS 1893 standards.
	<b>CO4</b>	Evaluate the seismic performance and design strategies for masonry structures.
	<b>CO5</b>	Design ductile detailing and structural wall systems for earthquake resistance as per IS 13920.
<b>OPEN CHANNEL FLOW</b>	<b>CO1</b>	Apply the fundamental principles of fluid flow in pipelines and networks under



**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

<b>(23APE0105)</b>		steady and unsteady conditions.
	<b>CO2</b>	Evaluate the uniform and varied flow in open channels using theoretical and computational approaches.
	<b>CO3</b>	Analyze the impact of unsteady flow phenomena such as surges and dam breaks
	<b>CO4</b>	Evaluate sediment transport processes and their influence on river morphology and hydraulic structures.
	<b>CO5</b>	Create hydraulic models for flow measurement and physical modeling applications in fluid mechanics.
<b>FOUNDATION ENGINEERING (23APE0106)</b>	<b>CO1</b>	Understand the principles and methods of Soil Exploration
	<b>CO2</b>	Evaluate the bearing capacity and settlement of shallow foundations.
	<b>CO3</b>	Analyze the load-carrying capacity and settlement of Deep foundations
	<b>CO4</b>	Analyze the slope stability using different failure theories and numerical methods
	<b>CO5</b>	Apply classical earth pressure theories to check the stability of retaining walls
<b>Air Pollution &amp; Control (23APE0107)</b>	<b>CO1</b>	Understand the sources, classification, and global effects of air pollution.
	<b>CO2</b>	Analyze meteorological parameters affecting air pollution dispersion.
	<b>CO3</b>	Design control systems for particulate matter using appropriate removal techniques.
	<b>CO4</b>	Apply suitable technologies for gaseous pollutant removal.
	<b>CO5</b>	Evaluate Sources of vehicular and indoor air pollution and mitigation strategies
<b>WATERSHED MANAGEMENT (23APE0108)</b>	<b>CO1</b>	Understand the concept of watershed management, stakeholder roles, pollution sources, and environmental guidelines for water quality
	<b>CO2</b>	Analyze soil erosion processes, sediment yield, and wetland hydrology, including the role of water in wetland ecosystems
	<b>CO3</b>	Analyze surface and groundwater interactions, wetland treatment efficiency, and hydrological models for integrated water resource management.
	<b>CO4</b>	Apply water harvesting techniques, hydrologic modeling, and wetland design methods for sustainable watershed management.
	<b>CO5</b>	Understand irrigation water management strategies, drought mitigation policies, and the role of water foot print in agricultural sustainability.
<b>ADVANCED STRUCTURAL ANALYSIS 23APE0109</b>	<b>CO1</b>	Analyze the three and two hinged arches for different loading conditions
	<b>CO2</b>	Analyze the frames using moment distribution method
	<b>CO3</b>	Analyze the beams and frames using Kani's method
	<b>CO4</b>	Analyze the beams using flexibility method





**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

<b>RENEWABLE ENERGY SOURCES</b> <b>(23AOE0202)</b>	<b>CO5</b>	Analyze the beams using Stiffness methods
	<b>CO1</b>	Understand solar radiation concepts, solar angles, and solar energy collection and storage methods.
	<b>CO2</b>	Analyze the working principles, technologies, characteristics, and configurations of solar PV systems.
	<b>CO3</b>	Analyze the components, design, and performance factors of wind energy conversion systems.
	<b>CO4</b>	Understand Geothermal energy sources, applications, and their potential in India.
	<b>CO5</b>	Understand the working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems.
<b>AUTOMATION AND ROBOTICS</b> <b>(23APE0322)</b>	<b>CO1</b>	Explain the need, types, and elements of automation systems and analyze different levels of automation strategies in industry.
	<b>CO2</b>	Demonstrate the operation of automated flow lines and apply methods for assembly line balancing and optimization.
	<b>CO3</b>	Identify robotic components and describe their configuration, degrees of freedom, and industrial applications in various processes.
	<b>CO4</b>	Apply transformation techniques and D-H notation to solve problems in robot kinematics and evaluate actuator and sensor selection.
	<b>CO5</b>	Analyze robot dynamics using Jacobians and Euler formulations and develop suitable trajectories for obstacle-free motion.
<b>DIGITAL ELECTRONICS</b> <b>(23AOE0402)</b>	<b>CO1</b>	Understand the logic gates and minimization of Boolean functions using K-Maps
	<b>CO2</b>	Analyze the design procedure of Arithmetic circuits and code conversions using logic gates
	<b>CO3</b>	Analyze the design concepts of combinational logic circuits using logic gates.
	<b>CO4</b>	Analyze the design aspects of sequential logic circuits using flip flops.
	<b>CO5</b>	Understand various programmable logic devices and digital ICs.
<b>OPERATING SYSTEMS</b> <b>(23AOE0504)</b>	<b>CO1</b>	Understand the basic concepts of Operating Systems and its services
	<b>CO2</b>	Apply the concepts of process synchronization and CPU scheduling by drawing Gantt chart
	<b>CO3</b>	Analyze the memory management and its allocation policies.
	<b>CO4</b>	Apply the different conditions for deadlock handling and solve various disk scheduling algorithms.
	<b>CO5</b>	Understand the various System Security and Protection mechanisms.
<b>MACHINE LEARNING</b> <b>(23AOE0505)</b>	<b>CO1</b>	Understand the types of Machine Learning and preparing to model
	<b>CO2</b>	Evaluate the hypotheses by comparing its learning algorithms
	<b>CO3</b>	Evaluate the decision making problems by using SVM and graphical models
	<b>CO4</b>	Apply the supervised learning techniques for few machine learning problems
	<b>CO5</b>	Analyze the Unsupervised learning methods using clustering methods.
<b>ADVANCED OPERATION RESEARCH</b> <b>(23AOE9902)</b>	<b>CO1</b>	Understand the concepts of linear programming in solving practical problems in industry.
	<b>CO2</b>	Analyze the transportation models to trace the solutions to the real-world problems.





**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

	<b>CO3</b>	Apply mathematical skills to solve nonlinear programming models arising from a wide range of applications.
	<b>CO4</b>	Apply the concept of non-linear programming for solving non-linear constraints.
	<b>CO5</b>	Apply the concept of unconstrained geometric programming for solving the non-linear constraints.
<b>MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES (23AOE9903)</b>	<b>CO1</b>	Apply the applications to quantum systems through the study of vector spaces, inner products, and linear operators.
	<b>CO2</b>	Analyze the transition from finite to infinite dimensional systems with linear algebra concepts to function spaces.
	<b>CO3</b>	Analyze the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.
	<b>CO4</b>	Evaluate the statistical interpretations through quantum mechanical principles to solve problems in simple quantum systems.
	<b>CO5</b>	Create the understanding of measurement processes and modern quantum theory from the advanced concepts in composite systems.
<b>PHYSICS OF ELECTRONIC MATERIALS AND DEVICES (23AOE9907)</b>	<b>CO1</b>	Understand the fundamentals of crystal growth and thin films.
	<b>CO2</b>	Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.
	<b>CO3</b>	Understand the basics of Semiconductors for Engineering Applications.
	<b>CO4</b>	Analyze the concepts of excitons and luminescence in Semiconductors.
	<b>CO5</b>	Apply the fundamentals of semiconductors for various display devices.
<b>CHEMISTRY OF POLYMERS AND APPLICATIONS (23AOE9912)</b>	<b>CO1</b>	Understand polymer fundamentals and classification systems.
	<b>CO2</b>	Analyze the chemical and physical properties of natural polymers and their applications.
	<b>CO3</b>	Apply the knowledge of thermoplastic and thermoset polymers in practical situations
	<b>CO4</b>	Understand the fundamental principles of hydrogel in polymer networks.
	<b>CO5</b>	Analyze the preparation and mechanism of conducting and degradable polymers
<b>ACADEMIC WRITING AND PUBLIC SPEAKING (23AOE9916)</b>	<b>CO1</b>	Apply the essential features of Academic Writing in scholarly works.
	<b>CO2</b>	Apply the strategies of writing skills in research paper writing without plagiarism.
	<b>CO3</b>	Create a coherent and well-organized paragraphs in essays, reports, reviews and SOP
	<b>CO4</b>	Analyze the characteristics and strategies of public speaking skills for impactful speeches.
	<b>CO5</b>	Apply non-verbal communication skills for effective public speaking.
<b>ACADEMIC WRITING AND PUBLIC SPEAKING (23AOE9916)</b>	<b>CO1</b>	Apply the essential features of Academic Writing in scholarly works.
	<b>CO2</b>	Apply the strategies of writing skills in research paper writing without plagiarism.
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**Annamacharya Institute of Technology and Sciences, Tirupati**  
**(Autonomous)**  
**Department of Civil Engineering**

	<b>CO5</b>	Apply non-verbal communication skills for effective public speaking.
<b>HIGHWAY ENGINEERING LAB (23APC0122)</b>	<b>CO1</b>	Evaluate the quality and suitability of aggregates for highway applications
	<b>CO2</b>	Evaluate the suitability of aggregates for road construction.
	<b>CO3</b>	Evaluate the quality and suitability of bitumen for highway applications
	<b>CO4</b>	Analyze test results to assess the consistency, durability, and temperature susceptibility of bituminous binders for pavement applications.
	<b>CO5</b>	Analyze bitumen extraction to determine binder content in bituminous mixes and assess compliance with mix design standards.
<b>ENVIRONMENTAL ENGINEERING LAB (23APC0123)</b>	<b>CO1</b>	Understand the sampling, preservation, and characterization methods of water and wastewater.
	<b>CO2</b>	Analyze physical and chemical water quality parameters such as turbidity, conductivity, sulphates, iron, fluoride, and chlorine content.
	<b>CO3</b>	Evaluate biological characteristics of water and wastewater including BOD, COD, DO, and coliforms.
	<b>CO4</b>	Evaluate treatment efficiency using parameters like optimum coagulant dosage, sludge volume index, and solids estimation.
	<b>CO5</b>	Evaluate standard laboratory procedures and instruments in the analysis of water and wastewater for environmental assessment.
<b>BUILDING INFORMATION MODELING (23ASC0103)</b>	<b>CO1</b>	Understand the fundamentals of BIM and Autodesk Revit's interface and workflow
	<b>CO2</b>	Apply basic drawing, editing and modification tools in Revit for creating and modifying models.
	<b>CO3</b>	Create various architectural elements such as walls, doors, windows, floors
	<b>CO4</b>	Create various architectural elements such as ceilings and roofs
	<b>CO5</b>	Design and elevations for visualization and detailing purposes.
<b>TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS (23AMC9902)</b>	<b>CO1</b>	Understand various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.
	<b>CO2</b>	Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.
	<b>CO3</b>	Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.
	<b>CO4</b>	Evaluate the rights and responsibilities of the holder of Intellectual Property.
	<b>CO5</b>	Apply various forms of copy rights and patents at national and international levels.