# ANURAG Engineering College

An Autonomous Institution, Accredited by NAAC with A+ Grade,
ISO 9001 : 2015 Institution
(Approved by AICTE, New Delhi, Affiliated to JNTUH, Hyderabad)
Ananthagiri (V&M), Suryapet (Dt). Pin: 508 206.

## DEPARTMENT OF MECHANICAL ENGINEERING


# COURSE OUTCOMES (CO)

## I YEAR I SEMESTER

### (MA101BS) MATRICES AND CALCULUS

After learning the contents of this course the student must be able to

CO 1: Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
CO 2: Find the Eigen values and Eigen vectors
Reduce the quadratic form to canonical form using orthogonal transformations.
CO 3: Solve the applications on the mean value theorems.
Evaluate the improper integrals using Beta and Gamma functions
CO 4: Find the extreme values of functions of two variables with/ without constraints.
CO 5: Evaluate the multiple integrals and apply the concept to find areas, volumes

### (AP102BS) APPLIED PHYSICS

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

CO 1: Understand various optical phenomena of light
CO 2: Apply basic the principles of quantum mechanics to classify solids based on band theory.
CO 3: Identify the role of semiconductor devices in science and engineering Applications.
CO 4: Understand the features and applications of Nano materials in various fields.
CO 5: Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

### (CD103ES) C PROGRAMMING AND DATA STRUCTURES

CO 1: Understand the various steps and know the usage of operators in Program development.
CO 2: Design programs involving the concepts of arrays and code reusability using functions.
CO 3: Analyze the concepts of pointers, strings to write C programs.
CO 4: Develop programs with user-defined data types and apply various file handling techniques.
CO 5: Implement various searching and sorting Techniques.

### (EN104HS) ENGLISH FOR SKILL ENHANCEMENT

Students will be able to

CO 1: Understand the importance of vocabulary and sentence structures.

CO 2: Choose appropriate vocabulary and sentence structures for oral and written communication.

CO 3: Demonstrate understanding of the rules of functional grammar.

CO 4: Develop comprehension skills from known and unknown passages through effective reading strategies.

CO 5: Construct paragraphs, letters, essays, abstracts, précis and reports in various contexts thereby improving proficiency in writing modules of English.

## (ME105ES) ENGINEERING WORKSHOP

CO 1: Study and practice on machine tools and their operations.

CO 2: Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, and foundry, house wiring and welding.

CO 3: Identify and apply suitable tools for different trades of engineering processes including drilling, material removing, measuring, and chiseling.

CO 4: Build right attitude, team working, precision and safety at work place.

CO 5: Apply basic electrical engineering knowledge and various Manufacturing processes.

## (ME106ES)ELEMENTS OF MECHANICAL ENGINEERING

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

CO 1: Understand the operation, usage, and applications of different measuring instrument and Tools.

CO 2: Examine the different characteristics of instruments like accuracy, precision etc.

CO 3: Prepare simple composite components and joining different materials using soldering Process.

**CO 4:** Identify tools & learn practically the process of turning, milling, grinding on mild steel pieces.

**CO 5:** Understand the basic components of IC engine, Gear box and boiler.

## (AP107BS) APPLIED PHYSICS LABORATORY

The students will be able to:

CO 1: Know the determination of the Planck's constant using Photo electric effect

CO 2: Appreciate quantum physics in semiconductor devices and optoelectronics.

CO 3: Gain the knowledge of various semiconductor devices like PN junction diode, Zener diode, BJT, LED, solar Cell

CO 4: Understand the properties and principles of laser and optical fiber.

CO 5: Carried out data analysis.

## (EN108HS)ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

CO 1: Reproduce speech sounds and improve language.
CO 2: Develop accent and pronunciation in various situations
CO 3: Understand variants in pronunciation by differentiating between British and American accents
CO 4: Identify the diverse purposes of listening and speaking
CO 5: Exhibit critical thinking, problem-solving and decision-making skills through Group Discussions and Interviews.

### (CD109ES)C PROGRAMMING AND DATA STRUCTURES LABORATORY

CO 1: Develop modular and readable C Programs
CO 2: Solve problems using strings, functions
CO 3: Handle data in files
CO 4: Implement stacks, queues using arrays, linked lists.
CO 5: To understand and analyze various searching and sorting algorithms.

### (ES110MC) ENVIRONMENTAL SCIENCE

After the completion of the course, the student will be able to understand
CO 1: The multidisciplinary nature of environment, essence of environment.
CO 2: About the natural resources utilization and their conservation.
CO 3: The importance of Biodiversity and its Conservation.
CO 4: About the causes and effects of environmental pollution and its management as well as environmental issues.
CO 5: About the environmental wastes management rules, regulations and EIA for the protection of environment and to achieve sustainable development.

## I YEAR II SEMESTER

### (MA201BS) ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

After learning the contents of this paper the student must be able to

CO 1: Identify whether the given differential equation of first order is exact or not
CO 2: Solve higher differential equation and apply the concept of differential equation to real world problems.
CO 3: Use the Laplace transforms techniques for solving ODE's.
CO 4: Find Divergence, curl, directional derivatives and identify solenoid and irrigational
CO 5: Evaluate the line, surface and volume integrals and converting them from one to another

### (CH202BS) ENGINEERING CHEMISTRY

The students will able to
CO 1: Understand the basic properties of water and its usage in domestic and industrial purposes.

CO 2: Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
CO 3: Learn the fundamentals and general properties of polymers and other engineering materials.
CO 4: Apply the knowledge of atomic, molecular and electronic changes related to conductivity.
CO 5: Apply the knowledge of engineering materials in daily life.

## (EG203ES) COMPUTER AIDED ENGINEERING GRAPHICS

CO 1: Apply computer aided drafting tools to create 2D and 3D objects.
CO 2: Visualize the different aspects of Points, Lines and Planes.
CO 3: Acquire knowledge on projections of solids.
CO 4: Draw the Sectional views of solids and plan the drawing for development of surfaces.
CO 5: Understand the isometric views and projections. Exposure to computer-aided geometric design and creating working drawings.

## (ME204ES)ENGINEERING MECHANICS

**Course Outcomes:** At the end of the course, students will be able to
CO 1: Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
CO 2: Solve problem of bodies subjected to friction.
CO 3: Find the location of centroid and calculate moment of inertia of a given section.
CO 4: Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
CO 5: Solve problems using work energy equations for translation, fixed axis rotation and plane Motion and solve problems of vibration.

## (ME205ES)ENGINEERING MATERIALS)

At the end of the course, students will be able to**:**
CO 1: Classify the various materials that will be essential for the mechanical engineering applications.
CO 2: Express the mechanical properties of metals and their testing procedures.
CO 3: Understand the application of materials and their processing
CO 4: Understand the requirement and need for the development of the new materials.

## (CH206BS) ENGINEERING CHEMISTRY LABORATORY

The experiments will make the student gain skills on:
CO 1: Determination of rate of corrosion of mild steel in various conditions.
CO 2: To perform methods such as conductometry, potentiometry and pH metry in order to find out the concentrations or equivalence points of acids and bases.
CO 3: To prepare polymers like Thiokol rubber and Bakelite.

CO 4: Estimation of Saponification value, Viscosity and surface tension of lubricant oils.
CO 5: Estimation of hardness of water, Chloride content of water sample.

## (CS207ES) PYTHON PROGRAMMING LABORATORY

CO 1: Able to develop programs using control statements.
CO 2: Able to code programs using modular approach.
CO 3: Read and write data from/to files in Python Programs
CO 4: To write GUI program to create window wizard using various buttons.
CO 5: Implement digital systems using python and to install and use various libraries.

## (ME208ES)FUELS AND LUBRICANTS LABORATORY

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

CO 1: Find the kinematic viscosity of lubricants and its variation with temperature.
CO 2: Determine the flash point, fire point, cloud point and pour point of liquid fuels.
CO 3: Determine the calorific value of solid, liquid and gaseous fuels.
CO 4: Determination of the dropping point of lubricating grease.
CO 5: Determination of distillation characteristics of petroleum products.

## (HS210MC) CONSTITUTION OF INDIA

**Course Outcomes:**

CO 1: Knowledge of historical perspective and salient features of Indian constitution
CO 2: Aware of the fundamental rights of Indian citizens.
CO 3: Know the directive principles and fundamental duties of government and citizens
CO 4: Knowledge of the Quasi-federal and parliamentary structure of Indian constitution
CO 5: Knowledge of the constitution amendment powers and Emergency Provisions of Indian constitution

# II YEAR I SEMESTER

## (PC301BS)PROBABILITY, STATISTICS & COMPLEX VARIABLES

After learning the contents of this paper the student must be able to:

CO 1: Formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

CO 2: Apply concept of estimation and testing of hypothesis to case studies.

CO 3: Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.

CO 4: Taylor's and Laurent's series expansions of complex function.

## (ME302ES)METALLURGY & MATERIAL SCIENCE

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

**CO 1**: Memorize the types of Crystal structures and their defects.

**CO 2:** Learn the necessity of alloying and identify types of alloy phases.

**CO 3:** Demonstrate importance of critical understanding of heat treatment in achieving required properties.

**CO 4:** Apply the knowledge of heat treatment to enhance surface properties.

**CO 5:** Analyze the properties and micro structure of ferrous and non-ferrous alloys.

**CO 6:** Develop new materials and enhance properties for the advanced applications.

## (ME303PC)MECHANICS OF SOLIDS

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

CO 1: Evaluate the internal forces, moments, stresses, strains, and deformations in structures made of various materials acted on by a variety of loads.

CO 2: Draw axial force, shear force and bending moment diagrams for beams and frames.

CO 3: Develop the Bending and Torsion formula and apply to the design of beams and shafts.

CO 4: Use the stress transformation equations to find the state of stress at a point for various rotated positions of the stress element and display the same in graphical form as Mohr's circle.

CO 5: Understand the different criteria for the safety of the component by applying the theories of elastic failure.

## (ME304PC)PRODUCTION TECHNOLOGY

Student will be able to:

**CO 1:** Elaborate the fundamentals of various moulding, casting techniques and furnaces.

**CO 2:** Identify the importance of permanent joining and principle behind different welding Processes.

**CO 3:** Explain the concepts of solid-state welding processes

**CO 4:** Understand the concepts of rolling and sheet metal operations in metal working.

**CO 5:** Elaborates the uniqueness of extrusion, forging and high energy rate forming processes in metal working.

## (ME305PC)THERMODYNAMICS

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

CO 1: Understand the basics of Thermodynamics

CO 2: Apply first and second laws of thermodynamics to different systems

CO 3: Determine the feasibility of a process w.r.to entropy changes

CO 4: Apply concepts of thermodynamic property relations to ideal gas and real gases

CO 5: Evaluate performance of power cycles and refrigeration cycles

### (ME306PC)PRODUCTION TECHNOLOGY LABORATORY

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

CO 1: Analyze the given problem and conducts investigation on the experimental setup.

CO 2: Operate different types of welding machines

CO 3: Perform operations on mechanical press.

CO 4: Get familiarity with processing of Plastics.

CO 5: Effectively communicate and explain the experimental analysis.

## (ME307PC)METALLURGY AND MECHANICS OF SOLIDS LABORATORY

At the end of the lab, the student will be able to:

CO 1: Analyze the behavior of the solid bodies subjected to various types of loading.

CO 2: Apply knowledge of materials and structural elements to the analysis of simple structures.

CO 3: Undertake problem identification, formulation and solution using a range of analytical methods

CO 4: Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.

CO 5: Expectation and capacity to undertake lifelong learning.

## (ME308PC)COMPUTER AIDED MACHINE DRAWING

CO 1: Preparation of engineering and working drawings with dimensions and bill of material during design and development.

CO 2: Developing assembly drawings using part drawings of machine components.

CO 3: Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

CO 4: Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

CO 5: Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
CO 6: Title boxes, their size, location and details - common abbreviations and their liberal usage
**CO 7:** Types of Drawings – working drawings for machine parts.

### (HS309MC) GENDER SENSITIZATION

**Course Outcomes:** After learning the contents of this paper the student must be able to

CO 1: Students will have developed a better understanding of important issues related to gender in contemporary India.

CO 2: Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.

CO 3: Students will acquire insight into the gendered division of labor and its relation to politics and economics.

CO 4: Men and women students and professionals will be better equipped to work and live together as equals.

**CO 5:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence**.**

## II YEAR II SEMESTER

### (EE401ES)BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

CO 1: To analyze and solve electrical circuits using network laws.

CO 2: To introduce components of Low Voltage Electrical Installations.

CO 3: To understand and analyze basic Electric and Magnetic circuits.

CO 4: To study the working principles of Electrical Machines.

CO 5: To identify and characterize diodes and various types of transistors.

### (ME402PC)KINEMATICS OF MACHINERY

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

CO 1: Understand the various elements in mechanism and the inversions of commonly used mechanisms such as four bar, slider crank and double slider crank mechanisms.
CO 2: Draw the velocity and acceleration polygons for a given configuration of a mechanism.
CO 3: Understand the conditions for straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
CO 4: Draw the displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
CO 5: Calculate the number of teeth and velocity ratio required for a given combination of

gears.

### (ME403PC)FLUID MECHANICS & HYDRAULIC MACHINES

CO 1: Able to explain the effect of fluid properties on a flow system.

CO 2: Able to identify type of fluid flow patterns and describe continuity equation.

CO 3: To analyse a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.

CO 4: To select and analyse an appropriate turbine with reference to given situation in power plants.

CO 5: To estimate performance parameters of a given Centrifugal and Reciprocating pump.

**CO 6:** Able to demonstrate boundary layer concepts.

## (ME404PC)IC ENGINES & GAS TURBINES

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

CO 1: Elaborate the working principles of IC Engine systems and its classification.

CO 2: Explore the combustion stages of SI and CI engines, and factors influence for better Combustion.

CO 3: Evaluate the testing and performance parameters of IC engines.

CO 4: Explain the function and working principles of rotary, reciprocating, dynamic axial Compressors.

CO 5: Understand the working principle of gas turbine and its classification with thermodynamic analysis.

## (ME405PC)INSTRUMENTATION AND CONTROL SYSTEMS

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

CO 1: Know the basic knowledge of the functional blocks of measurement systems.

CO 2: Describe the working of various physical variable Temperature and pressure measuring instruments.

CO 3: Explain the working of various physical variable Level, flow, Speed and Acceleration measuring instruments.

CO 4: Understand the working of various physical and Electrical Variables Stress, Humidity, Force, Torque and Power measuring instruments.

CO 5: Understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

## (EE406ES)BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

After learning the contents of this paper the student must be able to

CO 1: To analyze and solve electrical circuits using network laws

CO 2: To introduce components of Low Voltage Electrical Installations

CO 3: To understand and analyze basic Electric and Magnetic circuits

CO 4: To study the working principles of Electrical Machines

CO 5: To identify and characterize diodes and various types of transistors.

## (ME407PC)FLUID MECHANICS & HYDRAULIC MACHINES LABORATORY

CO 1: Able to explain the effect of fluid properties on a flow system.
CO 2: Able to identify type of fluid flow patterns and describe continuity equation.
CO 3: To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
CO 4: To select and analyze an appropriate turbine with reference to given situation in power plants.
**CO 5:** To estimate performance parameters of a given Centrifugal and Reciprocating pump.

## (ME408PC)INSTRUMENTATION LABORATORY

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

CO 1: Characterize and calibrate measuring devices.

CO 2: Identify and analyze errors in measurement.

CO 3: Analyze measured data using regression analysis.

CO 4: Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

## (HS410MC) HUMAN VALUES AND PROFESSIONAL ETHICS

CO 1: Understood the core values that shape the ethical behavior of an Engineer.

CO 2: Exposed awareness on professional ethics and human values.

CO 3: An ability to communicate effectively.

CO 4: Known their role in technological development.

**CO 5:** An understanding of professional and ethical responsibility.