



ATMA MALIK INSTITUTE OF TECHNOLOGY AND RESEARCH (AMRIT)

Mohili-Aghai, Shahapur, Thane, Maharashtra, India. Pincode: 421603
Contact: +91 7720012139 / +91 9552773875, info@vishwatmakengg.in

Department of Engineering Sciences & Humanities
Course outcome R-2019 University of Mumbai Syllabus (C- SCHEME)

A. First Year: Semester I

SUBJECT: Engineering Mathematics-I(FEC101)

CO 1 Apply the basic concepts of Complex Numbers and will be able to use it for engineering problems.

CO 2 Apply hyperbolic functions and logarithms in the subjects like electrical circuits, Electromagnetic wave theory.

CO 3 Apply the basic concepts of partial differentiation of function of several variables and will be able to use in subjects like Electromagnetic Theory, Heat and Mass Transfer etc

CO 4 Apply the concept of Maxima, Minima and Successive differentiation and will be able to use it for optimization and tuning the systems.

CO 5 Apply the concept of Matrices and will be able to use it for solving the KVL and KCL in electrical networks.

CO 6 Apply the concept of Numerical Methods for solving the engineering problems with the help of SCILAB software.

SUBJECT: Engineering Physics-I (FEC102)

CO 1 Illustrate the fundamentals of quantum mechanics and its application.

CO 2 Explain peculiar properties of crystal structure and apply them in crystallography using X-ray diffraction techniques.

CO 3 Comprehend the concepts of semiconductor physics and applications of semiconductors in electronic devices.

CO 4 Employ the concept of interference in thin films in measurements.

CO 5 Discuss the properties of Superconductors and Supercapacitors to apply them in novel applications.

CO 6 Compare the properties of engineering materials for their current and futuristic frontier applications.

SUBJECT: Engineering Chemistry-I (FEC103)

CO 1 Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and

CO 2 Describe the concept of aromaticity and interpret it with relation to specific aromatic systems.

CO 3 Illustrate the knowledge of various types of intermolecular forces and relate it to real gases.

CO 4 Interpret various phase transformations using thermodynamics.

CO 5 Illustrate the knowledge of polymers, fabrication methods, conducting polymers in various

CO 6 Analyze the quality of water and suggest suitable methods of treatment.

SUBJECT: Engineering Mechanics (FEC104)

CO 1 Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.

CO 2 Demonstrate the understanding of Centroid and its significance and locate the same.

CO 3 Correlate real life application to specific type of friction and estimate required force to

CO 4 Establish relation between velocity and acceleration of a particle and analyze the motion by

CO 5 Illustrate different types of motions and establish Kinematic relations for a rigid body
CO 6 Analyze particles in motion using force and acceleration, work-energy and impulse momentum princi
SUBJECT: Basic Electrical Engineering (FEC105)
CO 1 Apply various network theorems to determine the circuit response / behavior.
CO 2 Evaluate and analyze 1- Φ circuits.
CO 3 Evaluate and analyze 3- Φ AC circuits.
CO 4 Understand the constructional features and operation of 1- Φ transformer.
CO 5 Illustrate the working principle of 3- Φ machine.
CO 6 Illustrate the working principle of 1- Φ machines.
SUBJECT: Engineering Physics-I (FEL101)
CO1 Perform the experiments based on interference in thin films and analyze the results.
CO2 Verify the theory learned in the module crystallography.
CO3 Perform the experiments on various semiconductor devices and analyze their
CO4 Perform simulation study on engineering materials
SUBJECT: Engineering Chemistry-I (FEL102)
CO1 Determine Chloride content and hardness of water sample
CO2 Determine free acid ph of different solutions
CO3 Determine metal ion concentration
CO4 Synthesize polymers, biodegradable plastics.
CO5 Determine Viscosity of oil
SUBJECT: Engineering Mechanics (FEL103)
CO1 Verify equations of equilibrium of coplanar force system
CO2 Verify law of moments.
CO3 Determine the centroid of plane lamina.
CO4 Evaluate co-efficient of friction between the different surfaces in contact.
CO5 Demonstrate the types of collision/impact and determine corresponding coefficient of
CO6 Differentiate the kinematics and kinetics of a particle.
SUBJECT: Basic Electrical Engineering (FEL104)
CO1 Interpret and analyse the behaviour of DC circuits using network theorems.
CO2 Perform and infer experiment on single phase AC circuits.
CO3 Demonstrate experiment on three phase AC circuits.
CO4 Illustrate the performance of single phase transformer and machines.
SUBJECT: Basic Workshop Practice-I (FEL105)
CO1 Develop the necessary skill required to handle/use different fitting tools.
CO2 Develop skill required for hardware maintenance.
CO3 Able to install an operating system and system drives.
CO4 Able to identify the network components and perform basic networking and crimping.
CO5 Able to prepare the edges of jobs and do simple arc welding.
CO6 Develop the necessary skill required to handle/use different plumping tools.
CO7 Demonstrate the turning operation with the help of a simple job.
B. First Year: Semester II
SUBJECT: Engineering Mathematics-II (FEC201)

CO1 Apply the concepts of First Order and first degree Differential equation to the problems in the field of engineering.
CO2 Apply the concepts of Higher Order Linear Differential equation to the engineering problems.
CO3 Apply concepts of Beta and Gamma function to solve improper integrals.
CO4 Apply concepts of Double integral of different coordinate systems to the engineering problems like area and mass.
CO5 Apply concepts of triple integral of different coordinate systems to the engineering problems and problems based on volume of solids.
CO6 Solve differential equations and integrations numerically using SCILAB software to experimental aspect of applied mathematics.
SUBJECT: Engineering Physics-II (FEC202)
CO1 Describe the diffraction through slits and its applications.
CO2 Apply the foundation of laser and fiber optics in development of modern communication technology.
CO3 Relate the basics of electrodynamics which is prerequisite for satellite communications, antenna theory etc.
CO4 Explain the fundamentals of relativity.
CO5 Assimilate the wide scope of nanotechnology in modern developments and its role in emerging innovating
CO6 Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.
SUBJECT: Engineering Chemistry-II (FEC203)
CO1 Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in
CO2 Illustrate the concept of emission spectroscopy and describe the phenomena of fluorescence and
CO3 Explain the concept of electrode potential and nernst theory and relate it to electrochemical cells.
CO4 Identify different types of corrosion and suggest control measures in industries.
CO5 Illustrate the principles of green chemistry and study environmental impact.
CO6 Explain the knowledge of determining the quality of fuel and quantify the oxygen required for combustion of
SUBJECT: Engineering Graphics (FEC204)
CO1 Apply the basic principles of projections in Projection of Lines and Planes
CO2 Apply the basic principles of projections in Projection of Solids.
CO3 Apply the basic principles of sectional views in Section of solids.
CO4 Apply the basic principles of projections in converting 3D view to 2D drawing.
CO5 Read a given drawing.
CO6 Visualize an object from the given two views.
SUBJECT: C Programming (FEC205)
CO1 Formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language
CO2 Implement, test and execute programs comprising of control structures.
CO3 Decompose a problem into functions and synthesize a complete program.
CO4 Demonstrate the use of arrays, strings and structures in C language.
CO5 Understand the concept of pointers
SUBJECT: Professional Communication and Ethics- I (FEC206)
CO1 Eliminate barriers and use verbal/non-verbal cues at social and workplace situations.
CO2 Employ listening strategies to comprehend wide-ranging vocabulary, grammatical structures, tone and
CO3 Prepare effectively for speaking at social, academic and business situations.
CO4 Use reading strategies for faster comprehension, summarization and evaluation of texts.
CO5 Acquire effective writing skills for drafting academic, business and technical documents.

CO6 Successfully interact in all kinds of settings, displaying refined grooming and social skills
SUBJECT: Engineering Physics-II (FEL201)
CO1 Perform the experiments based on diffraction through slits using Laser source and analyze the results.
CO2 Perform the experiments using optical fibre to measure numerical aperture of a given fibre.
CO3 Perform the experiments on various sensors and analyze the result.
SUBJECT: Engineering Chemistry-II (FEL202)
CO1 Determine moisture and ash content of coal
CO2 Analyze flue gas
CO3 Determine saponification and acid value of oil
CO4 Determine flash point of a lubricating oil
CO5 Synthesize a drug and a biofuel.
CO6 Determine n/k and emf of Cu-Zn system
SUBJECT: Engineering Graphics (FEL203)
CO1 Apply the basic principles of projections in 2D drawings using a CAD software.
CO2 Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.
CO3 Apply the concepts of layers to create drawing.
CO4 Apply basic AutoCAD skills to draw different views of a 3D object.
CO5 Apply basic AutoCAD skills to draw the isometric view from the given two views.
SUBJECT: C programming (FEL204)
CO1 Translate given algorithms to a program.
CO2 Correct syntax and logical errors.
CO3 Write iterative as well as recursive programs.
CO4 Represent data in arrays, strings and structures and manipulate them through a program.
CO5 Declare pointers and demonstrate call by reference concept.
SUBJECT: Professional Communication and Ethics- I (FEL205)
CO1 Listen and comprehend all types of spoken discourse successfully.
CO2 Speak fluently and make effective professional presentations.
CO3 Read large quantities of text in a short time to comprehend, summarise and evaluate content.
CO4 Draft precise business letters, academic essays and technical guidelines.
CO5 Dress finely and conduct themselves with panache in social, academic and professional situations
SUBJECT: Basic Workshop Practice-II (FEL206)
CO1 Develop the necessary skill required to handle/use different carpentry tools.
CO2 Identify and understand the safe practices to adopt in electrical environment.
CO3 Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
CO4 Design, fabricate and assemble pcb.
CO5 Develop the necessary skill required to handle/use different masons tools.
CO6 Develop the necessary skill required to use different sheet metal and brazing tools.
CO7 Able to demonstrate the operation, forging with the help of a simple job.



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Department of Civil Engineering

Course outcome R-2019 University of Mumbai Syllabus

(C- SCHEME)

A. Second Year: Semester III

SUBJECT: Engineering Mathematics-III (CEC 301)

C01 Apply the concept of Laplace transform to solve the real integrals in engineering problems.

C02 Apply the concept of inverse Laplace transform of various functions in engineering problems.

C03 Expand the periodic function by using Fourier series for real life problems and complex engineering problems

C04 Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory

C05 Apply Matrix algebra to solve the engineering problems

C06 Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat and wave equations

SUBJECT: Mechanics of Solids (CEC 302)

C01 Evaluate stress - strain behavior of elastic members and thin cylinders subjected to internal pressure.

C02 Draw variation of axial force, shear force and bending moment diagram for statically determinate beams and frames.

C03 Calculate Moment of Inertia for cross sections and analyse the material response under the action of shear and the effect of flexure (bending).

C04 Predict the angle of twist and shear stress developed in torsion and compute direct and bending stresses developed in the cross section of centrally and eccentrically loaded columns

C05 Locate principal planes in members and calculate principal stresses using analytical and graphical method
and to calculate strain energy stored in members due to elastic deformation

C06 Evaluate slope and deflection of beams supported and loaded in different ways.

SUBJECT: Engineering Geology (CEC 303)

C01 Explain the concepts of Geology and its application for safe, stable and economic design of any civil engineering structure.

C02 Interpret the lithological characters of the rock specimen and distinguish them on the basis of studied parameters.

C03 Describe the structural elements of the rocks and implement the knowledge for collection and analysis of the geological data.

C04 Interpret the geological conditions for the dam site and calculate RQD for the assessment of rock masses

C05 Analyze the given data and suggest rock mass rating for assessment of tunnelling conditions.

C06 Interpret the causes of geological hazards and implement the knowledge for their prevention

SUBJECT: Architectural Planning & Design of Buildings (CEC 304)

C01 Remember and recall the intricate details of building design and drawing

C02 Understand the basic concepts of building design and drawing

C03 Learn how to apply professional ethics and act responsibly pertaining to the norms of building design and drawing practices

C04 Identify, analyze, research literature and solve complex building design and drawing problems.

C05 Have new solutions for complex building design and drawing problems

C06 Effectively communicate ideas, related to building design and drawing, both orally as well as in written format like reports & drawings

SUBJECT: Fluid Mechanics - I (CEC 305)

C0 1 Describe various properties of fluids and types of flow

C02 Determine the pressure difference in pipe flows, application of Continuity equation and Bernoulli's theorem to determine velocity and discharge

C03 Apply hydrostatic and dynamic solutions for fluid flow applications

C04 Analyse the stability of floating bodies

C05 Apply the working concepts of various devices to measure the flow through pipes and channels

C06 Explain the compressible flow, propagation of pressure waves and stagnation properties

SUBJECT: Mechanics of Solids -Lab (CEL 301)

C01 Evaluate stress - strain behavior of materials and assess the structural behavior by the virtue of stresses developed and deformation of elastic members.

C02 Analyze the material response under the action of shear and the effect of flexure (bending).

C03 Predict the angle of twist and shear stress developed in torsion.

C04 Evaluate slope and deflection of beams supported and loaded in different ways.

SUBJECT: Engineering Geology Lab. Practice (CEL 302)

C01 Identify various rock forming minerals on the basis of physical properties.

C02 Explain the characteristics of Igneous, Sedimentary and Metamorphic rocks and assess their suitability as construction material and foundation rock.

C03 Interpret the rock characteristics and comment on their suitability as water bearing horizons.

C04 Interpret the geological map and assess the suitability of the site for Civil Engineering works.

C05 Solve the borehole problems and interpret it in order to understand subsurface Geology of the area.

C06 Calculate RQD and evaluate the rock masses for Civil Engineering Works.

SUBJECT: Architectural Planning & Design of Buildings Lab (CEL 303)

C01 Plan and design of residential and public building by implementing the principles of planning of buildings, Green building principles, bye laws, regulations and codes for planning

C02 Preparing various working and detailed drawing of the buildings in CAD.

C03 Preparing layouts of various building services.

C04 Preparing perspective views for all types of buildings

C05 Preparing the reports based on the drawings prepared, if required

SUBJECT: Fluid Mechanics - I (Lab) (CEL 304)
CO1 Calculate the metacentric height
CO2 Verify the Bernoulli's theorem
CO3 Determine the discharge coefficients
CO4 Measure fluid flow using various devices
CO5 Determine the hydraulic coefficients of an orifice
Skill Based Lab Course-Computer Aided Drafting & Building Information Modelling (CEL305)
CO1 Transfer the plan from a drawing sheet to a 2-D drafting software
CO2 Visualize the various elements in the software like points, lines, polygons, etc. as objects of the real world and relate it with civil engineering components.
CO3 Apply civil engineering concepts to draft efficient civil engineering plans in accordance to various building bye laws and forms.
CO 4 Conceptualize the space, logistic and statutory constraints in the real world to draw an efficient plan so that optimization is achieved
CO5 Attach and retrieve information pertaining to various civil engineering components through 3-D modelling software
CO6 Demonstrate a virtual walkthrough of buildings
Mini Project -1 A CEM 301
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5 Analyse the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CO9 Demonstrate project management principles during project work.
B. Second Year: Semester IV
SUBJECT: Engineering Mathematics-IV (CEC 401)
CO 1 Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem
CO2 Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
CO3 Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
CO4 Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities
CO5 Apply the concept of probability distribution to engineering problems& Testing hypothesis of small samples using sampling theory
CO6 Apply the concepts of parametric and nonparametric tests for analysing practical problems
SUBJECT: Structural Analysis(CEC 402)

C01 Calculate axial forces in the Coplanar trusses by using Method of joints and method of sections and also calculate radial shear, normal thrust and bending moment in parabolic 3- Hinged arches.
C02 Draw Influence Line Diagrams for axial forces in trusses, Reactions, SF and B M in beams and find their values when rolling loads are passing over them..
C03 Evaluate rotation and displacement at a joint of frames and deflection at any joint of truss and will be able to compute static and kinematic indeterminacy of structure
C04 Apply Flexibility methods and make use of Clapeyron's Theorem to analyze the indeterminate structures
C05 Analyse the indeterminate structures such as beams & simple rigid jointed frames using direct stiffness method.
C06 Analyse the indeterminate structures using Moment Distribution as Stiffness method and make plastic analysis.
SUBJECT: Surveying (CEC 403)
C01 Apply the principles of surveying and field procedures to conduct the various surveys
C02 Use various methods for taking linear and angular measurements
C03 Collect, record and analyse the field data for preparing drawings.
C04 Explain the advancements in instruments and methods
C05 Calculate the area of land and volume of earthwork
C06 Set out curves
SUBJECT: Building Materials & Concrete Technology(CEC 404)
C01 To develop and implement the conceptual knowledge of building materials in the construction industry.
C02 Assess the properties of building stones and their classifications. Understand the concept of various methods of manufacturing of bricks and different types of concrete blocks.
C03 To expose students to various quality control aspects of civil engineering materials by performing different lab tests on materials
C04 Identify the ingredients and properties of fresh and hardened concrete
C05 To interpret and design concrete mix for various grades for various exposure
C06 To study the new technology for manufacturing, testing and quality of concrete
SUBJECT: Fluid Mechanics - II(CEC 405)
C01 The knowledge of closed conduit flows, determine various losses through pipes, Pipe
C02 Theory of Laminar flow and Turbulent flow,
C03 Understand the concept of Boundary Layer theory, flow separation and forces around submerged bodies
C04 Application of moment of momentum principle on pipe bends and sprinklers
C05 The importance of dimensionless numbers, dimensional analysis and similarities.
SUBJECT: Structural Analysis Tutorial(CEL 401)
C01 Calculate axial forces in the Coplanar trusses by using Method of joints and method of sections and also calculate radial shear, normal thrust and bending moment in parabolic 3-Hinged arches.
C02 Draw Influence Line Diagrams for axial forces in trusses, Reactions, SF and B M in beams and find their values when rolling loads are passing over them..

C03 Evaluate rotation and displacement at a joint of frames and deflection at any joint of truss and will be able to compute static and kinematic indeterminacy of structure.

C04 Analyse the indeterminate structures such as beams & simple rigid jointed frames using Flexibility methods and direct stiffness method.

SUBJECT: Surveying(Lab) (CEL 402)

C01 Various surveying instruments, their least counts, various parts and suitable uses.

C02 Methods of measurements in the field.

C03 Skills for collecting, recording and analysing the field data.

C04 Advanced instruments and methods.

C05 First hand practical experience by receiving field exposure to collect site specific data.

C06 Setting out techniques.

SUBJECT: Building Materials & Concrete Technology (Lab)(CEL 403)

C01 Develop collaborative skills to work in a team/group

C02 Test physical properties of cement, aggregates and concrete.

C03 Test various other building materials like tiles, bricks and timber

C04 Evaluate the effects of admixtures on physical properties of concrete.

C05 Design the concrete mix.

C06 To bridge the gap between theoretical and market/industrial practices by market surveys.

SUBJECT: Fluid Mechanics – II (Lab)(CEL 404)

C01 Verify the Reynold's experiment

C02 Estimate the viscosity of fluid

C03 Calculate the losses in pipes

C04 Assess the flow pattern and velocity distribution in pipe flow

C05 learn the water hammer phenomenon through demonstration

C06 learn the wind tunnel testing through demonstration

SUBJECT: Skill Based Lab Course-II Total Station and Geographical Information System (Lab)(CEL 405)

C01 Operate a Total Station and traverse the field

C02 Perform various operations like computing height of a structure, computing area of plot, subdividing area, demarcating boundaries, etc. Using Total Station

C03 Set out foundation plan using Total Station

C04 Compute the point, line and area features using Global Navigation Satellite

C05 Plot various existing features in a geographic area on a GIS platform

C06 Add attribute and perform various statistical operations in GIS

SUBJECT: Mini Project -1B (CEM 401)

C01 Identify problems based on societal /research needs.

C02 Apply Knowledge and skill to solve societal problems in a group.

C03 Develop interpersonal skills to work as member of a group or leader.

C04 Draw the proper inferences from available results through theoretical/experimental/simulations.

C05 Analyse the impact of solutions in societal and environmental context for sustainable development.

C06 Use standard norms of engineering practices

C07 Excel in written and oral communication.

C08 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
C09 Demonstrate project management principles during project work.

C. Third Year: Semester V

SUBJECT: Theory of Reinforced Concrete Structures (CEC 501)

C01 Understand the fundamentals of WSM and LSM.
C02 Apply various clauses specified in IS: 456-2000 for designing structural members with safety and economy.
C03 Understand the use of readymade design charts and curves from Special Publications of Bureau of Indian Standards.
C04 Analyze and design various reinforced concrete elements such as beam, slab, column, footings using the concept of Limit State Method.
C05 Describe impact of jet on stationary, moving, hinged and series of plates also solve the numerical based on forces acting on it.

SUBJECT: Applied Hydraulics (CEC 502)

C01 Describe impact of jet on stationary, moving, hinged and series of plates also solve the numerical based on forces acting on it. and gradually-varying flows.
C02 Distinguish various types of turbines, Characteristic curves and its components.
C03 Analyze Centrifugal pumps by incorporating velocity triangle diagrams.
C04 Know the working mechanism of various Hydraulic machines.
C05 Identify the hydraulic behaviour of open channel flow and design the most economical section of channels
C06 Explain mathematical relationships for hydraulic jumps, surges, and critical, uniform, and gradually-varying flows

SUBJECT: Geotechnical Engineering-I (CEC 503)

C01 Explain the basic concepts of the physical and engineering properties of soil and derive the relationships among various unit weights & other parameters.
C02 Comprehend clay mineralogy and plasticity behavior of clay.
C03 Analyze grain size distribution of soil and classify the soil as per IS code.
C04 Evaluate the coefficient of permeability of different types of soils and draw the flow net diagram to estimate seepage discharge.
C05 Compute the effective stress and pore water pressure inside the soil mass under different geotechnical conditions.
C06 Evaluate the compaction parameters in laboratory and field as well as understand the necessity and methods of soil exploration

SUBJECT: Transportation Engineering (CEC 504)

C01 Compare various modes of transportation and understand basic technical aspects of railways, airways and waterways
C02 Understand different road plans, requirements of alignments and Design horizontal and vertical geometrical elements of highways.
C03 Carry out different traffic studies and analyze basic parameters of traffic engineering for efficient planning and control of traffic.
C04 Design the flexible and rigid pavement as per relevant IRC codes
C05 Construct different types of pavements, use of soil stabilization and planning of highway drainage
C06 Carry out structural and functional evaluation of pavement, identify the failures and design the overlay

Department Level Optional Course - Department Level Optional Course – 1 Advanced Concrete Technology(CEDLO5017)

C01 To use the various concrete materials and demonstrate the fresh properties of concrete.

C02 To perform different testing methods of concrete.

C03 To describe the durability of concrete and apply the knowledge of durability in extreme weather concreting.

C04 To design the concrete mix for field application by different methods.

C05 To explain the various properties of special concrete.

C06 To discuss the quality of concrete and explain the acceptance criteria.

SUBJECT: Theory of Reinforced Concrete Structures(Lab) (CEL 501)

C01 Understand the fundamentals of WSM and LSM. .

C02 Apply various clauses specified in IS: 456-2000 for designing structural members with safety and economy.

C03 Understand the use of readymade design charts and curves from Special Publications of Bureau of Indian Standards

C04 Analyze and design various reinforced concrete elements such as beam, slab, column, footings using the concept of Limit State Method.

SUBJECT: Applied Hydraulics (Lab) (CEL 502)

C01 Evaluate the efficiencies and discuss the working of various pumps and turbines.

C02 Apply impulse momentum principle to hydraulic machines.

C03 Determine the rate of flow through open channel.

C04 Generate and evaluate Gradually varied flow (GVF) and Rapid varied Flow (RVF) in open channel flow.

C05 Compute the Chezy's Constant through tilting flume.

SUBJECT: Geotechnical Engineering – I (Lab) (CEL 503)

C01 Determine the physical and engineering properties of soil

C02 Determine the plasticity characteristics of soil

C03 Carry out sieve analysis of soil, plot grain size distribution curve and determine the IS classification of soil

C04 Determine coefficient of permeability of soils

C05 Determine the compaction characteristics of soils log

C06 Compute the field SPT 'N' value and prepare the bore

SUBJECT: Transportation Engineering – I (Lab) (CEL 504)

C01 Classify Bitumen on basis of Penetration and Viscosity grade.

C02 Select Bitumen as per suitability on basis of Softening point and Ductility value.

C03 Determine suitability of aggregate on basis of Impact value, Abrasion value and Crushing value.

C04 Differentiate Elongated and Flaky aggregates on basis of Shape test.

C05 Carry out Classified volume study at mid-block section of road.

C06 Plot speed profile curve (S-Curve) at mid-block section.

Subject: Professional Communication and Ethics (CEL505)

C01 Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.

C02 Strategize their personal and professional skills to build a professional image and meet the demands of the industry.

C03 Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
C04 Deliver persuasive and professional presentations
C05 Develop creative thinking and interpersonal skills required for effective professional communication.
C06 Apply codes of ethical conduct, personal integrity and norms of organizational behaviour.

C. Third Year: Semester VI

Subject: Design and Drawing of Steel Structures (CEC601)

C01 Use the knowledge of Limit State Design philosophy as applied to steel structures. IS 800 code clauses
C02 Design bolted and welded connections.
C03 Design members subjected to axial tension.
C04 Design compression members, Built-up columns and column bases.
C05 Design members subjected to bending moment, shear force etc.
C06 Estimate design loads as per IS 875 for roof truss and design the Steel roof truss.

Subject: Water Resources Engineering (CEC602)

C01 Describe National water Policy, Calculate Crop water requirement and Classify various types and methods of irrigation.
C02 Estimate flood discharge and Runoff by traditional and modern usage tools for planning and management of water resources projects.
C03 Apply knowledge on ground water, well hydraulics to estimate the safe yield and ground water potential
C04 Analyze and design gravity dams and earthen dams with spillways for sustainable development
C05 Compare different silt theories related to irrigation channel and design the same.
C06 Classify and Explain various canal structures and suggest remedial measures for water logging to save fertile irrigation

Subject: Geotechnical Engineering-II (CEC603)

C01 Evaluate the consolidation parameters for the soil.
C02 Calculate the shear strength parameters for the soil.
C03 Calculate the factors of safety of different types of slopes under various soil condition, analyze the stability of slopes.
C04 Calculate lateral earth pressure under various soil condition.
C05 Calculate bearing capacity of shallow foundations using theoretical and field methods.
C06 Calculate load carrying capacity of individual as well as group of pile foundation using theoretical and field methods and pile settlement.

Subject: Environmental Engineering (CEC604)

C01 Analyse the quality of water and make outline of water Supply scheme.
C02 Design the various units of water treatment plant and apply the advanced, miscellaneous treatments whenever necessary.
C03 Build service connection of water supply from main and building drainage system at construction site along with rain water harvesting layout.
C04 Analyse and plan sewerage system along with test for sewer line.
C05 Design the units of sewage treatment plant. Also, able to apply the knowledge of low-cost treatment and stream sanitation.

C06 Understand air pollution, noise pollution and functional elements of solid waste management

Subject: Department Level Optional Course-2 Construction Equipment & Techniques (CEDLO6013)

C01 Understand the use/applications of various conventional construction equipments and select the best out of them for a particular site requirement.

C02 Know modern methods/equipments used for underground as well as underwater tunnelling.

C03 Compare conventional and modern methods of formwork and get acquainted with techniques used on sites with restricted space.

C04 Understand the techniques involved and the equipments required thereof for laying of utility lines, bridge construction and installation of structural steel members.

C05 Gain knowledge about the setting up of different kinds of the power generating structures.

C06 Get acquainted with the equipments/ techniques for construction of transporting facilities

Subject: Department Level Optional Course-2 Traffic Engineering and Management (CEDLO6017)

C01 Understand different characteristics of the road users and vehicles from their consideration and view point in the traffic engineering and transportation planning.

C02 Conduct different traffic surveys, analyzing the data collected as a part of such studies and interpreting it with the help of the different statistical models.

C03 Discuss the aspects associated with road safety, its audit and different TSM measures.

C04 Explain the concepts of PCU and LOS, their implication in determination of the capacity using Speed-Flow-Density relationships.

C05 Discuss transportation planning and ascertain the financial viability of any transportation network in the inception stage itself.

C06 Improve the effectiveness and efficiency of transportation systems through advanced technologies in Information systems and communication.

Subject: Design and Drawing of Steel Structures (Lab)(CEL601)

C01 Calculate dead, live and wind loads on the structure.

C02 Analyze the structure by analytical/graphical method.

C03 Use steel table for selecting appropriate section.

C04 Design the members for various load combinations.

C05 Design the bolted and welded connection.

C06 Read and Prepare the detailed fabrication drawing and design report.

Subject: Water Resources Engineering (Lab)(CEL602)

C01 Classify various techniques of water distribution and compute water requirement of crops.

C02 Discuss in detail about hydrological process and interpret plotting of hydrographs.

C03 Apply their knowledge on well hydraulics and compute discharge from an aquifer.

C04 Classify and describe various hydraulic structures such as dams and carry out its analysis for structural stability.
C05 Compare different silt theories related to irrigation channel and design the same.
C06 Identify and classify different canal head works - its distribution system and canal structures
Subject: Geotechnical Engineering-II Lab(CEL603)
C01 Determine consolidation parameters such as coefficient of compressibility, coefficient of volume change, coefficient of consolidation.
C02 Determine cohesion and angle of shearing resistance for various soil types.
C03 Determine the CBR value of soil for pavement design.
C04 Determine swelling pressure of soil.
C05 Understand the concept of stress distribution in soils due to vertically applied load.
C06 Solve design problems using geotechnical software
Subject: Environmental Engineering-II Lab(CEL604)
C01 Impart the knowledge on quality or characteristic of water and wastewater sample.
C02 Interpret the required treatment for water and wastewater based on standards and norms.
C03 Impart the knowledge on quality of solid waste.
C04 Measure the concentration of particulate matters, dust and dispersed pollutants in air.
C05 Inspect the levels of noise and interpret the results.
Subject: Skill Based Lab Course-III (CEL605)
C01 To understand the functions involved various softwares related to civil engineering field.
C02 To perform different functions of the software related to analysing modelling and designing the structure, creation of database and its analysis.
C03 To describe and represent the data obtained from site, experimental work in various formats as per industrial requirements
C04 To import road geometric design into the software as well as relate with the design standards applied into the software.
C05 To design the effective distribution network system for the distribution of water resources.
C06 To apply the knowledge to create the programme in excel and various computer languages for solving problems pertaining to civil engineering field.
Subject: Mini Project -2B(CEM601)
C01 Identify problems based on societal /research needs and formulate a solution strategy.
C02 Apply fundamentals to develop solutions to solve societal problems in a group
C03 Analyze the specific need, formulate the problem and deduce the interdisciplinary approaches, software-based solutions and computer applications.
C04 Develop systematic flow chart, evaluate inter disciplinary practices, devices, available software, estimate and recommend possible solutions.
C05 Draw the proper inferences from available results through theoretical/experimental/simulations and assemble physical systems.

C06 Create devises or design a computer program or develop computer application.

C. Fourth Year: Semester VII

SUBJECT: Design and Drawing of Reinforced Concrete Structures (CEC 701)

C01 Design G+3 RCC framed building using IS code recommendations.

C02 Design different types of retaining walls with detailing of reinforcement

C03 Design different types of water tanks with detailing of reinforcement.

C04 Apply the basic concepts of structural dynamics

C05 Evaluate the response of structure during an earthquake and calculate design forces.

C06 Explain principles of Pre-stressed Concrete and its losses.

SUBJECT: Quantity Survey, Estimation & Valuation(CEC 702)

C01 Apply the measurement systems to various civil engineering items of work.

C02 Draft the specifications for various items of work & determine unit rates of items of works

C03 Estimate approximate cost of the structures by using various methods & prepare detailed estimates of various civil engineering structures, including bar bending schedule, by referring drawings.

C04 Assess the quantities of earthwork & construct mass haul diagrams.

C05 Draft tender notice & demonstrate the significance of the tender as well as contract process.

C06 Determine the present fair value of any constructed building at stated time.

SUBJECT: Department Level Optional Course-3:Pre-stressed Concrete(CEDLO7011)

C01 Explain the concept of pre-stressing, its casting techniques and applications.

C02 Describe difference between RCC and PSC elements and their behavior.

C03 Estimate the loss of stresses in pre-stressing steel.

C04 Analyze and design the pre-stressed concrete element using relevant IS Code.

SUBJECT: Department Level Optional Course-3:Applied Hydrology & Flood Control(CEDLO7012)

C01 Explain the types and materials used in offshore structures

C02 Evaluate of the structural response of offshore structures based on both component and system.

C03 Apply general engineering and design concepts to offshore structures

C04 Apply Morison's equations to calculate wave force, lift force, etc.

SUBJECT: Department Level Optional Course-3: Advanced Construction Technology(CEDLO7015)

C01 Evaluate the procedure of construction techniques for sub structure of major civil engineering projects.

C02 Get a thorough knowledge of various stages of construction of super structure of major civil engineering projects

C03 Gain an experience in the implementation of new construction technology on engineering concepts which are applied in field Advanced construction technology in special structures.
C04 Get a diverse knowledge of the different methods of advancement in construction techniques and ground improvement techniques.
C05 Learn various dredging systems for major civil engineering projects.
C06 Explain the theoretical and practical aspects of rehabilitation and strengthening techniques in civil engineering along with the design and management applications.

SUBJECT: Department Level Optional Course-3: Solid and Hazardous Waste Management(CEDLO7022)

C01 Acquire the knowledge of functional elements of solid waste management.
C02 Illustrate solid waste collection system, route optimization techniques, transfer station and processing of solid waste.
C03 Develop the ability to plan waste minimization and processing of solid waste.
C04 Explain approaches to treat the solid waste in the most effective manner for sustainable development.
C05 Discuss safe methods of handling, management and disposal of hazardous waste.
C06 Summarize waste management techniques used for assorted solid waste

SUBJECT: Institute Level Optional Course – I : Cyber Security and Laws(ILOC7016)

C01 Explain the concept of cybercrime and its effect on outside world • • •
C02 Interpret and apply IT law in various legal issues
C03 Distinguish different aspects of cyber law
C04 Apply Information Security Standards compliance during software design and development

SUBJECT: Institute Level Optional Course – I : Disaster Management and Mitigation Measures(ILOC7017)

C01 Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
C02 Plan of national importance structures based upon the previous history.
C03 Get acquainted with government policies, acts and various organizational structure associated with an emergency.
C04 Get to know the simple do's and don'ts in such extreme events and act accordingly.

SUBJECT: Design and Drawing of Reinforced Concrete Structures (CEL 701)

C01 Design G+3 RCC framed building using IS code recommendations.
C02 Design different types of water tanks with detailing of reinforcement.
C03 Design different types of retaining walls with detailing of reinforcement
C04 Apply the basic concepts of structural dynamics
C05 Explain response of structure during an earthquake and calculate design forces.
C06 Explain principles of Prestressed Concrete and its losses.

SUBJECT: Quantity Survey, Estimation & Valuation(CEL 702)

C01 Identify current unit rates of various construction materials through market survey & also study District Schedule of Rates (DSR)
C02 Prepare rate analysis of few important Items of work
C03 Estimate approximate cost of the structures by using various methods & prepare detailed estimates of various civil engineering structures, including bar bending schedule, by referring drawings.
C04 Assess the quantities of earthwork & construct mass haul diagrams
C05 Draft tender notice & demonstrate the significance of the tender as well as contract process
C06 Evaluate present fair value of any constructed building at stated time.
SUBJECT: Major Project Part-I(CEP 701)
C01 Review & comprehend literature in the selected domain
C02 Articulate problem statement & identify the objectives
C03 Identify existing methods or solutions to solve identified problem
C04 Identify modern engineering tools & other resources to solve the problem
C05 Formulate methodology to solve the identified problem
C06 Effectively communicate their project work by writing reports & presentations

C. Fourth Year: Semester VIII

SUBJECT: Construction Management(CEC 801)

C01 Explain & apply the knowledge of management functions like planning, scheduling, Executing & controlling the construction projects.
C02 Prepare feasible project schedule by using various scheduling techniques.
C03 Gain knowledge of managing various resources & recommend best method of allocating resources to the project
C04 Develop optimum relationship between time & cost for construction project
C05 Implement quality & safety measures on construction sites during execution of Civil Engineering projects.
C06 Describe the importance of labour acts.

SUBJECT: Department Level Optional Course-5: Design of Hydraulic Structures(CEDLO8012)

C01 Explain the Reservoir planning, storage capacity, Sedimentation & Reservoir losses.
C02 Carry out the stability analysis of Gravity & Earth Dam.
C03 Explain the causes of failure of various dams & their design criteria.
C04 Design an ogee spillway.
C05 Suggest suitable energy dissipation measures.
C06 Describe the various minor irrigation structures such as Weirs & barrages, Canal Regulators and Cross-drainage works.

SUBJECT: Department Level Optional Course-5: Industrial Waste Treatment(CEDLO8015)

C01 Explain the impact of industrial wastewater characteristics on natural streams.
C02 Analyze various stream protections measures to protect the natural streams.
C03 Summarize waste minimization techniques for industrial wastewater.
C04 Relate biological treatment concept and summarize various treatments along with advance technologies.

C05 Describe waste water generated during manufacturing process and decide the suitable treatment for effluents.
C06 Evaluate legislative framework for the remediation of industrial wastewater through environmental audit, environmental impact assessment and common effluent treatment plant.
SUBJECT: Department Optional Course 6: Repairs, Rehabilitation and Retrofitting of Structures(CEDLO8021)
C01 Describe the concept of repair and its need.
C02 Classify various causes of deterioration of concrete structure and Distresses monitoring techniques.
C03 Classify various materials of repairs and their properties.
C04 Explain various methods of repairs of concrete structure.
C05 Describe various methods of repairs of steel structure.
C06 Explain seismic retrofitting and maintenance of heritage structures.
SUBJECT: Institute Level Optional Course – II : Project Management(ILOC8011)
C01 Apply selection criteria and select an appropriate project from different options.
C02 Write work break down structure for a project and develop a schedule based on it.
C03 Identify opportunities and threats to the project and decide an approach to deal with them strategically.
C04 Use Earned value technique and determine & predict status of the project.
C05 Capture lessons learned during project phases and document them for future reference
SUBJECT: Institute Level Optional Course – II : Environmental Management(ILOC8019)
C01 Describe the concept of environmental management .
C02 Evaluate ecosystem and interdependence, food chain etc
C03 Compare and interpret environment related legislations
SUBJECT: Construction Management(CEL 801)
C01 Summarize & apply the knowledge of management functions like planning, scheduling,
C02 Executing & controlling the construction projects.
C03 Prepare feasible project schedule by using various scheduling techniques.
C04 Gain knowledge of managing various resources & recommend best method of allocatingresources to the project.
C05 Develop optimum relationship between time & cost for construction project.
C06 Implement quality & safety measures on construction sites during execution of Civil Engineering projects.
C07 Explain the importance of labour acts.
SUBJECT: Major Project- Part II(CEP 801)
C01 Perform on analytical, experimental or numerical method to solve identified problem
C02 Produce alternative design solution to meet the functional requirements of the defined problem.

C03 Represent the data in Tabular or graphical forms so as to facilitate, analysis & explain of the data.
C04 Express Engineering principles & manage the finance required for the execution of the Project.
C05 Infer at results, conclusion with its validation, also propose the future scope of work on the identified problem.
C06 Communicate effectively their project work by writing reports and publishing technical papers based on entire project work.



ATMA MALIK INSTITUTE OF TECHNOLOGY AND RESEARCH (AMRIT)

Mohili-Aghai, Shahapur, Thane, Maharashtra, India. Pincode: 421603
Contact: +91 7720012139 / +91 9552773875, info@vishwamkengg.in

Department of Computer Engineering
Course outcome R-2019 University of Mumbai Syllabus
(C- SCHEME)

A. Second Year: Semester III

SUBJECT: Engineering Mathematics-III(CSC301)

CO 1 Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.

CO 2 Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.

CO 3 Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.

CO 4 Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.

CO 5 Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI

CO 6 Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.

SUBJECT: Discrete Structures and Graph Theory (CSC302)

CO 1 Understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving

CO 2 Ability to reason logically.

CO 3 Ability to understand relations, functions, Diagraph and Lattice

CO 4 Ability to understand and apply concepts of graph theory in solving real world problems.

CO 5 Understand use of groups and codes in Encoding-Decoding

CO 6 Analyze a complex computing problem and apply principles of discrete mathematics to identify solutions

SUBJECT: Data Structure (CSC303)

CO1 Students will be able to implement Linear and Non-Linear data structures.

CO2 Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.

CO3 Students will be able to explain various data structures, related terminologies and its types

CO4 Students will be able to choose appropriate data structure and apply it to solve problems in various domains.

CO5 Students will be able to analyze and Implement appropriate searching techniques for a given problem

CO6 Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.

SUBJECT: Digital Logic & Computer Organization and Architecture (CSC304)

CO1 To learn different number systems and basic structure of computer system.

CO2 To demonstrate the arithmetic algorithms.

CO3 To understand the basic concepts of digital components and processor organization.

CO4 To understand the generation of control signals of computer.

CO5 To demonstrate the memory organization.

CO6 To describe the concepts of parallel processing and different Buses.
SUBJECT: Computer Graphics (CSC305)
CO1 Describe the basic concepts of Computer Graphics.
CO2 Demonstrate various algorithms for basic graphics primitives
CO3 Apply 2-D geometric transformations on graphical objects.
CO4 Use various Clipping algorithms on graphical objects
CO5 Explore 3-D geometric transformations, curve representation techniques and projections methods.
CO6 Explain visible surface detection techniques and Animation.
SUBJECT: Data Structures Lab (CSL301)
CO1 Students will be able to implement linear data structures & be able to handle operations like insertion, deletion, searching and traversing on them.
CO2 Students will be able to implement nonlinear data structures & be able to handle operations like insertion, deletion, searching and traversing on them
CO3 Students will be able to choose appropriate data structure and apply it in various problems
CO4 Students will be able to select appropriate searching techniques for given problems.
SUBJECT: Digital Logic & Computer Organization and Architecture Lab (CSL302)
CO1 To understand the basics of digital components
CO2 Design the basic building blocks of a computer: ALU, registers, CPU and memory
CO3 To recognize the importance of digital systems in computer architecture
CO4 To implement various algorithms for arithmetic operations.
SUBJECT: Computer Graphics Lab (CSL303)
CO1 Implement various output and filled area primitive algorithms
CO2 Apply transformation, projection and clipping algorithms on graphical objects.
CO3 Perform curve and fractal generation methods.
CO4 Develop a Graphical application/Animation based on learned concept
SUBJECT: Skill based Lab Course: Object Oriented Programming with Java(CSL304)
CO1 To apply fundamental programming constructs.
CO2 To illustrate the concept of packages, classes and objects
CO3 To elaborate the concept of strings, arrays and vectors.
CO4 To implement the concept of inheritance and interfaces.
CO5 To implement the concept of exception handling and multithreading.
CO6 To develop GUI based application.
SUBJECT:Mini Project A(CSM301)
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5 Analyze the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication
CO8 Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO9 Demonstrate project management principles during project work
B. Second Year: Semester IV

SUBJECT: Engineering Mathematics-IV(CSC401)

CO 1 Apply the concepts of eigenvalues and eigenvectors in engineering problems.

CO 2 Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.

CO 3 Apply the concept of Z- transformation and inverse in engineering problems.

CO4 Use the concept of probability distribution and sampling theory to engineering problems.

CO5 Apply the concept of Linear Programming Problems to optimization.

CO6 Solve Non-Linear Programming Problems for optimization of engineering problems.

SUBJECT: Analysis of Algorithms(CSC402)

CO1 Analyze the running time and space complexity of algorithms.

CO2 Describe, apply and analyze the complexity of divide and conquer strategy.

CO3 Describe, apply and analyze the complexity of greedy strategy.

CO4 Describe, apply and analyze the complexity of dynamic programming strategy.

CO5 Explain and apply backtracking, branch and bound.

CO6 Explain and apply string matching techniques.

SUBJECT: Database Management System(CSC403)

CO1 Recognize the need of database management system

CO2 Design ER and EER diagram for real life applications

CO3 Construct relational model and write relational algebra queries.

CO4 Formulate SQL queries

CO5 Apply the concept of normalization to relational database design.

CO6 Describe the concept of transaction, concurrency and recovery.

SUBJECT: Operating System (CSC404)

CO1 Understand the objectives, functions and structure of OS

CO2 Analyze the concept of process management and evaluate performance of process scheduling algorithms.

CO3 Understand and apply the concepts of synchronization and deadlocks

CO4 Evaluate performance of Memory allocation and replacement policies

CO5 Understand the concepts of file management.

CO6 Apply concepts of I/O management and analyze techniques of disk scheduling.

SUBJECT: Microprocessor(CSC505)

CO1 Describe core concepts of 8086 microprocessor.

CO2 Interpret the instructions of 8086 and write assembly and Mixed language programs.

CO3 Identify the specifications of peripheral chip.

CO4 Design 8086 based system using memory and peripheral chips.

CO5 Appraise the architecture of advanced processors

CO6 Understand hyperthreading technology

SUBJECT: Analysis of Algorithms Lab(CSL401)

CO1 Implement the algorithms using different approaches.

CO2 Analyze the complexities of various algorithms.

CO3 Compare the complexity of the algorithms for specific problem.

CO 6 Develop machine learning applications using Python.

SUBJECT: Database Management system Lab(CSL402)

CO1 Design ER /EER diagram and convert to relational model for the realworld application.

CO2 Apply DDL, DML, DCL and TCL commands

CO3 Write simple and complex queries

CO4 UsePL / SQL Constructs.
CO5 Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity
SUBJECT:Operating System Lab (CSL403)
CO1 Demonstrate basic Operating system Commands, Shell scripts, System Calls and API wrt Linux
CO2 Implement various process scheduling algorithms and evaluate their performance.
CO3 Implement and analyze concepts of synchronization and deadlocks.
CO4 Implement various Memory Management techniques and evaluate their performance.
CO5 Implement and analyze concepts of virtual memory.
CO6 Demonstrate and analyze concepts of file management and I/O management techniques.
SUBJECT:Microprocessor Lab (CSL404)
CO1 Use appropriate instructions to program microprocessor to perform various task
CO2 Develop the program in assembly/ mixed language for Intel 8086 processor
CO3 Demonstrate the execution and debugging of assembly/ mixed language program
SUBJECT:Skill Base Lab Course: Python Programming(CSL405)
CO1 To understand basic concepts in python.
CO2 To explore contents of files, directories and text processing with python
CO3 To develop program for data structure using built in functions in python.
CO4 To explore django web framework for developing python-based web application.
CO5 To understand Multithreading concepts using python.
SUBJECT:Mini Project B(CSM401)
CO1Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 TDevelop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/experimental/simulations.
CO5 Analyze the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO9 Demonstrate project management principles during project work
C. Third Year: Semester V
SUBJECT: Theoretical Computer Science(CSC501)
CO 1 Understand concepts of Theoretical Computer Science, difference and equivalence of DFA and NFA , languages described by finite automata and regular expressions.
CO2 Design Context free grammer, pushdown automata to recognize the language.
CO3 Develop an understanding of computation through Turing Machine.
CO4 Acquire fundamental understanding of decidability and undecidability.
SUBJECT: Software Engineering(CSC502)
CO1 Identify requirements & assess the process models.
CO2 Plan, schedule and track the progress of the projects.
CO3 Design the software projects.
CO4 Do testing of software project.
CO5 Identify risks, manage the change to assure quality in software projects.
SUBJECT: Computer Network(CSC503)
CO1 Demonstrate the concepts of data communication at physical layer and compare ISO - OS Imodel with TCP/IP model.
CO2 Explore different design issues at data link layer.

CO3 Design the network using IP addressing and sub netting / supernetting schemes.
CO4 Analyze transport layer protocols and congestion control algorithms.
CO5 Explore protocols at application layer
SUBJECT: Data Warehousing and Mining (CSC504)
CO1 Understand data warehouse fundamentals and design data warehouse with dimensional modelling and apply OLAP operations.
CO2 Understand data mining principles and perform Data preprocessing and Visualization.
CO3 Identify appropriate data mining algorithms to solve real world problems.
CO4 Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
CO5 Describe complex information and social networks with respect to web mining.
SUBJECT: Internet Programming(CSDLO5012)
CO1 Implement interactive web page(s) using HTML and CSS.
CO2 Design a responsive web site using JavaScript
CO3 Demonstrate database connectivity using JDBC
CO4 Demonstrate Rich Internet Application using Ajax
CO5 Demonstrate and differentiate various Web Extensions.
CO6 Demonstrate web application using Reactive Js
SUBJECT: Advance Database Management System(CSDLO5013)
CO1 Design distributed database using the various techniques for query processing
CO2 Measure query cost and perform distributed transaction management
CO3 Organize the data using XML and JSON database for better interoperability
CO4 Compare different types of NoSQL databases
CO5 Formulate NoSQL queries using Mongodb
CO6 Describe various trends in advance databases through temporal, graph based and spatial
SUBJECT: Software Engineering Lab (CSC502)
CO1 Identify requirements and apply software process model to selected case study.
CO2 Develop architectural models for the selected case study.
CO3 Use computer-aided software engineering (CASE) tools.
SUBJECT: Computer Network Lab(CSL502)
CO1 Design and setup networking environment in Linux.
CO2 Use Network tools and simulators such as NS2, Wireshark etc. to explore networking algorithms and protocols.
CO3 Implement programs using core programming APIs for understanding networking concepts.
SUBJECT: Data Warehousing and Mining Lab (CSL503)
CO1 Design data warehouse and perform various OLAP operations.
CO2 Implement data mining algorithms like classification.
CO3 Implement clustering algorithms on a given set of data sample.
CO4 Implement Association rule mining & web mining algorithm.
SUBJECT: Business Communication & Ethics II(CSL504)
CO1 Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
CO2 Strategize their personal and professional skills to build a professional image and meet the demands of the industry.

CO3 Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
CO4 Deliver persuasive and professional presentations.
CO5 Develop creative thinking and interpersonal skills required for effective professional communication.
CO6 Apply codes of ethical conduct, personal integrity and norms of organizational behaviour
SUBJECT: Mini Project 2A (CSM 501)
CO Identify societal/research/innovation/entrepreneurship problems through appropriate literature surveys
CO2 Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it.
CO3 Validate, Verify the results using test cases/benchmark data/theoretical/inferences/experiments/simulations
CO4 Analyze and evaluate the impact of solution/product/research/innovation /entrepreneurship towards societal/environmental/sustainable development
CO5 Use standard norms of engineering practices and project management principles during project work
CO6 Communicate through technical report writing and oral presentation.
<ul style="list-style-type: none"> ● The work may result in research/white paper/ article/blog writing and publication ● The work may result in business plan for entrepreneurship product created ● The work may result in patent filing.
CO7 Gain technical competency towards participation in Competitions, Hackathons, etc.
CO8 Demonstrate capabilities of self-learning, leading to lifelong learning.
CO9 Develop interpersonal skills to work as a member of a group or as leader
D. Third Year: Semester VI
SUBJECT: System Programming and Compiler Construction(CSC601)
CO1 Identify the relevance of different system programs.
CO2 Explain various data structures used for assembler and microprocessor design.
CO3 Distinguish between different loaders and linkers and their contribution in developing efficient user applications.
CO4 Understand fundamentals of compiler design and identify the relationships among different phases of the compiler.
SUBJECT: Cryptography & System Security (CSC602)
CO1 Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory problems related to confidentiality and authentication
CO2 Understand, compare and apply different encryption and decryption techniques to solve
CO3 Apply different message digest and digital signature algorithms to verify integrity and achieve authentication and design secure applications
CO4 Understand network security basics, analyse different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP
CO5 Analyse and apply system security concept to recognize malicious code
SUBJECT: Mobile Computing(CSC603)
CO1 To identify basic concepts and principles in computing, cellular architecture.
CO2 To describe the components and functioning of mobile networking.
CO3 To classify variety of security techniques in mobile network.
CO4 To apply the concepts of WLAN for local as well as remote applications.

CO5 To describe Long Term Evolution (LTE) architecture and its interfaces.
SUBJECT: Artificial Intelligence(CSC604)
CO1 Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
CO2 Ability to choose an appropriate problem solving method and knowledge representation technique.
CO3 Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
CO4 Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
CO5 Ability to design and develop AI applications in real world scenarios.
SUBJECT: Internet of Things(CSDLO6011)
CO1 Understand the concepts of IoT and the Things in IoT.
CO2 Emphasize core IoT functional Stack and understand application protocols for IoT.
CO3 Apply IoT knowledge to key industries that IoT is revolutionizing.
CO4 Examines various IoT hardware items and software platforms used in projects.
SUBJECT: System Programming and Compiler Construction Lab 1(CSL601)
CO1 Generate machine code by implementing two pass assemblers.
CO2 Implement Two pass macro processor.
CO3 Parse the given input string by constructing Top down/Bottom-up parser.
CO4 Identify and Validate tokens for given high level language and Implement synthesis phase of compiler.
CO5 Explore LEX & YACC tools.
SUBJECT: Cryptography & System Security Lab(CSL602)
CO1 apply the knowledge of symmetric and asymmetric cryptography to implement simple ciphers.
CO2 explore the different network reconnaissance tools to gather information about networks.
CO3 explore and use tools like sniffers, port scanners and other related tools for analysing packets in a Network.
CO4 set up firewalls and intrusion detection systems using open-source technologies and to explore email security.
CO5 explore various attacks like buffer-overflow and web application attack.
SUBJECT: Mobile Computing Lab (CSL603)
CO1 develop and demonstrate mobile applications using various tools
CO2 articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.
CO3 Students will able to carry out simulation of frequency reuse, hidden/exposed terminal problem
CO4 implement security algorithms for mobile communication network
CO5 demonstrate simulation and compare the performance of Wireless LAN
SUBJECT: Artificial Intelligence Lab (CSL604)
CO1 Identify languages and technologies for Artificial Intelligence
CO2 Understand and implement uninformed and informed searching techniques for real world problems.
CO3 Create a knowledge base using any AI language.
CO4 Design and implement expert systems for real world problems.
SUBJECT: Cloud Computing (CSL605)
CO1 Implement different types of virtualization techniques.
CO2 Analyze various cloud computing service models and implement them to solve the given problems.
CO3 Design and develop real world web applications and deploy them on commercial cloud(s).
CO4 Explain major security issues in the cloud and mechanisms to address them.
CO5 Explore various commercially available cloud services and recommend the appropriate one for the given application.

CO6 Implement the concept of containerization
SUBJECT: Mini Project 2B(CSM601)
CO1 Identify societal/research/innovation/entrepreneurship problems through appropriate literature surveys
CO2 Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it
CO3 Validate, Verify the results using test cases/benchmark data/theoretical/inferences/experiments/simulations
CO4 Analyze and evaluate the impact of solution/product/research/innovation /entrepreneurship towards societal/environmental/sustainable development
CO5 Use standard norms of engineering practices and project management principles during project work
CO6 Communicate through technical report writing and oral presentation.
<ul style="list-style-type: none"> ● The work may result in research/white paper/ article/blog writing and publication ● The work may result in business plan for entrepreneurship product created ● The work may result in patent filing.
CO7 Gain technical competency towards participation in Competitions, Hackathons, etc.
CO8 Demonstrate capabilities of self-learning, leading to lifelong learning.
CO9 Develop interpersonal skills to work as a member of a group or as leader
E. Fourth Year: Semester VII
SUBJECT: Machine Learning(CSC701)
CO1 To acquire fundamental knowledge of developing machine learning models.
CO2 To select, apply and evaluate an appropriate machine learning model for the given application.
CO3 To demonstrate ensemble techniques to combine predictions from different models.
CO4 To demonstrate the dimensionality reduction techniques.
SUBJECT: Big Data Analysis(CSC702)
CO1 Understand the building blocks of Big Data Analytics.
CO2 Apply fundamental enabling techniques like Hadoop and MapReduce in solving real world problems.
CO3 Understand different NoSQL systems and how it handles big data.
CO4 Apply advanced techniques for emerging applications like stream analytics.
CO5 Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications, etc.
CO6 Apply statistical computing techniques and graphics for analyzing big data.
SUBJECT: Natural Language Processing(CSDC7013)
CO1 To describe the field of natural language processing.
CO2 To design language model for word level analysis for text processing.
CO3 To design various POS tagging techniques and parsers.
CO4 To design, implement and test algorithms for semantic and pragmatic analysis.
CO5 To formulate the discourse segmentation and anaphora resolution.
CO6 To apply NLP techniques to design real world NLP applications.
SUBJECT:Information Retrieval (CSDC7023)
CO1 Define and describe the basic concepts of the Information retrieval system.
CO2 Design the various modeling techniques for information retrieval systems.
CO3 Understand the query structure and various query operations

CO4 Analyzing the indexing and scoring operation in information retrieval systems
CO5 Perform the evaluation of information retrieval systems
CO6 Analyze various information retrieval for real world application
SUBJECT: Cyber Security and Laws (ILO 7016)
CO1 Understand the concept of cybercrime and its effect on outside world
CO2 Interpret and apply IT law in various legal issues
CO3 Distinguish different aspects of cyber law
CO4 Apply Information Security Standards compliance during software design and development
SUBJECT: Machine Learning Lab (CSL7011)
CO1 To implement an appropriate machine learning model for the given application.
CO2 To implement ensemble techniques to combine predictions from different models.
CO3 To implement the dimensionality reduction techniques.
SUBJECT: Big Data Analytics Lab (CSL7012)
CO1 To interpret business models and scientific computing paradigms, and apply software tools for big data analytics
CO2 To implement algorithms that uses Map Reduce to apply on structured and unstructured data
CO3 To perform hands-on NoSql databases such as Cassandra, HadoopHbase, MongoDB, etc.
CO4 To implement various data streams algorithms
CO5 To develop and analyze the social network graphs with data visualization techniques.
SUBJECT: Natural Language Processing Lab (CSDL7013)
CO1 Apply various text processing techniques.
CO2 Design language model for word level analysis.
CO3 Model linguistic phenomena with formal grammar.
CO4 Design, implement and analyze NLP algorithm
CO5 To apply NLP techniques to design real world NLP applications such as machine translation, sentiment analysis, text summarization, information extraction, Question Answering system etc.
CO6 Implement proper experimental methodology for training and evaluating empirical NLP systems.
SUBJECT: Information Retrieval (CSDL7023)
CO1 To frame queries for information retrieval
CO2 To implement modeling techniques
CO3 To perform query expansion techniques
CO4 To demonstrate evaluation techniques for IR
SUBJECT: Major Project Stage I (CSP701)
CO1 To develop the understanding of the problem domain through extensive review of literature.
CO2 To Identify and analyze the problem in detail to define its scope with problem specific data.
CO3 To know various techniques to be implemented for the selected problem and related technical skills through feasibility analysis.
CO4 To design solutions for real-time problems that will positively impact society and environment..
CO5 To develop clarity of presentation based on communication, teamwork and leadership skills.
CO6 To inculcate professional and ethical behavior
E. Fourth Year: Semester VIII
SUBJECT: Distributed Computing(CSC801)
CO1 Demonstrate the knowledge of basic elements and concepts related to distributed system technologies.
CO2 Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object-based middleware.

CO3 Analyze the various techniques used for clock synchronization, mutual exclusion and deadlock.
CO4 Demonstrate the concepts of Resource and Process management.
CO5 Demonstrate the concepts of Consistency, Replication Management and fault Tolerance.
CO6 Apply the knowledge of Distributed File systems in building large-scale distributed applications.
SUBJECT: Digital Forensics(CSDC8012)
CO1 Discuss the phases of Digital Forensics and methodology to handle the computer security incident.
CO2 Describe the process of collection, analysis and recovery of the digital evidence.
CO3 Explore various tools to analyze malwares and acquired images of RAM/hard drive.
CO4 Acquire adequate perspectives of digital forensic investigation in mobile devices
CO5 Analyze the source and content authentication of emails and browsers.
CO6 Produce unambiguous investigation reports which offer valid conclusions.
SUBJECT:High Performance Computing (CSDC8022)
CO1 Understand parallel and pipeline processing approaches
CO2 Design a parallel algorithm to solve computational problems and identify issues in parallel programming.
CO3 Analyze the performance of parallel computing systems for clusters in terms of execution time, total parallel overhead, speedup.
CO4 Develop efficient and high-performance parallel algorithms using OpenMP and message passing paradigm
CO5 Develop high-performance parallel programming using OpenCL and CUDA framework
CO6 Perform the range of activities associated with High Performance Computing in Cloud Computing
SUBJECT:Project Management(ILO 8021)
CO1 Apply selection criteria and select an appropriate project from different options.
CO2 Write work breakdown structure for a project and develop a schedule based on it.
CO3 Identify opportunities and threats to the project and decide an approach to deal with them strategically.
CO4 Use Earned value technique and determine & predict status of the project.
CO5 Capture lessons learned during project phases and document them for future reference
SUBJECT: Distributed Computing Lab (CSL801)
CO1 Develop test and debug using Message-Oriented Communication or RPC/RMI based client-server programs.
CO2 Implement techniques for clock synchronization.
CO 3 Implement techniques for Election Algorithms.
CO4 Demonstrate mutual exclusion algorithms and deadlock handling.
CO5 Implement techniques of resource and process management.
CO6 Describe the concepts of distributed File Systems with some case studies.
SUBJECT: Digital Forensics Lab (CSDC8022)
CO 1 Acquire proficiency in identifying the different types of fibers and understanding their properties.
CO 2 To measure the losses, dispersion and compensation techniques in all optical network.
CO 3 Learn to design all optical network with amplifiers and modern lasers for error free transmission.
CO 4 To design or implement point to point optical fiber network, WDM or DWDM Network
CO 5 To design free space optical system with atmospheric impairments and propose mitigation technique for minimum BER.
SUBJECT: Major Project Stage II (ECP 801)
CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.
CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.

CO 3 Analyse the impact of solutions in societal and environmental context for sustainable development.

CO 4 Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
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CO 5 Develop interpersonal skills & Excel in written and oral communication.
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CO 6 Demonstrate project management principles during project work.



ATMA MALIK INSTITUTE OF TECHNOLOGY AND RESEARCH (AMRIT)

Mohili-Aghai, Shahapur, Thane, Maharashtra, India. Pincode: 421603
Contact: +91 7720012139 / +91 9552773875, info@vishwatmakengg.in

Department of Electronics & Telecommunication Engineering

Course outcome R-2019 University of Mumbai Syllabus

(C- SCHEME)

A. Second Year: Semester III

SUBJECT: Engineering Mathematics-III (ECC 301)
CO 1 Understand the concept of Laplace Transform and its application to solve the real integrals in engineering problems.
CO 2 Understand the concept of Inverse Laplace Transform of various functions and its applications in engineering problems.
CO 3 Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
CO 4 Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function.
CO 5 Apply Matrix algebra to solve the engineering problems
CO 6 Apply the concepts of vector calculus in real life problems.
SUBJECT: Electronics Devices & Circuits (ECC 302)
CO 1 Know functionality and applications of various electronic devices.
CO 2 Explain working of various electronics devices with the help of V-I characteristics.
CO 3 Derive expressions for performance parameters of BJT and MOSFET circuits.
CO 4 Evaluate performance of Electronic circuits (BJT and MOSFET based).
CO 5 Select appropriate circuit for given application.
CO 6 Design electronic circuit (BJT, MOSFET based) circuits for given specifications.
SUBJECT: Digital System Design (ECC 303)
CO 1 Understand types of digital logic, digital circuits, and logic families.
CO 2 Analyze, design, and implement combinational logic circuits.
CO 3 Analyze, design, and implement sequential logic circuits.
CO 4 Develop a digital logic and apply it to solve real-life problems.
CO 5 Classify different types of memories and PLDs.
CO 6 Simulate and implement basic combinational and sequential circuits using VHDL/Verilog
SUBJECT: Network Theory (ECC 304)
CO 1 Apply their knowledge in analyzing Circuits by using network theorems.
CO 2 Apply the time and frequency method of analysis.
CO 3 Evaluate circuit using graph theory.
CO 4 Find the various parameters of two port network.
CO 5 Apply network topology for analyzing the circuit.
CO 6 Synthesize the network using passive elements.
SUBJECT: Electronics Instrumentation & Control (ECC305)
CO 1 Understand the components and parameters of measurement system.
CO 2 Able to measure resistance, capacitance, inductance using different methods.
CO 3 Understand the analysis of systems in time domain

CO 4 Evaluate stability using Root locus method
CO 5 Understand the analysis of system in frequency domain.
CO 6 Predict stability of given system using appropriate criteria.
SUBJECT: Electronics Devices & Circuits Laboratory (ECL301)
CO 1 Know various equipment, electronics devices and components, and measuring instruments used to perform laboratory work
CO 2 Students will be able to explain functionality of various equipment, electronics devices and components and instruments used to perform laboratory work.
CO 3 Students will be able connect various equipment, devices, components and measuring devices using bread board as per the circuit diagram for experiment to be performed.
CO 4 Students will able to perform experiment to gather appropriate data. CO 5 Students will able to analyse data obtained from experiment to relate theory with experiment results.
CO 6 Students will able to prepare laboratory report (Journal) to summarise the outcome each experiment.
SUBJECT: Digital System Design Laboratory (ECL302)
CO 1 Identify various Digital ICs and basic building blocks of digital system design
CO 2 Design and implement combinational circuits like adder, subtractor, multiplexer, code converters etc.
CO 3 Identify and understand working of various types of flip flops and their inter conversions
CO 4 Design and implement basic sequential circuits such as counters, registers etc.
CO 5 Acquire basic knowledge of VHDL/Verilog basic programming.
SUBJECT: Electronics Instrumentation & Control Lab (ECL 303)
CO 1 Students Should be able to design Kelvin's bridge for measurement for measurement of resistance
CO 2 Students Should be able to design Schering Bridge for measurement for measurement of capacitance
CO 3 Students Should be able to design Hay's bridge for measurement for measurement of inductance.
CO 4 Understand how to Measure displacement using LVDT.
CO 5 Students Should be able to use bode plot for stability analysis.
CO 6 Students Should be able to verify stability analysis for root locus method using scilab
SUBJECT: Skill Lab: C++ & Java (ECL 304)
CO 1 Describe the basic principles of OOP
CO 2 Design and apply OOP principles for effective programming
CO 3 Develop programming applications using OOP language.
CO 4 Implement different programming applications using packaging.
CO 5 Analyze the strength of OOP.
CO 6 Percept the Utility and applicability of OOP
SUBJECT: Mini Project 1A (ECM 301)
CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.
CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO 3 Analyze the impact of solutions in societal and environmental context for sustainable development.
CO 4 Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
CO 5 Develop interpersonal skills & Excel in written and oral communication.
CO 6 Demonstrate project management principles during project work.

B. Second Year: Semester IV

SUBJECT: Engineering Mathematics-IV (ECC 401)

CO 1 Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.

CO 2 Apply the concept of Correlation & Regression to the engineering problems in data science, machine learning & AI

CO 3 Apply the concept of probability & expectation for getting the spread of the data & distribution of probabilities.

CO 4 Apply the concept of vector spaces & orthogonalization process in Engineering Problems.

CO 5 Use of concept of Quadratic forms & singular value decomposition which are very useful tools in various Engineering applications.

CO 6 Find the extremals of the functional using the concept of Calculus of variations.

SUBJECT: Microcontroller (ECC 402)

CO 1 Understand Computer and its memory System.

CO 2 Understand the detailed architecture of 8051 and ARM7 Core.

CO 3 Write programs for 8051 microcontrollers.

CO 4 Design an applications using microcontroller.

SUBJECT: Linear Integrated Circuits (ECC 403)

CO 1 Outline and classify all types of integrated circuits.

CO 2 Understand the fundamentals and areas of applications for the integrated circuits.

CO 3 Develop the ability to design practical circuits that perform the desired operations

CO 4 Understand the differences between theoretical & practical results in integrated circuits.

CO5 Identify the appropriate integrated circuit modules for designing engineering application.

SUBJECT: Signals & Systems (ECC 404)

CO 1 Classify and Analyze different types of signals and systems.

CO 2 Perform Time domain analysis of Continuous Time and Discrete Time systems.

CO 3 Analyze continuous time LTI signals and systems in transform domain.

CO 4 Analyze and realize discrete time LTI signals and systems in transform domain.

CO 5 Represent signals using Fourier Series and Analyze the systems using the Fourier Transform.

CO 6 Demonstrate the concepts learnt in Signals and systems Course using the modern engineering tools.

SUBJECT: Principle of Communication Engineering (ECC 405)

CO 1 Understand the basic components and types of noises in communication system.

CO 2 Analyze the concepts of amplitude modulation and demodulation.

CO 3 Analyze the concepts of angle modulation and demodulation.

CO 4 Compare the performance of AM and FM receivers.

CO 5 Describe analog and digital pulse modulation techniques.

CO 6 Illustrate the principles of multiplexing and demultiplexing techniques.

SUBJECT: Microcontroller Lab (ECL 401)

CO 1 Understand different development tools required to develop microcontroller based systems.

CO 2 Write assembly language programs for arithmetic and logical operations, code conversion & data transfer operations

CO 3 Write assembly language programs for general purpose I/O, Timers & Interrupts

CO 4 Interface & write programs for Input and Output devices
CO 5 Develop microcontroller based Applications.
SUBJECT: Linear Integrated Lab (ECL 402)
CO 1 Understand the differences between theoretical, practical and simulated results in integrated circuits.
CO 2 Apply the knowledge to do simple mathematical operations
CO 3 Apply knowledge of op-amp, timer and voltage regulator ICs to design simple applications.
SUBJECT: Principle of communication Engineering Lab (ECL 403)
CO 1 Analyze analog modulation techniques..
CO 2 Analyze the waveforms of Radio receivers.
CO 3 Implement analog pulse modulation and demodulation circuits.
CO 4 Demonstrate digital pulse modulation and demodulation techniques.
CO 5 Verify the concepts of TDM and FDM.
SUBJECT: Skill Lab: Python (ECC 404)
CO 1 Describe syntax and semantics in Python.
CO 2 Illustrate different file handling operations.
CO 3 Interpret object oriented programming in Python.
CO 4 Design GUI Applications in Python.
CO 5 Express proficiency in the handling Python libraries for data science.
CO 6 Develop machine learning applications using Python.
SUBJECT: Mini Project 1B (ECM 401)
CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.
CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO 3 Analyze the impact of solutions in societal and environmental context for sustainable development.
CO 4 Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
CO 5 Develop interpersonal skills & Excel in written and oral communication.
CO 6 Demonstrate project management principles during project work.
C. Third Year: Semester V
SUBJECT: Digital Communication (ECC 501)
CO 1 Apply the concepts of information theory in source coding.
CO 2 Compare different error control systems and apply various error detection codes.
CO 3 Analyze different error correction codes.
CO 4 Compare various baseband transmission methods for digital signals. CO 5 Evaluate the performance of optimum baseband detection in the presence of white noise.
CO 6 Compare the performances of different digital modulation techniques.
SUBJECT: Discrete Time Signal Processing (ECC 502)
CO 1 Recall the system representations and understand the relation between different transforms.
CO 2 Understand the concepts of discrete-time Fourier transform, fast Fourier transform and apply in system analysis.
CO 3 Design digital IIR and FIR filters to satisfy the given specifications and evaluate the frequency response and pole-zero representations to choose a particular filter for the given application.
CO 4 Interpret the different realization structures of Digital IIR and FIR filters.
CO 5 Analyze the impact of hardware limitations on the performance of digital filters.

CO 6 Apply signal processing concepts, algorithms in applications related to the field of biomedical and audio signal processing.

SUBJECT: Digital VLSI (ECC 503)

CO 1 Know various tools and processes used in VLSI Design.

CO 2 Explain working of various CMOS combinational and sequential circuits used in VLSI Design.

CO 3 Derive expressions for performance parameters of basic building blocks like CMOS inverter.

CO 4 Relate performance parameters with design parameters of VLSI circuits.

CO 5 Select suitable circuit and design style for given application.

CO 6 Design and realize various combinational and sequential circuits for given specifications.

SUBJECT: Random Signal Analysis (ECC 504)

CO 1 Apply theory of probability in identifying and solving relevant problems.

CO2 Differentiate continuous and discrete random variables and their distributions.

CO 3 Analyze mean, variance, and distribution function of random variables and functions of random variables.

CO 4 Understand the relation between multiple random variables.

CO 5 Define a random process, determine the type of the process and find the response of LTI system for WSS process.

CO 6 Explain linear regression algorithms and apply for predictive applications.

SUBJECT: Sensor Technology (ECCDLO5015)

CO 1 Understand the transduction principle of various sensors.

CO 2 Select sensors suitable for required application.

CO 3 Analyze wireless sensing techniques.

CO 4 Design the data acquisition system.

CO 5 Identify signal conditioning method for particular application.

CO 6 Create an application using various sensor technologies.

SUBJECT: Digital Communication Lab (ECCL 501)

CO 1 Students should be able to compare different line coding methods

CO 2 Students Should be able to demonstrate various digital modulation techniques

CO 3 Understand effect of interference using eye diagram.

CO 4 Understand the concept of information theory in source coding.

SUBJECT: Discrete Time Signal Processing Lab (ECCL 501)

CO 1 Perform basic discrete time signal processing operations such as

Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation, etc. and interpret the results.

CO 2 Demonstrate their ability towards interpreting and performing frequency analysis of different discrete time sequences and systems.

CO 3 Design and implement the FIR and IIR Filters for given specifications. CO 4 Implement and analyze applications related to the field of biomedical signal processing and audio signal processing.

SUBJECT: Digital VLSI Lab (ECL 503)

CO 1 Write spice code for given combinational and sequential CMOS circuits.

CO 2 Perform various analysis like operating point, dc, transient etc. of given CMOS circuits.

CO 3 Evaluate performance of given CMOS circuits.

CO 4 Draw layout of given CMOS circuit and also able extract various parasitic using open source layout tool like Magic

CO 5 Design, simulate, and verify CMOS circuit for given specifications.

SUBJECT: Professional Communication Ethics II (ECL 504)

CO 1 Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.

CO 2 Strategize their personal and professional skills to build a professional image and meet the demands of the industry.

CO 3 Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.

CO 4 Deliver persuasive and professional presentations.

CO 5 Develop creative thinking and interpersonal skills required for effective professional communication.

CO 6 Apply codes of ethical conduct, personal integrity and norms of organizational behavior.

SUBJECT: Mini Project 2A (ECM 501)

CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.

CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.

CO 3 Analyze the impact of solutions in societal and environmental context for sustainable development.

CO 4 Demonstrate capabilities of self-learning in a group, which leads to life-long learning.

CO 5 Develop interpersonal skills & Excel in written and oral communication.

CO 6 Demonstrate project management principles during project work.

D. Third Year: Semester VI

SUBJECT: Electromagnetics & Antenna (ECC 601)

CO 1 Describe electromagnetics field including static and dynamic in terms of Maxwell's equations.

CO 2 Apply Maxwell's equation to solve various electromagnetic phenomenon such as electromagnetic wave propagation in different medium, power in EM wave.

CO 3 Derive the field equations for the basic radiating elements and describe basic antenna parameters like radiation pattern, directivity, gain etc..

CO 4 Implement different types of Antenna arrays such as Planner and Circular array etc.

CO 5 Implement different types of the antenna structures such as Microstrip antenna and reflector antenna etc.

CO 6 Analyze and explain electromagnetics wave propagation such as Ground wave, sky wave and Space wave propagation.

SUBJECT: Computer Communication Network (ECC 602)

CO 1 Analyze network topologies, hardware devices, addressing schemes and the protocol stacks.

CO 2 Compare various transmission media and broadband technologies.

CO 3 Analyze the flow control, error control and the medium access control techniques.

CO 4 Judge Network layer addressing and routing schemes. CO 5 Analyze connection oriented and connectionless services. CO 6 Apply the knowledge of application layer protocols

SUBJECT: Image Processing & Machine Vision (ECC 603)

CO 1 Understand fundamentals of image processing and machine vision.

CO 2 Enhance the quality of image using spatial and frequency domain techniques for image enhancement.

CO 3 Learn image morphology and restoration techniques.

CO 4 Learn image segmentation techniques based on principle of discontinuity and similarity using various algorithms.

CO 5 Represent boundaries and shapes using standard techniques.

CO 6 Classify the object using different classification methods.
SUBJECT: Artificial Neural Network & Fuzzy Logic (ECC 604)
CO 1 Comprehend the concepts of biological neurons and artificial neurons.
CO 2 Analyze the feed-forward and feedback neural networks and their learning algorithms.
CO 3 Comprehend the neural network training and design concepts.
CO 4 Comprehend the concept of Machine learning and algorithms of neural network.
CO 5 Build a simple CNN model and apply in image classification.
CO 6 Analyze the application of neural networks and fuzzy logic to real world problems.
SUBJECT: Internet of Things & Industry 4.0 (ECCDLO 6015)
CO 1 Discuss case studies and use cases of IoT design.
CO 2 Illustrate various protocols of web connectivity.
CO 3 Understand and use tools for data management and analytics in IoT.
CO 4 Explain various frameworks for industry 4.0 standards.
CO 5 Prepare case studies on applications of IIOT.
CO 6 Understand advanced concepts and applications of industry 4.0.
SUBJECT: Electromagnetics & Antenna Lab (ECL 601)
CO 1 Students will be able to describe electromagnetics field including static and dynamic in terms of Maxwell's equations.
CO 2 Students will be able to apply Maxwell's equation to solve various electromagnetic phenomenon such as electromagnetic wave propagation in different medium, power in EM wave
CO 3 Students will derive the field equations for the basic radiating elements and describe basic antenna parameters like radiation pattern, directivity, gain etc.
CO 4 Students will be able to implement different types of the antenna structures such as Antenna arrays, Microstrip antenna and reflector antenna etc.
SUBJECT: Computer Communication Network Lab (ECL 602)
CO 1 Design a small or medium sized computer network including media types, end devices, and interconnecting devices that meets a customer's specific needs.
CO 2 Perform configurations on routers and Ethernet switches
CO 3 Demonstrate knowledge of programming for network communications.
CO 4 Simulate computer networks and analyze the simulation results.
CO 5 Troubleshoot connectivity problems in a host occurring at multiple layers of the OSI model.
CO 6 Develop knowledge and skills necessary to gain employment as computer network engineer and network administrator.
SUBJECT: Image Processing & Machine Vision Lab (ECL 603)
CO 1 Understand fundamentals & basic operation in image processing.
CO 2 Perform enhancement of digital images in spatial domain.
CO 3 Perform enhancement of digital images in frequency domain.
CO 4 Perform edge detection and morphological operations on digital images.
SUBJECT: Skill Lab: Linux Network and Server Programming (ECL 604)
CO 1 Install Linux using different platform and execute standard Linux commands.
CO 2 Describe the basic knowledge of Linux Operating System.
CO 3 Deploy the system administrative functionality.
CO 4 Solve the problems using shell script programming.
CO 5 Develop network based applications.

CO 6 Apply the Linux commands using programming skill to deploy different servers like ftp, telnet etc.

SUBJECT: Mini Project 2B: Linux Network and Server Programming (ECL 604)

CO 1 Understand various FPGA families and method of FPGA synthesis and implementation.

CO 2 Learn the working of basic EDA tools like Xilinx, Modelsim, cadence, etc.

CO 3 Able to program, simulate and synthesize circuits in Verilog HDL.

CO 4 Learn the technique of interfacing of LED, switches and seven segment with FPGA.

CO 5 Learn the project documentation, designing and handling techniques.

CO 6 Analysis of FPAG fault detection and verification principles.

E. Fourth Year: Semester VII

SUBJECT: Microwave engineering (ECC 701)

CO 1 To understand the concept of transmission line & impedance matching.

CO 2 Describe the types of waveguides, rectangular waveguides and field equations.

CO 3 Understand the coupling mechanisms in waveguides and analyze the waveguide multiport junctions.

CO 4 Explore the microwave linear tubes and analyze with microwave cross field tubes.

CO 5 Understand the microwave solid state devices and avalanche transit time devices.

CO 6 Demonstrate the microwave bench set up and conducting measurements of different.

SUBJECT: Mobile Communication System (ECC 702)

CO 1 Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.

CO 2 Classify different types of propagation models and analyze the link budget.

CO 3 Compare and contrast GSM, GPRS, HSCSD, EDGE and IS-95 Technologies.

CO 4 Apply the concepts of 3G technologies for UMTS and CDMA 2000.

CO 5 Describe the features and working principle of 3GPP LTE.

CO 6 Discuss the emerging technologies for upcoming mobile communication systems.

SUBJECT: Cloud Computing & Security (ECCDLO 7013)

CO 1 Explain the fundamentals of cloud computing.

CO 2 Interpret the significance of virtualization in the context of cloud computing.

CO 3 Describe cloud computing services working on AWS, Azure and Google cloud platforms.

CO 4 Explain application design aspects of cloud computing.

CO 5 Interpret security aspects to cloud computing.

CO 6 Explain advances in cloud computing in terms of multimedia cloud, fog, edge computing and real applications of cloud.

SUBJECT: 5G Technology (ECCDLO 7022)

CO 1 Distinguish between the major cellular communication standards (1G/2G/3G/4G/5G systems) and architecture of wireless communications networks.

CO 2 Apply the 5G techniques e.g., massive MIMO, mmWave etc. for the design of communication systems.

CO 3 Analyze various modulation and multiplexing techniques e.g., OFDM, NOMA etc.

CO 4 Describe applications of cognitive radio in 5G Wireless Communications.

SUBJECT: Cyber security & Law (ECCILO 7016)

CO 1 Understand the concept of cybercrime and its effect on outside world.

CO 2 Interpret and apply IT law in various legal issues.

CO 3 Distinguish different aspects of cyber law.

CO 4 Apply Information Security Standards compliance during software design and development.
SUBJECT: Microwave Engineering Lab (ECCL 701)
CO 1 Able to handle microwave equipment.
CO 2 Able to understand microwave measurements and test the characteristics of microwave components.
CO 3 Demonstrate the microwave bench set up and conducting measurements of different parameters.
CO 4 Able to understand Wave guide and transmission line measurements.
SUBJECT: Mobile Communication System Lab (ECL 702)
CO 1 Demonstrate the effect of cellular system design parameters on system capacity and quality of service.
CO 2 Compare and contrast trunking radio systems.
CO 3 Examine the effect of small-scale fading parameters on the performance of radio channel characteristics.
CO 4 Analyze link budget for various propagation path-loss models.
CO 5 Summarize the attributes of OFDM, MIMO, and Cognitive radio.
CO 6 Evaluate the performance of different MIMO systems.
SUBJECT: Major Project Stage I (ECP 701)
CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.
CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO 3 Analyse the impact of solutions in societal and environmental context for sustainable development.
CO 4 Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO 5 Develop interpersonal skills & Excel in written and oral communication.
CO 6 Demonstrate project management principles during project work.
F. Fourth Year: Semester VIII
SUBJECT: Optical Communication Network (ECC 801)
CO 1 Understand optical networks at large by identifying the types of fibers, cables and deployment.
CO 2 Design point to point optical fiber communication links using appropriate optical fibers, light sources, couplers, detectors, and multiplexers.
CO 3 Design a short haul or long-haul optical network with repeater by incorporating suitable amplifiers.
CO 4 Compare SDH, PDH and WDM techniques and implement.
CO 5 Explore concepts of designing and operating principles of modern optical communication systems and networks.
CO 6 Apply the knowledge acquired to design the next generation fiber and FSO networks for indoor and outdoor applications.
SUBJECT: Wireless Network (ECCDLO 8013)
CO 1 Explain fundamental architecture, design issues and standards of wireless networks.
CO 2 Compare different types of Personal Area Network (PAN) technologies such as ZigBee, Bluetooth, UWB, NFC and 6LoWPAN.
CO 3 Analyze different LAN topologies and technologies and ad hoc networks.
CO 4 Compare various types of network protocols, ad hoc vehicle networks and Wireless MANs.
CO 5 Evaluate the planning and design of performance of GSM and CDMA system in Wireless WANs.
CO 6 Understand the basic network architecture of Wireless sensor networks concepts to develop an IoT applications.

SUBJECT: Satellite and Nano Satellite communication (ECCDLO 8022)

CO 1 Understand the basic concepts of satellite communication system and orbital parameters.

CO 2 Illustrate various satellite sub-systems, and launching mechanisms.

CO 3 Explore various earth station technologies.

CO 4 Analyze and evaluate link budget and various performance parameters of satellite signal for proper communication.

CO 5 Understand Nano satellite's structure design, payloads, Thermal control system.

CO 6 Understand concept of space segment for Nano satellite.

SUBJECT: Project Management (ECCIO 8011)

CO 1 Apply selection criteria and select an appropriate project from different options.

CO 2 Write work break down structure for a project and develop a schedule based on it.

CO 3 Identify opportunities and threats to the project and decide an approach to deal with them strategically.

CO 4 Use Earned value technique and determine & predict status of the project.

CO 5 Capture lessons learned during project phases and document them for future reference.

SUBJECT: Optical Communication Network Lab (ECL 801)

CO 1 Acquire proficiency in identifying the different types of fibers and understanding their properties.

CO 2 To measure the losses, dispersion and compensation techniques in all optical network.

CO 3 Learn to design all optical network with amplifiers and modern lasers for error free transmission.

CO 4 To design or implement point to point optical fiber network, WDM or DWDM Network

CO 5 To design free space optical system with atmospheric impairments and propose mitigation technique for minimum BER.

SUBJECT: Major Project Stage II (ECP 801)

CO 1 Identify problems based on societal /research needs & Apply Knowledge and skill to solve societal problems in a group.

CO 2 Draw the proper inferences from available results through theoretical/ experimental/simulations.

CO 3 Analyse the impact of solutions in societal and environmental context for sustainable development.

CO 4 Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.

CO 5 Develop interpersonal skills & Excel in written and oral communication.

CO 6 Demonstrate project management principles during project work.



ATMA MALIK INSTITUTE OF TECHNOLOGY AND RESEARCH (AMRIT)

Mohili-Aghai, Shahapur, Thane, Maharashtra, India. Pincode: 421603
Contact: +91 7720012139 / +91 9552773875, info@vishwatmakengg.in

Department of Mechanical Engineering
Course outcome R-2019 University of Mumbai Syllabus
(C- SCHEME)

A. Second Year: Semester III

MEC301 Engineering Mathematics-III
CO1 Apply the concept of Laplace transform to solve the real integrals in engineering problems.
CO2 Apply the concept of inverse Laplace transform of various functions in engineering problems.
CO3 Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
CO4 Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.
CO5 Apply Matrix algebra to solve the engineering problems.
CO6 Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat and wave equations
MEC302 :Strength of Materials
CO1 Demonstrate fundamental knowledge about various types of loading and stresses induced.
CO2 Draw the SFD and BMD for different types of loads and support conditions.
CO3 Analyse the bending and shear stresses induced in beam.
CO4 Analyse the deflection in beams and stresses in shaft.
CO5 Analyse the stresses and deflection in beams and Estimate the strain energy in mechanical elements.
CO6 Analyse buckling phenomenon in columns.
MEC303 : Production Processes
CO1 Demonstrate an understanding of casting process
CO2 Illustrate principles of forming processes.
CO3 Demonstrate applications of various types of welding processes.
CO4 Differentiate chip forming processes such as turning, milling, drilling, etc.
CO5 Illustrate the concept of producing polymer components and ceramic components.
CO6 Illustrate principles and working of non-traditional manufacturing
CO7 Understand the manufacturing technologies enabling Industry 4.0
MEC304 : Materials and Metallurgy
CO1 Identify the various classes of materials and comprehend their properties
CO2 Apply phase diagram concepts to engineering applications
CO3 Apply particular heat treatment for required property development
CO4 Identify the probable mode of failure in materials and suggest measures to prevent them
CO5 Choose or develop new materials for better performance
CO6 Decide an appropriate method to evaluate different components in service
MEC305 : Thermodynamics
CO1 Demonstrate application of the laws of thermodynamics to a wide range of systems.
CO2 Compute heat and work interactions in thermodynamic systems
CO3 Demonstrate the interrelations between thermodynamic functions to solve practical problems.
CO4 Compute thermodynamic interactions using the steam table and Mollier chart

CO5 Compute efficiencies of heat engines, power cycles.
CO6 Apply the fundamentals of compressible fluid flow to the relevant systems
MEL301 : Materials Testing
CO1 Prepare metallic samples for studying its microstructure following the appropriate procedure.
CO2 Identify effects of heat treatment on microstructure of medium carbon steel and hardenability of steel using
CO3 Perform Fatigue Test and draw S-N curve
CO4 Perform Tension test to Analyze the stress - strain behaviour of materials
CO5 Measure torsional strength, hardness and impact resistance of the material
CO6 Perform flexural test with central and three point loading conditions
MEL302 Machine Shop Practice
CO1 Know the specifications, controls and safety measures related to machines and machining operations.
CO2 Use the machines for making various engineering jobs.
CO3 Perform various machining operations
CO4 Perform Tool Grinding
CO5 Perform welding operations
MESBL301 Skill Based Lab: CAD – Modeling
CO1 Illustrate basic understanding of types of CAD model creation.
CO2 Visualize and prepare 2D modeling of a given object using modeling software.
CO3 Build solid model of a given object using 3D modeling software.
CO4 Visualize and develop the surface model of a given object using modeling software.
CO5 Generate assembly models of given objects using assembly tools of a modeling software
CO6 Perform product data exchange among CAD systems.
MEPBL301 Mini Project - 1A
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5 Analyse the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CO9 Demonstrate project management principles during project work.
A. Second Year: Semester IV
MEC401 Engineering Mathematics-IV
CO1 Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's
CO2 Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various
CO3 Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
CO4 Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and
CO5 Apply the concept of probability distribution to engineering problems & testing hypothesis of small samples
CO6 Apply the concepts of parametric and nonparametric tests for analyzing practical problems.
MEC402 Fluid Mechanics
CO1 Define properties of fluids, classify fluids and evaluate hydrostatic forces on various surfaces.
CO2 Illustrate understanding of dimensional analysis of Thermal and Fluid systems.
CO3 Differentiate velocity potential function and stream function and solve for velocity and acceleration of a fluid at
CO4 Formulate and solve equations of the control volume for fluid flow systems and Apply Bernoulli's

CO5 Calculate pressure drop in laminar and turbulent flow, evaluate major and minor losses in pipes.
CO6 Calculate resistance to flow of incompressible fluids through closed conduits and over surfaces
MEC403 Kinematics of Machinery
CO1 Identify various components of mechanisms
CO2 Develop mechanisms to provide specific motion
CO3 Draw velocity and acceleration diagrams of various mechanisms
CO4 Choose a cam profile for the specific follower motion
CO5 Predict condition for maximum power transmission in the case of a belt drive
CO6 Illustrate requirements for an interference-free gear pair
MEC404 CAD/CAM
CO1 Identify suitable computer graphics techniques for 3D modeling.
CO2 Transform, manipulate objects & store and manage data.
CO3 Develop 3D model using various types of available biomedical data.
CO4 Create the CAM Toolpath for specific given operations.
CO5 Build and create data for 3D printing of any given object using rapid prototyping and tooling processes.
CO6 Illustrate understanding of various cost effective alternatives for manufacturing products.
MEC404 Industrial Electronics
CO1 Illustrate construction, working principles and applications of power electronic switches.
CO2 Identify rectifiers and inverters for dc and ac motor speed control.
CO3 Develop circuits using OPAMP and Timer IC 555.
CO4 Identify digital circuits for industrial applications.
CO5 Demonstrate the knowledge of basic functioning of microcontrollers.
CO6 Analyze speed-torque characteristics of electrical machines for speed control.
MEL401 Industrial Electronics
CO1 Demonstrate characteristics of various electrical and electronics components
CO2 Develop simple applications built around these components
CO3 Identify use of different logic gates and their industrial applications
CO4 Built and demonstrate parameter measurements using microcontroller
CO5 Test and Analyze speed-torque characteristics of electrical machines for speed control.
MEL402 Kinematics of Machinery
CO1 Draw velocity diagram using Instantaneous Centre method
CO2 Find velocity and acceleration of a point on a four-bar mechanism by using Relative method.
CO3 Analyze velocity and acceleration of a specific link of a slider crank mechanism using graphical approach by
CO4 Plot displacement-time, velocity-time, and acceleration-time diagrams of follower motion.
CO5 Draw cam profile for the specific follower motion.
CO6 Develop and build mechanisms to provide specific motion.
MEL403 Python Programming
CO1 Demonstrate understand of basic concepts of python programming.
CO2 Identify, install and utilize python packages
CO3 Develop and execute python programs for specific applications.
CO4 Develop and build python program to solve real-world engineering problems
CO5 Prepare a report on case studies selected.
MESBL401 Skill based Lab: CNC and 3-D Printing
CO1 Develop and execute part programming for any given specific operation.
CO2 Build any given object using various CNC operations.

CO3 Demonstrate CAM Tool path and prepare NC- G code.
CO4 Develop 3D model using available biomedical data
CO5 Build any given real life object using 3D printing process.
CO6 Convert 2D images into 3D model
MEPBL 401 Mini Project - 1B
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5. Analyse the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CO9 Demonstrate project management principles during project work.
C. Third Year: Semester V
MEC501 Mechanical Measurements and Controls
CO1 Handle, operate and apply the precision measuring instruments / equipment's.
CO2 Analyze simple machined components for dimensional stability & functionality.
CO3 Classify various types of static characteristics and types of errors occurring in the system.
CO4 Classify and select proper measuring instrument for displacement, pressure, flow and temperature
CO5 Design mathematical model of system/process for standard input responses and analyse error
CO6 Analyse the problems associated with stability.
MEC502 Thermal Engineering
CO1 Analyze the three modes of heat transfer in engineering application.
CO2 Develop mathematical models for different modes of heat transfer.
CO3 Analyze performance parameters of different types of heat exchangers.
CO4 Identify and analyze the Transient heat Transfer in engineering applications.
CO5 Explain construction and working of different components of internal combustion engines.
CO6 Evaluate engine performance and emission characteristics.
MEC503 Dynamics of Machinery
CO1 Demonstrate working Principles of different types of governors and Gyroscopic effects on the mechanical
CO2 Illustrate basic of static and dynamic forces
CO3 Determine natural frequency of element/system
CO4 Determine vibration response of mechanical elements / systems
CO5 Design vibration isolation system for a specific application
CO6 Demonstrate basic concepts of balancing of forces and couples
MEC504 Finite Element Analysis
CO1 Solve differential equations using weighted residual methods.
CO2 Develop the finite element equations to model engineering problems governed by second order differential
CO3 Apply the basic finite element formulation techniques to solve engineering problems by using one dimensional
CO4 Apply the basic finite element formulation techniques to solve engineering problems by using two dimensional
CO5 Apply the basic finite element formulation techniques to find natural frequency of single degree of vibration
CO6 Use commercial FEA software, to solve problems related to mechanical engineering.
MEDLO5011 Optimization Techniques
CO1 Identify the types of optimization problems and apply the calculus method to single variable problems.

CO2 Formulate the problem as Linear Programming problem and analyse the sensitivity of a decision variable.
CO3 Apply various linear and non-linear techniques for problem solving in various domain.
CO4 Apply multi-objective decision making methods for problem in manufacturing environment and other domain.
CO5 Apply multi criterion decision making methods for problem in manufacturing environment and other domain.
CO6 Apply Design of Experiments method for Optimization
MEDLO5012 Design of Experiments
CO1 Plan, design, and conduct experimental investigations efficiently and effectively;
CO2 Understand strategy in planning and conducting experiments;
CO3 Choose an appropriate experimentation scheme to evaluate a new product design or process
CO4 improvement through experimentation strategy, data analysis, and interpretation of experimental results.
MEDLO5013 Computational Methods
CO1 Understand and develop mathematical models of physical systems.
CO2 Identify an appropriate mathematical formulation to linear algebraic equations.
CO3 Build an appropriate mathematical formulation to non-linear algebraic equations.
CO4 Evaluate and interpret the data regression, curve fitting and statistics.
CO5 Apply the numerical techniques and numerical schemes.
CO6 Formulate the concept of numerical methods in realistic applications.
MEL501 Thermal Engineering
CO1 Estimate thermal conductivity of engineering materials.
CO2 Evaluate performance parameters of extended surfaces.
CO3 Analyze heat transfer parameters in various engineering applications.
CO4 Analyze engine performance and emission parameters at different operating conditions.
MEL502 Dynamics of Machinery
CO1 Plot and analyze governor characteristics
CO2 Analyze gyroscopic effect on laboratory model
CO3 Estimate natural frequency of mechanical systems
CO4 Analyze vibration response of mechanical systems
CO5 Determine damping coefficient of a system
CO6 Balance rotating mass
MEL503 Finite Element Analysis
CO1 Select appropriate element for given problem
CO2 Select suitable meshing and perform convergence test
CO3 Select appropriate solver for given problem
CO4 Interpret the result
CO5 Apply basic aspects of FEA to solve engineering problems 6. Validate FEA solution
MESBL501 Professional Communication And Ethics – II
CO1 Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their
CO2 Strategize their personal and professional skills to build a professional image and meet the demands of the
CO3 Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group
CO4 Deliver persuasive and professional presentations.
CO5 Develop creative thinking and interpersonal skills required for effective professional communication.
CO6 Apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
MEPBL501 Mini Project - 2A
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.

CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5 Analyse the impact of solutions in societal and environmental context for sustainable development.
CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CO9 Demonstrate project management principles during project work.
C. Third Year: Semester VI
MEC601 Machine Design
CO1 Use design data book/standard codes to standardise the designed dimensions
CO2 Design Knuckle Joint, cotter joint and Screw Jack
CO3 Design shaft under various conditions and couplings
CO4 Select bearings for a given applications from the manufacturers catalogue.
CO5 Select and/or design belts and flywheel for given applications
CO6 Design springs, clutches and brakes
MEC602 Turbo Machinery
CO1 Define various parameters associated with steam generators and turbo machines.
CO2 Identify various components and mountings of steam generators with their significance.
CO3 Identify various turbo machines and explain their significance.
CO4 Apply principles of thermodynamics and fluid mechanics to estimate various parameters like mass flow rate power, torque, efficiency, temperature, etc.
CO5 Evaluate performance of SG and Turbo machines and apply various techniques to enhance performance.
CO6 Evaluate various phenomena related to performance like cavitation, choking, surging.
MEC603 Heating, Ventilation, Air Conditioning and Refrigeration
CO1 Illustrate the fundamental principles and applications of refrigeration and air conditioning systems.
CO2 Identify various HVAC&R components
CO3 Evaluate performance of various refrigeration system
CO4 Estimate cooling and heating loads for an airconditioning system.
CO5 Select air handling unit & design air distribution system
CO6 Apply the knowledge of HVAC for the sustainable development of refrigeration and airconditioning systems.
MEC604 Automation and Artificial Intelligence
CO1 Demonstrate understanding of fundamentals of industrial automation and AI.
CO2 Design & develop pneumatic / hydraulic circuits.
CO3 Design and develop electropneumatic circuits and PLC ladder logics.
CO4 Demonstrate understanding of robotic control systems and their applications.
CO5 Demonstrate understanding of various AI and machine learning technologies.
MEDLO6021 Press Tool Design
CO1 Demonstrate various press working operations for mass production of sheet metal parts
CO2 Identify press tool requirements to build concepts pertaining to design of press tools
CO3 Prepare working drawings and setup for economic production of sheet metal components
CO4 Select suitable materials for different elements of press tools
CO5 Illustrate the principles and blank development in bent & drawn components
CO6 understand safety aspects and automation in press working
MEDLO6022 Tool Engineering
CO1 Calculate the values of various forces involved in the machining operations

CO2 Design various single and multipoint cutting tools
CO3 Analyze heat generation in machining operation and coolant operations
CO4 Illustrate the properties of various cutting tool materials and hence select an appropriate tool material for
CO5 Demonstrate the inter-relationship between cutting parameters and machining performance measures like
CO6 Analyze economics of machining operations
MEDLO6023 Metal Forming Technology
CO1 Understand the concept of different metal forming process.
CO2 Approach metal forming processes both analytically and numerically
CO3 Design metal forming processes
CO4 Develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.
MEL601 Machine Design
CO1 Design shaft under various conditions
CO2 Design Knuckle Joint / cotter joint
CO3 Design Screw Jack
CO4 Design Flexible flange couplings/ Leaf spring
CO5 Convert design dimensions into working/manufacturing drawing
CO6 Use design data book/standard codes to standardise the designed dimensions.
MEL602 Turbo Machinery
CO1 Differentiate boiler, boiler mountings and accessories
CO2 Conduct a trial on reciprocating compressor / centrifugal compressor.
CO3 Conduct a trial on impulse turbine and analyze its performance
CO4 Conduct a trial on reaction turbine and analyze its performance
CO5 Conduct a trial on Centrifugal pump and analyze its performance
CO6 Conduct a trial on Reciprocating pump and analyze its performance
CO7 Conduct a trial on gear pump
MEL603 Heating, Ventilation, Air Conditioning and Refrigeration
CO1 Aware of the roles and ethics of HVAC &R engineers in related industries.
CO2 Present the impact of professional engineering solutions in societal and environmental contexts.
CO3 performance of HVAC &R systems Evaluate
CO4 Develop awareness of the engineering and technological aspects in the HVAC &R industries.
CO5 Communicate effectively through the preparation of report and practical presentation.
CO6 Analyse of HVAC&R in various application design aspects .
MESBL601 Measurements and Automation
CO1 Apply inspection gauge to check or measure surface parameters.
CO2 Measure surface parameters using precision measurement tools and equipment.
CO3 Measure different mechanical parameters by using sensors.
CO4 Analyse the response of a control systems.
CO5 Demonstrate use of automated controls using pneumatic and hydraulic systems.
CO6 Implement program on PLC system and demonstrate its application
MEPBL601 Mini Project - 2B
CO1 Identify problems based on societal /research needs.
CO2 Apply Knowledge and skill to solve societal problems in a group.
CO3 Develop interpersonal skills to work as member of a group or leader.
CO4 Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO5 Analyse the impact of solutions in societal and environmental context for sustainable development.

CO6 Use standard norms of engineering practices
CO7 Excel in written and oral communication.
CO8 Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CO9 Demonstrate project management principles during project work.
C. Final Year: Semester VII
MEC701 Design of Mechanical System
CO1 Apply the concept of system design.
CO2 Select appropriate gears for power transmission on the basis of given load and speed
CO3 Design material handling systems such as hoisting mechanism of EOT crane,
CO4 Design belt conveyor systems
CO5 Design engine components such as cylinder, piston, connecting rod and crankshaft
CO6 Design pumps for the given applications MEC702 Logistics and Supply Chain Management
MEC702 Logistics and Supply Chain Management
CO1 Demonstrate a sound understanding of Logistics and Supply Chain Management concepts and their role in
CO2 Identify the drivers of supply chain performance and risks in supply chain management.
CO3 Apply various techniques of inventory management and rank the items using inventory management technique
CO4 Apply various strategies and techniques to minimize overall logistics cost
CO5 Understand the role of digitization in supply chain management leading to sustainability
CO6 Apply various mathematical models/tools to design the supply chain network
MEDLO7031 Automotive Power Systems
CO1 Demonstrate the working of Fuel supply and ignition system of I.C. engines
CO2 Illustrate the working of lubrication, cooling and supercharging systems.
CO3 Comprehend the different technological advances in engines and alternate fuels
CO4 Identify and describe the history and different EV/HEV drivetrain topologies
CO5 Compare and evaluate various energy sources and energy storage components for EV and HEV application.
CO6 Comprehend EV and HEV working through Case studies.
MEDLO7032 Renewable Energy Sources
CO1 Describe the need for renewable energy and its potential for the development of a sustainable environment.
CO2 Analyze different solar collectors using geometrical parameters and photovoltaics for generation of solar
CO3 Identify and analyze various wind turbine energy harnessment techniques.
CO4 Design biogas plant for harnessing energy from organic waste.
CO5 Describe significance of hydrogen energy to fulfill present and future energy needs.
CO6 Describe the operating principle of geothermal energy and ocean energy and their role in sustainable development.
MEDLO7033 Vehicle Systems
CO1 Understand the working of different Vehicle Systems and Subsystems
CO2 Understand the working of different Vehicle Electrical systems and subsystems.
CO3 Understand different Vehicle Body systems and layouts.
CO4 Illustrate working and functions of different vehicle mechanical,electrical and chassis systems.
CO5 Understand the effect of aerodynamics on the functioning of a vehicle.
CO6 Comprehend the different technological advances in vehicle systems.
MEDLO7041 Machinery Diagnostics
CO1 Relate basic concepts of Machinery Diagnostic.
CO2 Describe the working of Vibration Measuring Instruments.
CO3 Apply different Signal Processing Techniques in Vibration Measurement.

CO4 Identify common faults in Machinery using Vibration Spectrum.
CO5 Interpret the Vibration Signals for Monitoring and Prognosis.
MEDLO7042 Vibration Controls
CO1 Apply basic concepts of Vibration Isolation and Damping.
CO2 Identify suitable Vibration Absorber
CO3 Identify suitable Vibration Isolator
CO4 Apply suitable method to Control the vibrations to the acceptable level.
MEDLO7043 Advanced Vibration
CO1 Estimate natural frequency of mechanical element / system.
CO2 Understand the concepts of Vibration Isolation and Control.
CO3 Analyse vibratory response of mechanical element / system.
CO4 Analyse vibration of Continuous system.
CO5 Analyse Random Vibrations.
CO6 Analyse Non-Linear Vibrations.
ILO7011 Product Life Cycle Management
CO1 Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
CO2 Illustrate various approaches and techniques for designing and developing products.
CO3 Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
CO4 Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant
ILO7012 Reliability Engineering
CO1 Understand and apply the concept of Probability to engineering problems
CO2 Apply various reliability concepts to calculate different reliability parameters
CO3 Estimate the system reliability of simple and complex systems
CO4 Carry out a Failure Mode Effect and Criticality Analysis
ILO7013 Management Information System
CO1 Explain how information systems Transform Business
CO2 Identify the impact information systems have on an organization
CO3 Describe IT infrastructure and its components and its current trends
CO4 Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
CO5 Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses
ILO7014 Design of Experiments
CO1 Plan data collection, to turn data into information and to make decisions that lead to appropriate action.
CO2 Apply the methods taught to real life situations
CO3 Plan, analyze, and interpret the results of experiments
ILO7015 Operations Research
CO1 Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
CO2 Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution
CO3 Solve specialized linear programming problems like the transportation and assignment problems, solve network
CO4 Understand the applications of integer programming and a queuing model and compute important
ILO7016 Cyber Security and Laws

CO1 Understand the concept of cybercrime and its effect on outside world
CO2 Interpret and apply IT law in various legal issues
CO3 Distinguish different aspects of cyber law
CO4 Apply Information Security Standards compliance during software design and development
ILO7017 Disaster Management and Mitigation Measures
CO1 Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
CO2 Plan of national importance structures based upon the previous history.
CO3 Get acquainted with government policies, acts and various organizational structure associated with an
CO4 Get to know the simple do's and don'ts in such extreme events and act accordingly.
ILO7018 Energy Audit and Management
CO1 To identify and describe present state of energy security and its importance.
CO2 To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
CO3 To describe the energy performance evaluation of some common electrical installations and identify the energy
CO4 To describe the energy performance evaluation of some common thermal installations and identify the energy
CO5 To analyze the data collected during performance evaluation and recommend energy saving measures
ILO7019 Development Engineering
CO1 Apply knowledge for Rural Development.
CO2 Apply knowledge for Management Issues.
CO3 Apply knowledge for Initiatives and Strategies
CO4 Develop acumen for higher education and research.
CO5 Master the art of working in group of different nature.
CO6 Develop confidence to take up rural project activities independently
MEL701 DESIGN OF MECHANICAL SYSTEMS
CO1 Apply the concept of system design.
CO2 Design of hoisting mechanism of EOT crane,
CO3 Design belt conveyor systems
CO4 Design pumps for the given applications
CO5 Design engine components such as cylinder, piston, connecting rod and crankshaft
MEL702 Maintenance Engineering Lab
CO1 Identify different tools used for maintenance.
CO2 Apply different maintenance strategies.
CO3 Demonstrate the process of servicing a machine.
CO4 Identify common faults in Machinery using Vibration Spectrum.
CO5 Interpret the Vibration Signals for Monitoring and Prognosis.
MEL703 Industrial Skills
CO1 Skilfully prepare and edit documents and slides on MS Word and MS PowerPoint etc.
CO2 Execute functions on MS Excel.
CO3 Learn how to navigate tasks and execute functions in G-suite.
CO4 Understand and practice metacognitive skills of creativity and problem solving.
CO5 Hone team building and leadership skills.
MEP701 Major Project 1
CO1 Students will be able to develop the understanding of the problem domain through extensive review of
CO2 Students will be able to identify and analyse the problem in detail to define its scope with problem specific
CO3 Students will be able to identify various techniques to be implemented for the selected problem and related
CO4 Students will be able to design solutions for real-time problems that will positively impact society and

CO5 Students will be able to develop clarity of presentation based on communication, teamwork and leadership
CO6 Students will be able to inculcate professional and ethical behaviour.
D. Final Year: Semester VIII
MEC801 Operations Planning and Control
CO1 Illustrate operations functions and manage operations in a better way.
CO2 Apply various strategies to develop aggregate production plan based on the demand forecasting.
CO3 Apply various algorithms in scheduling and sequencing of manufacturing and service operations the resources
CO4 Develop Material Requirements Plans (MRP) to estimate the planned order releases.
CO5 Apply various techniques for facility layout planning and line balancing to optimize
CO6 Demonstrate the importance of implementation of JIT, Lean, Agile and manufacturing in manufacturing and service organizations.
MEDLO8051 Composite Materials
CO1 Select the type of material for the fibres and matrix in a composite material for the given application.
CO2 Relate stresses and strains through the elastic constants for a given lamina.
CO3 Evaluate elastic properties of a lamina based on the properties of its constituents.
CO4 Predict failure of a lamina under the given loading condition.
CO5 Select the number of laminae and their stacking sequence in a composite material for the given loading
CO6 Identify the type of damage occurring in a composite structure and select an appropriate method to repair it.
MEDLO8052 Smart Materials
CO1 Classify and select different types of smart materials
CO2 Comprehend Important Concepts and principles of Smart Materials
CO3 synthesis, sensing and actuation of Piezoelectric Materials, Magneto strictive Materials, Shape Memory Alloys,
CO4 synthesis, sensing and actuation of Ferrofluids and Magneto rheological Fluids, Soft Matter, Carbon Nanotubes
CO5 Classify and select Smart Materials for Energy Applications: Materials used for energy storage
CO6 Classify and select Composite Materials, Nano Composite Materials
MEDLO8053 Micro Electro Mechanical Systems (MEMS)
CO1 Apply laws of scaling for development of a MEMS device
CO2. Understand the materials and their processing to make MEMS
CO3. Select and use microfabrication techniques for microsystems
CO4 Understand the development of micro sensors and actuators
CO5 Analyze microsystems technology for technical feasibility as well as practicality
CO6 Develop useful applications of MEMS.
MEDLO8061 Product Design and Development
CO1 Describe the process of product design & development.
CO2 Employ engineering, scientific, and mathematical principles to develop and execute a design project from a
CO3 Create 3D solid models of mechanical components using CAD software.
CO4 Demonstrate individual skills using selected manufacturing techniques such as rapid prototyping.
CO5 Fabricate an electromechanical assembly of a product from engineering drawings.
CO6 Work collaboratively in a team to complete a design project.
CO7 Effectively communicate the results of projects and other assignments both in a written and oral format.
MELO8062 Design for X
CO1 Apply design concepts and guidelines formanufacturing and assembly.
CO2 Demonstrate the concept of value analysis and its relevance.

CO3 Understand the economics of product development
CO4 Apply design concepts for reliability and maintainability
MEDLO8063 Total Quality Management
CO1 To apply QM and principles of TQM in organizational development process.
CO2 To apply the QC & QM tools in process improvement.
CO3 To apply SQC techniques to improve process quality.
CO4 To apply Six Sigma project in TQM Implementation
CO5 To apply QMS and Certification for Quality Accreditation
CO6 To apply the advanced tools for Quality Sustainability.
ILO8021 Project Management
CO1 Apply selection criteria and select an appropriate project from different options.
CO2 Write work break down structure for a project and develop a schedule based on it.
CO3 Identify opportunities and threats to the project and decide an approach to deal with them strategically.
CO4 Use Earned value technique and determine & predict status of the project.
CO5 Capture lessons learned during project phases and document them for future reference
ILO 8022 Finance Management
CO1 Understand Indian finance system and corporate finance
CO2 Take investment, finance as well as dividend decisions ILO8023 Entrepreneurship Development and
CO3 Understand the concept of business plan and ownerships
CO4 Interpret key regulations and legal aspects of entrepreneurship in India
CO5 Understand government policies for entrepreneurs
ILO8024 Human Resource Management
CO1 Understand the concepts, aspects, techniques and practices of the human resource management.
CO2 Understand the Human resource management (HRM) processes, functions, changes and challenges in today's
CO3 Gain knowledge about the latest developments and trends in HRM.
CO4 Apply the knowledge of behavioural skills learnt and integrate it with in inter personal and intergroup
ILO8025 Professional Ethics and Corporate Social Responsibility (CSR)
CO1 Understand rights and duties of business
CO2 Distinguish different aspects of corporate social responsibility
CO3 Demonstrate professional ethics
CO4 Understand legal aspects of corporate social responsibility
ILO802 Research Methodology
CO1 Prepare a preliminary research design for projects in their subject matter areas
CO2 Accurately collect, analyze and report data
CO3 Present complex data or situations clearly
CO4 Review and analyze research findings
ILO8027 IPR and Patenting
CO1 understand Intellectual Property assets
CO2 assist individuals and organizations in capacity building
CO3 work for development, promotion, protection, compliance, and enforcement of Intellectual Property and
ILO 8028 Digital Business Management
CO1 Identify drivers of digital business
CO2 Illustrate various approaches and techniques for E-business and management

CO3 Prepare E-business plan
ILO8029 Environmental Management
CO1 Understand the concept of environmental management
CO2 Understand ecosystem and interdependence, food chain etc.
CO3 Understand and interpret environment related legislations
MEL801 Product Design and Development
CO1 Identify the need for developing products
CO2 Select suitable PD&D processes
CO3 apply the creativity & industrial design methods to design & develop the chosen product
CO4 Work collaboratively in a team to complete a PD&D project.
CO5 Effectively communicate the results of projects and other assignments both in a written and oral format.
MEL802 Laboratory based on IoT
CO1 Develop simple applications using microcontrollers 8051 and Arduino.
CO2 Interface simple peripheral devices to a Microcontroller.
CO3 Use microcontroller based embedded platforms in IoT.
CO4 Use wireless peripherals for exchange of data.
CO5 Setup cloud platform and log sensor data.
MEP801 Major Project II
CO1 Students will be able to implement solutions for the selected problem by applying technical and professional
CO2 Students will be able to analyze impact of solutions in societal and environmental context for sustainable development.
CO3 Students will be able to collaborate best practices along with effective use of modern tools.
CO4 Students will be able to develop proficiency in oral and written communication with effective leadership and teamwork.
CO5 Students will be able to nurture professional and ethical behavior.
CO6 Students will be able to gain expertise that helps in building lifelong learning experience.