2.6.1 Program outcomes, program specific outcomes and course outcomes for all programs offered by the Institution are stated and displayed on website and communicated to teachers and students

Sr. No	Details
1	Course Outcomes of First Year Subjects
2	Course Outcomes of Biomedical Engineering Subjects
3	Course Outcomes of Biotechnology Subjects
4	Course Outcomes of Chemical Engineering Subjects
5	Course Outcomes of Computer Engineering Subjects
6	Course Outcomes of Electronics & Telecommunication Subjects
7	Course Outcomes of Information Technology Subjects

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Course Outcomes of First Year Subjects

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COURSE OUTCOMES- FIRST YEAR

F. E. Sem I (REV- 2019)

FEC101- Engineering Mathematics-I

Learners will be able to:

FEC101.1	Illustrate the basic concepts of Complex numbers.
FEC101.2	Apply the knowledge of complex numbersto solve problems in hyperbolic functions and logarithmic function.
FEC101.3	Illustrate the basic principles of Partial differentiation
FEC101.4	Illustrate the knowledge of Maxima, Minima and Successive differentiation.
FEC101.5	Apply principles of basic operations of matrices, rank and echelon form of matrices to solve simultaneous equations.
FEC101.6	Illustrate SCILAB programming techniques to the solution of linear and simultaneous algebraic equations.

FEC102-Engineering Physics-I

Learners will be able to:

FEC102.1	Illustrate the fundamentals of quantum mechanics and its application.
FEC102.2	Explain peculiar properties of crystal structure and apply them in crystallography using X-ray diffraction techniques.
TEC102.3	Comprehend the concepts of semiconductor physics and applications of semiconductors in electronic devices.

FEC102.4	Employ the concept of interference in thin films in measurements.
FEC102.5	Discuss the properties of Superconductors and Supercapacitors to apply them in novel applications.
FEC102.6	Compare the properties of engineering materials for their current and futuristic frontier applications.

FEC103- Engineering Chemistry-I

Learners will be able to:

FEC103.1	Explain the concept of microscopic chemistry in terms of atomic and molecular orbital theory and relate it to diatomic molecules.
FEC103.2	Describe the concept of aromaticity and interpret it with relation to specific aromatic systems
FEC103.3	Illustrate the knowledge of various types of intermolecular forces and relate it to real gases.
FEC103.4	Interpret various phase transformations using thermodynamics.
FEC103.5	Illustrate the knowledge of polymers, fabrication methods, conducting polymers in various industrial fields.
FEC103.6	Analyze the quality of water and suggest suitable methods of treatment.

FEC104- Engineering Mechanics

Learners will be able to:

FEC104.1	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.
FEC104.2	Demonstrate the understanding of Centroid and its significance and locate the same.

FEC104.3	Correlate real life application to specific type of friction and estimate required force to overcome friction.
FEC104.4	Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation
FEC104.5	Illustrate different types of motions and establish Kinematic relations for a rigid body
FEC104.6	Analyze particles in motion using force and acceleration, work-energy and impulsemomentum principles

FEC105- Basic Electrical Engineering

Learners will be able to:

FEC105.1	Apply various network theorems to determine the circuit response / behavior.
FEC105.2	Evaluate and analyze 1-Φ circuits.
FEC105.3	Evaluate and analyze 3-Φ AC circuits.
FEC105.4	Understand the constructional features and operation of 1-Φ transformer.
FEC105.5	Illustrate the working principle of 3-Φ machine.
FEC105.6	Illustrate the working principle of 1-Φ machines.

FEL101 - Engineering Physics-I

Learners will be able to:

FEL101.1	Perform the experiments based on interference in thin films and analyze the results.

FEL101.2	Verify the theory learned in the module crystallography.
FEL101.3	Perform the experiments on various semiconductor devices and analyze their characteristics.
FEL101.4	Perform simulation study on engineering materials.

FEL102 - Engineering Chemistry-I

Learners will be able to:

FEL102.1	Determine Chloride content and hardness of water sample
FEL102.2	Determine free acid ph of different solutions
FEL102.3	Determine metal ion concentration
FEL102.4	Synthesize polymers, biodegradable plastics
FEL102.5	Determine Viscosity of oil

FEL103 - Engineering Mechanics

Learners will be able to:

FEL103.1	Verify equations of equilibrium of coplanar force system
FEL103.2	Verify law of moments.
FEL103.3	Determine the centroid of plane lamina.

FEL103.4	Evaluate co-efficient of friction between the different surfaces in contact.
FEL103.5	Demonstrate the types of collision/impact and determine corresponding coefficient of restitution.
FEL103.6	Differentiate the kinematics and kinetics of a particle.

FEL104 - Basic Electrical Engineering

Learners will be able to:

FEL104.1	Interpret and analyse the behaviour of DC circuits using network theorems.
FEL104.2	Perform and infer experiment on single phase AC circuits.
FEL104.3	Demonstrate experiment on three phase AC circuits.
FEL104.4	Illustrate the performance of single phase transformer and machines.

FEL105 - Basic Workshop Practice-I

Learners will be able to:

FEL105.1	Develop the necessary skill required to handle/use different fitting tools.
FEL105.2	Develop skill required for hardware maintenance.
FEL105.3	Able to install an operating system and system drives.
FEL105.4	Able to identify the network components and perform basic networking and crimping.

FEL105.5	Able to prepare the edges of jobs and do simple arc welding.
FEL105.6	Develop the necessary skill required to handle/use different plumping tools.
FEL105.7	Demonstrate the turning operation with the help of a simple job.

THADOMAL SHAHANI ENGINEERING COLLEGE

FIRST YEAR
F. E. Sem II (REV- 2019)

FEC201 - ENGINEERING MATHEMATICS - II

Learner will be able to:	
FEC 201.1	Solve various types of First Order differential equation.
FEC 201.2	Solve various types of Higher Order Differential equation.
FEC 201.3	Illustrate the concepts of Beta and Gamma function,DUIS and rectification.
FEC 201.4	Apply the concepts of Double integral
FEC 201.5	Apply the concept of Triple integral.
FEC 201.6	Apply the principles of Numerical Method for solving differential equation and numerical integration analytically and using Scilab also.

FEC202 - ENGINEERING PHYSICS - II

Learner will be able to:	
FEC 202.1	Describe the diffraction through slits and its applications.
FEC 202.2	Apply the foundation of laser and fiber optics in development of modern communication technology.

FEC 202.3	Relate the basics of electrodynamics which is prerequisite for satellite communications, antenna theory etc.
FEC 202.4	Explain the fundamentals of relativity.
FEC 202.5	Assimilate the wide scope of nanotechnology in modern developments and its role in emerging innovating applications.
FEC 202.6	Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.

FEC203 - ENGINEERING CHEMISTRY - II

Learner will be able to:	
FEC 203.1	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
FEC 203.2	Illustrate the concept of emission spectroscopy and describe the phenomena of fluorescence and phosphorescence in relation to it.
FEC 203.3	Explain the concept of electrode potential and nernst theory and relate it to electrochemical cells.
FEC 203.4	Identify different types of corrosion and suggest control measures in industries.
FEC 203.5	Illustrate the principles of green chemistry and study environmental impact.
FEC 203.6	Explain the knowledge of determining the quality of fuel and quantify the oxygen required for combustion of fuel.

FEC204 - ENGINEERING GRAPHICS - II

Learner will be able to:	
FEC 204.1	Apply the basic principles of projections in Projection of Lines and Planes
FEC 204.2	Apply the basic principles of projections in Projection of Solids.
FEC 204.3	Apply the basic principles of sectional views in Section of solids.
FEC 204.4	Apply the basic principles of projections in converting 3D view to 2D drawing.
FEC 204.5	Read a given drawing.
FEC 204.6	Visualize an object from the given two views.

FEC205 - C PROGRAMMING

Learner will be able to:	
FEC 205.1	Formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language
FEC 205.2	Implement, test and execute programs comprising of control structures.
FEC 205.3	Decompose a problem into functions and synthesize a complete program.
FEC 205.4	Demonstrate the use of arrays, strings and structures in C language.
FEC 205.5	Understand the concept of pointers

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FEC206 - PROFESSIONAL COMMUNICATION AND ETHICS

Learner will be able to:	
FEC 206.1	Eliminate barriers and use verbal/non-verbal cues at social and workplace situations.
FEC 206.2	Employ listening strategies to comprehend wide-ranging vocabulary, grammatical structures, tone and pronunciation.
FEC 206.3	Prepare effectively for speaking at social, academic and business situations.
FEC 206.4	Use reading strategies for faster comprehension, summarization and evaluation of texts.
FEC 206.5	Acquire effective writing skills for drafting academic, business and technical documents.
FEC 206.6	Successfully interact in all kinds of settings, displaying refined grooming and social skills

FEL201 - ENGINEERING PHYSICS - II

Learner will be able to:	
FEL 201.1	Perform the experiments based on diffraction through slitsusing Laser source and analyze the results.
FEL 201.2	Perform the experiments using optical fibre to measure numerical aperture of a given fibre.
FEL 201.3	Perform the experiments on various sensors and analyze the result.

FEL202 - ENGINEERING CHEMISTRY - II

Learner will be able to:	
FEL 202.1	Determine moisture and ash content of coal
FEL 202.2	Analyze flue gas
FEL 202.3	Determine saponification and acid value of oil
FEL 202.4	Determine flash point of a lubricating oil
FEL 202.5	Synthesize a drug and a biofuel.
FEL 202.6	Determine na/k and emf of cu-zn system

FEL203 - ENGINEERING GRAPHICS

Learner will be able to:	
FEL 203.1	Apply the basic principles of projections in 2D drawings using a CAD software.
FEL 203.2	Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.
FEL 203.3	Apply the concepts of layers to create drawing.
FEL 203.4	Apply basic AutoCAD skills to draw different views of a 3D object.
FEL 203.5	Apply basic AutoCAD skills to draw the isometric view from the given two views.

FEL204 - C PROGRAMMING

Learner will be able to:	
FEL 204.1	Translate given algorithms to a program.
FEL 204.2	Correct syntax and logical errors.
FEL 204.3	Write iterative as well as recursive programs.
FEL 204.4	Represent data in arrays, strings and structures and manipulate them through a program.
FEL 204.5	Declare pointers and demonstrate call by reference concept.

FEL205 - PROFESSIONAL COMMUNICATION AND ETHICS - I

Learner will be able to:	
FEL 205.1	Listen and comprehend all types of spoken discourse successfully.
FEL 205.2	Speak fluently and make effective professional presentations.
FEL 205.3	Read large quantities of text in a short time to comprehend, summarise and evaluate content.
FEL 205.4	Draft precise business letters, academic essays and technical guidelines.
FEL 205.5	Dress finely and conduct themselves with panache in social, academic and professional situations.

FEL206 - BASIC WORKSHOP PRACTICE - II

Learner will be able to:	
FEL 206.1	Develop the necessary skill required to handle/use different carpentry tools.
FEL 206.2	Identify and understand the safe practices to adopt in electrical environment.
FEL 206.3	Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
FEL 206.4	Design, fabricate and assemble pcb.
FEL 206.5	Develop the necessary skill required to handle/use different masons tools.
FEL 206.6	Develop the necessary skill required to use different sheet metal and brazing tools.
FEL 206.7	Able to demonstrate the operation, forging with the help of a simple job.

Course Outcomes of Biomedical Engineering Subjects

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S.E. Sem III : Course Outcomes

BMC301 - Engineering Mathematics III	
Learners will be able to:	
BMC301.1	Apply the concept of Laplace transform to solve the real integrals in engineering problems.
BMC301.2	Apply the concept of inverse Laplace transform of various functions in engineering problems.
BMC301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
BMC301.4	Find orthogonal trajectories and analytic function by using basic concepts of complex variables.
BMC301.5	Illustrate the use of matrix algebra to solve the engineering problems.
BMC301.6	Apply the concepts of vector calculus in real life problems.

BMC302 - Human Anatomy and Physiology for Engineers	
Learners will be able to:	
BMC302.1	Explain the organization of the human body, homeostasis and its maintenance, structure and functions of a cell and basic tissues.
BMC302.2	Explain the components of blood and their functions.
BMC302.3	Explain the anatomical parts and physiological processes of the cardiovascular system and respiratory system.
BMC302.4	Explain the anatomical parts and physiological processes of the aliment`
BMC302.5	Explain the structure and functions of nervous system, eye and skin along with the secretions and functions of all endocrine glands.

BMC303 - Medical Sensors	
Learners will be able to:	
BMC303.1	Explain different components of a generalized medical instrumentation system, input transducer properties, and instrument characteristics.
BMC303.2	Apply the knowledge of principles of various types of transducers and sensors including motion, displacement, force, pressure sensors to different medical applications.
BMC303.3	Apply the knowledge of principles of various types of temperature sensors to different medical applications.
BMC303.4	Apply the knowledge of the various biopotential electrodes for measuring different types of biopotentials.
BMC303.5	Apply the principles of various chemical sensors for measuring concentration of biochemical analytes.
BMC303.6	Explain the principles of various biosensors and their medical applications.

BMC304 - Electronic Circuits Analysis and Design	
Learners will be able to:	
BMC304.1	Explain the transfer characteristics in analysing the electronic circuits which use diode, BJT etc.
BMC304.2	Explain equivalent circuits of BJT and apply them to analyse and design BJT based amplifier circuits

BMC304.3	Apply the knowledge of mathematical model to analyse multistage amplifiers.
BMC304.4	Design and analyse power amplifiers.
BMC304.5	Apply the concept of transfer characteristics, D.C. load line, A.C. load line to analyse MOSFET amplifiers.

BMC305 - Digital Electronics	
Learners will be able to:	
BMC305.1	Describe various number systems, logic gates and logic families.
BMC305.2	Apply Boolean algebra, K-maps for Logic reduction and implementations in SOP and POS form
BMC305.3	Develop combinational circuits such as code converter circuits, parity generator checker circuits and magnitude comparator circuits. Also, circuits using multiplexers, de-multiplexers, and decoders.
BMC305.4	Design synchronous sequential circuits and asynchronous counters using flip flops
BMC305.5	Design various registers using flip flops.

BML301 - Human Anatomy and Physiology for Engineers Lab	
Learners will be able to:	
BML301.1	Demonstrate measurement of blood pressure using occlusive cuff method.
BML301.2	Apply blood cell counting principles for measuring blood composition.
BML301.3	Demonstrate the measurement of electrical activity of heart and the related parameters.
BML301.4	Demonstrate the measurement of various lung volumes and capacities.
BML301.5	Appropriately utilize laboratory equipment, such as microscopes, general lab ware, and virtual simulations.
BML301.6	Locate and identify anatomical structures.

BML302 - Medical Sensors Lab	
Learners will be able to:	
BML302.1	Analyse step response of a first-order system.
BML302.2	Demonstrate the measurement of displacement using various displacement sensors.
BML302.3	Demonstrate the measurement of force and pressure using a force sensor and a pressure sensor respectively.
BML302.4	Demonstrate the measurement of temperature using various temperature sensors.
BML302.5	Distinguish various biopotential electrodes.
BML302.6	Demonstrate the measurement of pH of a solution using a pH electrode.

BML303 - Electronic Circuits Analysis and Design Lab	
Learners will be able to:	
BML303.1	Explain the transfer characteristics of basic semiconductor devices.
BML303.2	Design and verify the outputs of various electronic circuits such as clipper, clampers etc using bread boards and various lab equipment's.
BML303.3	Design amplifier circuits and plot its frequency response.

BML304 - Electronics Lab (SBL)

	Learners will be able to:
BML304.1	Design and implement analog and digital electronic circuits on bread board and verify the outputs.
BML304.2	Learn one of the tools for simulating different circuits.
BML304.3	Know the limitations of ideal environment of simulations and also importance of simulation in designing the circuits.
BML304.4	Learn soldering skills for implementing the circuits on PCB.

BMM301 - Mini Project – 1 A	
Learners will be able to:	
BMM301.1	Identify problems based on societal /research needs.
BMM301.2	Apply Knowledge and skill to solve societal problems in a group.
BMM301.3	Develop interpersonal skills to work as member of a group or leader.
BMM301.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
BMM301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
BMM301.6	Use standard norms of engineering practices
BMM301.7	Excel in written and oral communication.
BMM301.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
BMM301.9	Demonstrate project management principles during project work.

S.E. Sem IV : Course Outcomes

BMC401 - Engineering Mathematics IV	
Learners will be able to:	
BMC401.1	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
BMC401.2	Demonstrate the use of Correlation and Regression to the engineering problems in data science, machine learning and AI.
BMC401.3	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
BMC401.4	Apply the concept of vector spaces and orthogonalization process in Engineering Problems.
BMC401.5	Use the concept of Quadratic forms and Singular value decomposition in various Engineering applications.
BMC401.6	Find the extremals of the functional using the concept of Calculus of variation

BMC402 - Integrated Circuit Design	
Learners will be able to:	

BMC402.1	Demonstrate basics of operational amplifiers.
BMC402.2	Analyse different types of Op-Amp based circuits.
BMC402.3	Analyse and design operational amplifier to perform mathematical operations.
BMC402.4	Design operational amplifier based oscillators.
BMC402.5	Learn various waveform generation ICs and their applications to use effectively in projects.
BMC402.6	Apply the knowledge of various special function ICs and special purpose diodes for designing practical applications.

BMC403 - Principles of Control Systems	
Learners will be able to:	
BMC403.1	To describe basic concepts of control system such as open loop, closed loop, feedback and feed forward systems
BMC403.2	To develop the mathematical model of different type of systems
BMC403.3	To analyze systems using state space techniques
BMC403.4	To analyse stability in time domain using root locus and BIBO stability
BMC403.5	To examine correlation between stability analysis of systems in time and frequency domain
BMC403.6	To analyse effect of PID controller in control design

BMC404 - Medical Imaging – I	
Learners will be able to:	
BMC404.1	Discuss different parts of a X-Ray Equipment and outline process of X-Ray Interaction with matter.
BMC404.2	Explain concepts of Radiography techniques such as Computed Radiography (CR), Digital Radiography (DR) and Mammography with focus on its clinical applications.
BMC404.3	Explain working principle of Fluoroscopic Imaging and Digital Subtraction Angiography and outline its clinical applications.
BMC404.4	Describe system configuration of Computed Tomography, Apply CT Image Reconstruction Algorithms and enlist its clinical applications.
BMC404.5	Highlight the key advancements in CT Technology and demonstrate its application in area of Clinical angiography and Cardiac CT

BMC405 - Biomaterials and Artificial Organs	
Learners will be able to:	
BMC405.1	Classify various biomaterials and select biomaterials for specific application
BMC405.2	Explain biological, mechanical and physio-chemical tests conducted on biomaterials before implantation in the human body.

BMC405.3	Explain properties and applications of metals and ceramic biomaterials.
BMC405.4	Explain properties and applications of polymeric, degradable and composite biomaterials.
BMC405.5	Explain design aspects and materials used in the fabrication of artificial organs.

BML401 - Integrated Circuit Design Lab	
Learners will be able to:	
BML401.1	Read the data sheet of different ICs, compare the parameters to select appropriate IC.
BML401.2	To design and implement various building blocks of different biomedical instruments.

BML402 - Principles of Control Systems Lab	
Learners will be able to:	
BML402.1	To describe basic concepts of control system such as open loop, closed loop, feedback and feed forward systems
BML402.2	To develop the mathematical model of different type of systems
BML402.3	To analyse systems using state space techniques
BML402.4	To analyse stability in time domain using root locus and BIBO stability
BML402.5	To examine correlation between stability analysis of systems in time and frequency domain
BML402.6	To analyse effect of PID controller in control design

BML403 - Medical Imaging – I Lab	
Learners will be able to:	
BML403.1	Discuss different parts of a X-Ray Equipment and outline process of X-Ray Interaction with matter.
BML403.2	Explain concepts of Radiography techniques such as Computed Radiography (CR), Digital Radiography (DR) and Mammography with focus on its clinical applications.
BML403.3	Explain working principle of Fluoroscopic Imaging and Digital Subtraction Angiography and outline its clinical applications.
BML403.4	Describe system configuration of Computed Tomography, Apply CT Image Reconstruction Algorithms and enlist its clinical applications.
BML403.5	Highlight the key advancements in CT Technology and demonstrate its application in area of Clinical angiography and Cardiac CT

BML404 - Computing Lab (SBL)	
Learners will be able to:	
BML404.1	Describe Numbers, Strings, Lists, Tuples, Dictionaries, Array and Math functions in Python
BML404.2	Express different Decision Making statements and Functions

BML404.3	Illustrate different file handling operations
BML404.4	Interpret object oriented programming in Python
BML404.5	Develop proficiency in handling Python libraries

BMM401 - Mini Project – 1 B	
Learners will be able to:	
BMM401.1	Identify problems based on societal /research needs.
BMM401.2	Apply Knowledge and skill to solve societal problems in a group.
BMM401.3	Develop interpersonal skills to work as member of a group or leader.
BMM401.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
BMM401.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
BMM401.6	Use standard norms of engineering practices
BMM401.7	Excel in written and oral communication.
BMM401.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
BMM401.9	Demonstrate project management principles during project work

T.E. Sem V : Course Outcomes

BMC501 - Biomedical Instrumentation - I	
Learners will be able to:	
BMC501.1	Explain the principles of various analytical instruments used in hospital and laboratories.
BMC501.2	Demonstrate knowledge about various blood cell counting systems and blood gas analyzers.
BMC501.3	Demonstrate knowledge about various automated drug delivery systems.
BMC501.4	Explain the basics of pulmonary function analyzer, ventilators, and demonstrate the use of ventilation therapy and anesthesia machine.
BMC501.5	Explain the basic principle and working of hemodialysis machine.

BMC502 - Digital Signal Processing	
Learners will be able to:	

BMC502.1	Understand the fundamental techniques and applications in digital processing of bio-signals.
BMC502.2	Understand circular and linear convolution and their implementation using Ztransform and DFT.
BMC502.3	Understand and implement efficient computational techniques like FFT.
BMC502.4	Design FIR and IIR filters by different methods.

BMC503 - Microcontrollers and Embedded Systems
Learners will be able to:

BMC503.1	Explain the fundamentals of embedded systems
BMC503.2	Apply the knowledge of 8051 Microcontroller architecture
BMC503.3	Apply the knowledge of 8051programming in assembly and C language
BMC503.4	Design and analyse 8051 interfacing with external memory, input/output devices and PC
BMC503.5	Apply the concept of serial communication protocols
BMC503.6	Explain the concept of Real Time Operating Systems (RTOS)

BMC504 - Medical Imaging – II
Learners will be able to:

BMC504.1	Understand use of Ultrasound in medicine, distinguish various ultrasonic display system, understand the construction and operation of the ultrasonic transducer.
BMC504.2	Understand the Doppler effect and clinical applications of Doppler Techniques.
BMC504.3	Describe working principle and physics involved in Magnetic Resonance Imaging (MRI)
BMC504.4	Understand the hardware of MRI Machine, Spin echo Imaging, Pulse sequence, image reconstruction, resolution and SNR, Biological effects, and clinical applications.
BMC504.5	To understand the basic principle of Magnetic Resonance Spectroscopy.
BMC504.6	To understand principle and working of Endoscopy and Thermography systems and its clinical applications.

BMDO5011 - Principles of Communication Engineering
Learners will be able to:

BMDO5011.1	Demonstrate concept of electronic communication system with effect of noise and modelling of noise
BMDO5011.2	Have in depth knowledge of amplitude modulation and understand the AM transmitters and Receiver system with characteristics.
BMDO5011.3	Exhibit basic operation of FM transmitter and receiver with types, analysis, advantages and disadvantages

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BMDO5011.4	Understand and compare the different types of Analog pulse modulation techniques
BMDO5011.5	Understand the different types of Digital pulse modulation techniques with merits and demerits
BMDO5011.6	Understand and compare different types of digital transmission techniques and multiplexing techniques

BMDO5012 - Very Large Scale Integration	
Learners will be able to:	
BMDO5012.1	To describe hardware description language used to model circuits.
BMDO5012.2	To develop some basic digital circuits using HDL
BMDO5012.3	To analyze the physics of MOS devices.
BMDO5012.4	To compare characteristics of various inverter circuits
BMDO5012.5	To compare the fabrication technology used in IC fabrication and how system clocking is designed.
BMDO5012.6	To design layouts for various digital gates applying the design rules

BMDO5013 - Tissue Engineering	
Learners will be able to:	
BMDO5013.1	To get acquainted with cellular responses
BMDO5013.2	To understand role of extracellular matrix in tissue engineering
BMDO5013.3	To understand cell characteristics.
BMDO5013.4	To understand tissue culture and cryopreservation techniques.
BMDO5013.5	To understand the selection of various biomaterials for tissue engineering
BMDO5013.6	To understand tissue engineering applications

BML501 - Biomedical Instrumentation- I Laboratory	
Learners will be able to:	
BML501.1	Appreciate the importance of wavelength selection for measurement of various ions present in the sample.
BML501.2	Explain principles of various analytical instruments used in hospital laboratories.
BML501.3	Design and implement power supply of regulated voltage and current

BML501.4	Explain the basic principle and working of hemodialysis machine.

BML502 - Digital Signal Processing Laboratory	
Learners will be able to:	
BML502.1	Understand the fundamental techniques and applications in digital processing of bio-signals.
BML502.2	Understand circular and linear convolution and their implementation using Z-transform and DFT.
BML502.3	Understand and implement efficient computational techniques like FFT.
BML502.4	Design FIR and IIR filters by different methods

BML503 - Microcontrollers and Embedded Systems Laboratory	
Learners will be able to:	
BML503.1	Design different programs using C compilers for 8051 controller
BML503.2	Design and develop 8051embedded C programs for timer based applications
BML503.3	Design and develop 8051embedded C programs for control of DC motors and stepper motors
BML503.4	Design and develop 8051embedded C programs for interfacing keyboard and display device
BML503.5	Design and develop 8051embedded C programs for interfacing with the PC

BML504 - Professional Communication and Ethics – II	
Learners will be able to:	
BML504.1	plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
BML504.2	strategize their personal and professional skills to build a professional image and meet the demands of the industry.
BML504.3	emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
BML504.4	deliver persuasive and professional presentations.
BML504.5	develop creative thinking and interpersonal skills required for effective professional communication.
BML504.6	apply codes of ethical conduct, personal integrity and norms of organizational behaviour.

BMM501 - Mini Project – 2 A	
Learners will be able to:	
BMM501.1	Identify problems based on societal /research needs.
BMM501.2	Apply Knowledge and skill to solve societal problems in a group.

BMM501.3	Develop interpersonal skills to work as member of a group or leader.
BMM501.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
BMM501.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
BMM501.6	Use standard norms of engineering practices
BMM501.7	Excel in written and oral communication.
BMM501.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
BMM501.9	Demonstrate project management principles during project work.

T.E. Sem VI : Course Outcomes

BMC601 - Biomedical Monitoring Equipment	
Learners will be able to:	
BMC601.1	Provide a better understanding about various bioelectrical signal recorders and patient safety
BMC601.2	Demonstrate the principles of electronics used in designing various biomedical monitoring equipment.
BMC601.3	Understand the basic princples and working of audiometry equipments and hearing aids
BMC601.4	Provide a better understanding about foetal and neonatal monitoring systems.
BMC601.5	Acquire the ability to explain the various blood flow and cardiac output meauremnet devices.
BMC601.6	Acquire in-depth knowledge about different streams in Biomedical Engineering with greater emphasis on health care Equipment and the advanced technologies such as Telemetry and Telemedicine.

BMC602 - Microprocessors and Microcontrollers	
Learners will be able to:	
BMC602.1	Understand the basic of Microprocessor and Microcontroller based systems and their architecture.
BMC602.2	Understand 8086 microprocessor along with its architecture and memory organization.
BMC602.3	Understand peripheral controller ICs used in interfacing.
BMC602.4	Understand 8051 Microcontroller architecture, memory organization, Interrupt structure, Port structure, Timers/Counters
BMC602.5	Understand assembly language and C compilers used to program 8051
BMC602.6	Design simple interfaces for keyboard LCD, ADC/DAC and Stepper motors
BMC603 - Digital Image Processing	
Learners will be able to:	

BMC603.1	Acquire the fundamental concepts of a digital image processing system such as image acquisition, enhancement, segmentation, transforms, compression, morphology, representation and description.
BMC603.2	Analyze images in the spatial domain.
BMC603.3	Analyze images in the frequency domain through the Fourier transform.
BMC603.4	Design and implement with MATLAB/C/Labview algorithms for digital image processing operations such as point processing, histogram processing, spatial and frequency domain filtering, denoising, transforms, compression, and morphological processing

	BMC604 - Medical Imaging-I
Learners will be able to:	
BMC604.1	Understand X ray imaging along with X ray tube construction, X ray generators and the total radiographic system.
BMC604.2	Understand Fluoroscopic Imaging and Digital Subtraction Angiography.
BMC604.3	Distinguish between CR and DR. Understand Mammography.
BMC604.4	Understand the technique of Computed tomography, the CT scanner configuration, reconstruction techniques and clinical applications.
BMC604.5	Apply the knowledge of CT and learn advancements in CT.
BMC604.6	Understand the applications of X-rays in the field of Radiotherapy.

	BMDLO6021 - HealthcareSoftware
Learners will be able to:	
BMDLO6021.1	Understanding of Microsoft .NET Framework and ASP.NET page structure
BMDLO6021.2	Designing of windows applications using C#.NET
BMDLO6021.3	Designing of web applications using ASP.NET controls
BMDLO6021.4	Creating database driven ASP.NET web applications using SQL Server
BMDLO6021.5	Debugging and deploying ASP.NET web applications.

	BMDLO6022 - Lasers and Fibre Optics
Learners will be able to:	
BMDLO6022.1	Understand the fundamentals and clinical applications of Laser and Fiber Optics.
BMDLO6022.2	Correlate the knowledge of medicine and engineering for the wellness of human being.
BMDLO6022.3	Understand the safety aspects while dealing with Laser and Fiber Optic Units.

	BMDLO6023 - Biological Modelling and Simulation
Learners will be able to:	
BMDLO6023.1	Explain the concepts, usage and process of physiological modelling

BMDLO6023.2	Apply basic biophysical laws for calculation of membrane potential under different equilibrium conditions and develop simulation programs for understanding neuronal functions
BMDLO6023.3	Understand the function of complex closed loop systems like temperature control using modelling.
BMDLO6023.4	Understand the function of neuromuscular system with the help of various models.
BMDLO6023.5	Understand the function of open loop system like eye movement system and differentiate open loop and closed loop system
BMDLO6023.6	Understand the usage of, and the assumptions behind biological models (immune response, drug delivery and insulin glucose feedback) in the working life.

BML601 - Biomedical Monitoring Equipment	
Learners will be able to:	
BML601.1	Design and Implement filters for filtering of noise from signals.
BML601.2	Design and Implement Instrumentation amplifier to amplify low amplitude signals.
BML601.3	Design and Implment a regulated power supply.
BML601.4	Design and Implement Pulse Width Modulator.
BML601.5	Undesrtand the working of ECG machine by recording ECG.
BML601.6	Provide a better understanding about foetal monitoring systems.
BML601.7	Test the hearing ability by use of an audiometry.

BML602 - Microprocessors and Microcontrollers	
Learners will be able to:	
BML602.1	Execute the program using microprocessor and microcontroller kits.
BML602.2	Execute assembly and C language programs using simulator.
BML602.3	Apply the knowledge of programming to implement a mini project

BML603 - Digital Image Processing	
Learners will be able to:	
BML603.1	Acquire the fundamental concepts of a digital image processing system such as image acquisition, enhancement, segmentation, transforms, compression, morphology, representation and description.
BML603.2	Analyze images in the spatial domain.
BML603.3	Analyze images in the frequency domain through the Fourier transform.
BML603.4	Design and implement with MATLAB/C/Labview algorithms for digital image processing operations such as point processing, histogram processing, spatial and frequency domain filtering, denoising, transforms, compression, and morphological processing.

BML604 - Medical Imaging-I	
Learners will be able to:	
BML604.1	Understand X ray imaging along with X ray tube construction, X ray generators and the total radiographic system.

BML604.2	Understand Fluoroscopic Imaging and Digital Subtraction Angiography
BML604.3	Distinguish between CR and DR. Understand Mammography.
BML604.4	Understand the technique of Computed tomography, the CT scanner configuration, reconstruction techniques and clinical applications.
BML604.5	Apply the knowledge of CT and learn advancements in CT.

BMDLL6021 - Healthcare Software	
Learners will be able to:	
BMDLL6021.1	Understanding of Microsoft .NET Framework and ASP.NET page structure
BMDLL6021.2	Designing of windows applications using C#.NET
BMDLL6021.3	Designing of web applications using ASP.NET controls
BMDLL6021.4	Creating database driven ASP.NET web applications using SQL Server
BMDLL6021.5	Debugging and deploying ASP.NET web applications

BMDLL6022 - Lasers and Fibre Optics	
Learners will be able to:	
BMDLL6022.1	Understand the fundamentals and clinical applications of Laser and Fiber Optics.
BMDLL6022.2	Correlate the knowledge of medicine and engineering for the wellness of human being.
BMDLL6022.3	Understand the safety aspects while dealing with Laser and Fiber Optic Units.

BMDLL6023 - Biological Modelling and Simulation	
Learners will be able to:	
BMDLL6023.1	Apply concept of physiological modelling to model thermometer system.
BMDLL6023.2	Virtually understand biophysical laws for calculation of membrane potential under different equilibrium conditions and develop simulation programs for understanding neuronal functions.
BMDLL6023.3	Simulate mathematical model for the eye movement
BMDLL6023.4	Electrically simulate model of thermoregulatory system
BMDLL6023.5	Understand the usage of, and the assumptions behind biological models

B.E. Sem VII : Course Outcomes

BMC701 - Life Saving and Surgical Equipment	
Learners will be able to:	
BMC701.1	Distinguish between the types of pacemakers on the basis of ICHD code and analyze the various circuits.
BMC701.2	Apply the knowledge of electronics to analyze defibrillator circuits.
BMC701.3	Explain the importance of use of Anesthesia machine and Capnograph during Surgery.
BMC701.4	Explain the basic principle, working and applications of surgical equipment with safety aspects.
BMC701.5	Explain the importance of measurement of oxygen saturation in human body and application of heart lung machine during surgery.

BMC701.6	Demonstrate the knowledge of lithotripsy technique

BMC702 - Basics of VLSI	
Learners will be able to:	
BMC702.1	Understand hardware description language used to model circuits
BMC702.2	Implement some basic digital circuits using HDL
BMC702.3	Understand the physics of MOS devices
BMC702.4	Understand the implementation of inverter circuits using CMOS devices and noise in these circuits
BMC702.5	Understand the fabrication technology used in IC fabrication and how system clocking is designed.
BMC702.6	Understand the design rules and layouts for various digital gates

BMC703 - Medical Imaging-II	
Learners will be able to:	
BMC703.1	Understand use of Ultrasound in medicine, distinguish various ultrasonic display system, understand the construction and operation of the ultrasonic transducer, understand the clinical applications of Doppler Techniques
BMC703.2	Apply the basic concepts of physics in understanding Physics of MRI
BMC703.3	Understand the hardware of MRI Machine, Spin echo Imaging, Pulse sequence, image reconstruction, resolution and SNR, Biological effects and clinical applications
BMC703.4	To understand the basic principle of Magnetic Resonance Spectroscopy
BMC703.5	To understand nuclear imaging techniques and positron emission tomography and apply the concepts to understand hybrid imaging
BMC703.6	To understand Endoscopy

BMDLO7031 - Networking and Information in Medical Systems	
Learners will be able to:	
BMDLO7031.1	Understand the fundamental components of computer networks and networking protocols.
BMDLO7031.2	Understand IP addressing, functioning and configuration of various networking devices and components
BMDLO7031.3	Understand concepts about network security
BMDLO7031.4	Understand the PACS components, architecture and PACS tele radiology
BMDLO7031.5	Understand HIS, RIS integration of HIS/RIS/PACS, PACS archive and servers
BMDLO7031.6	Understand IHE and IHE domains

BMDLO7032 - Advanced Image Processing	
Learners will be able to:	
BMDLO7032.1	Acquire the advanced concepts of a digital image processing system such as Colour imaging, Feature extraction, Restoration, Texture and Application

BMDLO7032.2	Extract feature and classify images.
BMDLO7032.3	Design Image restoration and segmentation using various complex algorithms.
BMDLO7032.4	Strategize and implement with MATLAB/C/SCILAB algorithms for advanced digital image processing operations.

BMDLO7033 - Embedded Systems	
Learners will be able to:	
BMDLO7033.1	To become aware of the embedded hardware and software components in an embedded system, classification, skills required for an embedded system designer and applications of modern embedded systems.
BMDLO7033.2	To analyse the design and development process of embedded systems.
BMDLO7033.3	To understand the I/O devices, communication buses and distributed networked embedded architecture.
BMDLO7033.4	To understand the concepts of device drivers and interrupt service mechanisms
BMDLO7033.5	To understand RTOS.
BMDLO7033.6	To understand the basic design and programming using RTOS.

ILO1011 - Product Life Cycle Management	
Learners will be able to:	
ILO1011.1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
ILO1011.2	Illustrate various approaches and techniques for designing and developing products.
ILO1011.3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
ILO1011.4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plan

ILO1012 - Reliability Engineering	
Learners will be able to:	
ILO1012.1	Understand and apply the concept of Probability to engineering problems
ILO1012.2	Apply various reliability concepts to calculate different reliability parameters
ILO1012.3	Estimate the system reliability of simple and complex systems
ILO1012.4	Carry out a Failure Mode Effect and Criticality Analysis

ILO1013 - Management Information System	
Learners will be able to:	
ILO1013.1	Explain how information systems Transform Business
ILO1013.2	Identify the impact information systems have on an organization
ILO1013.3	Describe IT infrastructure and its components and its current trends

ILO1013.4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
ILO1013.5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

ILO1014 - Design of Experiments	
Learners will be able to:	
ILO1014.1	Plan data collection, to turn data into information and to make decisions that lead to appropriate action.
ILO1014.2	Apply the methods taught to real life situations.
ILO1014.3	Plan, analyze, and interpret the results of experiments

ILO1015 - OperationsResearch	
Learners will be able to:	
ILO1015.1	Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.
ILO1015.2	Understand the relationship between a linear program and its dual, including strong duality and complementary slackness.
ILO1015.3	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
ILO1015.4	Solve specialized linear programming problems like the transportation and assignment problems.
ILO1015.5	Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
ILO1015.6	Understand the applications of, basic methods for, and challenges in integer programming
ILO1015.7	Model a dynamic system as a queuing model and compute important performance measures

ILO1016 - Cyber Security and Laws	
Learners will be able to:	
ILO1016.1	Understand the concept of cyber crime and its effect on outside world
ILO1016.2	Interpret and apply IT law in various legal issues
ILO1016.3	Distinguish different aspects of cyber law
ILO1016.4	Apply Information Security Standards compliance during software design and development

ILO1017 - Disaster Management and Mitigation Measures	
Learners will be able to:	
ILO1017.1	Understand natural as well as manmade disaster and their extent and possible effects on the economy.
ILO1017.2	Planning of national importance structures based upon the previous history.
ILO1017.3	Understand government policies, acts and various organizational structure associated with an emergency.
ILO1017.4	Know the simple do's and don'ts in such extreme events and act accordingly

ILO1018 - Energy Audit and Management

Learners will be able to:	
ILO1018.1	To identify and describe present state of energy security and its importance.
ILO1018.2	To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
ILO1018.3	To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
ILO1018.4	To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
ILO1018.5	To analyze the data collected during performance evaluation and recommend energy saving measures

ILO1019 - Development Engineering	
Learners will be able to:	
ILO1019.1	To identify and describe present state of energy security and its importance.
ILO1019.2	To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
ILO1019.3	To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
ILO1019.4	To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
ILO1019.5	To analyze the data collected during performance evaluation and recommend energy saving measures

BML701 - Life Saving and Surgical Equipment	
Learners will be able to:	
BML701.1	Design and implement basic Pacemaker circuits.
BML701.2	Design and implement basic oscillator circuits for Surgical Diathermy.
BML701.3	Demonstration the knowledge of application techniques of physiotherapy machines.
BML701.4	Demonstrate the knowledge of application technique of oximeter

BML702 - Basics of VLSI	
Learners will be able to:	
BML702.1	Understand hardware description language used to model circuits
BML702.2	Implement some basic digital circuits using HDL
BML702.3	Understand the physics of MOS devices
BML702.4	Understand the implementation of inverter circuits using CMOS devices and noise in these circuits
BML702.5	Understand the design rules and layouts for various digital gates

BML703 - Medical Imaging-II	
Learners will be able to:	
BML703.1	Understand the construction and working of ultrasound transducer
BML703.2	Understand the instrumentation and applications of Endoscopy
BML703.3	Apply the knowledge of Image processing in reconstructing the medical images

BML703.4	Understand the basic principles of MRI Physics and Nuclear imaging
BML703.5	Understand the concept of Hybrid Imaging.

BMDLL7031 - Networking and Information in Medical Systems	
Learners will be able to:	
BMDLL7031.1	Configure various networking devices and components
BMDLL7031.2	Design Basic Network using IP addressing and devices
BMDLL7031.3	Design data flow in Hospital Using IHE Domain.

BMDLL7032 - Advanced Image Processing	
Learners will be able to:	
BMDLL7032.1	Acquire the advanced concepts of a digital image processing system such as Colour imaging, Feature extraction, Restoration, Texture and Application
BMDLL7032.2	Extract feature and classify images.
BMDLL7032.3	Strategize and implement with MATLAB/C/SCILAB algorithms for advanced digital image processing operations.

BMDLL7033 - Embedded Systems	
Learners will be able to:	
BMDLL7033.1	To become aware of embedded hardware and software components in an embedded system.
BMDLL7033.2	To analyze the design and development process of embedded systems.
BMDLL7033.3	To understand the design, implementation and programming of a real world embedded system (case study).

BML704 - Project Stage - I	
Learners will be able to:	
BML704.1	Review literature to define problem statement
BML704.2	Apply knowledge of the engineering fundamentals acquired during the curriculum and beyond
BML704.3	Develop and create design using appropriate design methodologies considering the various health, society and environmental needs.
BML704.4	Write problem statement, Design concept in prescribed format.
BML704.5	Learn the behavioral science by working in a group.

B.E. Sem VIII : Course Outcomes

BMC801 - Biomedical Microsystems	
Learners will be able to:	
BMC801.1	Understand basic property and select appropriate material for MEMS application
BMC801.2	Develop or modify the MEMS processes for a simple MEMS device in order to reduce the fabrication time.
BMC801.3	Understand different microfabrication techniques and choose appropriate technique

BMC801.4	Analyze Micro total analysis system with designing of its components
BMC801.5	Demonstrate working principles of Bio Nano-sensors and drug delivery devices with types and fabrication
BMC801.6	Understand packaging techniques used in MEMS

BMC802 - Hospital Management	
Learners will be able to:	
BMC802.1	Understand and apply resource management concepts (personnel, finance, and material resources) and the processes and strategies needed in specific hospital sectors.
BMC802.2	Understand the management structure and functions in hospital. Communicate effectively and develop their leadership and team building abilities.
BMC802.3	Understand the principles of designing, implementing and commissioning of clinical services and supportive departments in the hospital.
BMC802.4	Understand the roles and responsibilities of Biomedical Engineer in hospital.
BMC802.5	Understand the functions of other Engineering services and axillary services
BMC802.6	Understand and apply materials management concept in industry

BMDLO8041 - Healthcare Informatics	
Learners will be able to:	
BMDLO8041.1	Understand Healthcare interoperability standards
BMDLO8041.2	Fabricate HL7 Messages
BMDLO8041.3	Understand and Design UML Diagrams
BMDLO8041.4	Understand semantic interoperability through DICOM
BMDLO8041.5	Edit and Compare DICOM file

BMDLO8042 - Robotics in Medicine	
Learners will be able to:	
BMDLO8042.1	Design basic Robotics system and formulate Kinematic, Inverse Kinematic motion planning solutions for various Robotic configurations.
BMDLO8042.2	Design Robotic systems for Medical application

BMDLO8043 - Nuclear Medicine	
Learners will be able to:	
BMDLO8043.1	Understand essential physics of nuclear medicine such as basic concepts of radioactivity, its measurement, interaction with matter and radionuclide production.
BMDLO8043.2	Understand concepts of radiopharmaceuticals and various aspects of radiation safety.
BMDLO8043.3	Apply the principles of physics to understand working of various detectors and counting systems.

BMDLO8043.4	Study principle of operation of different scanning system and their quality control function.
BMDLO8043.5	Understand various Emission Tomography Techniques along with their Clinical Applications.
BMDLO8043.6	Understand concept of radionuclide therapy and the function of radiotherapy equipment.

ILO2021 - Project Management	
Learners will be able to:	
ILO2021.1	Apply selection criteria and select an appropriate project from different options.
ILO2021.2	Write work break down structure for a project and develop a schedule based on it.
ILO2021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
ILO2021.4	Use Earned value technique and determine & predict status of the project.
ILO2021.5	Capture lessons learned during project phases and document them for future reference

ILO2022 - Finance Management	
Learners will be able to:	
ILO2022.1	Understand Indian finance system and corporate finance
ILO2022.2	Take investment, finance as well as dividend decisions

ILO2023 - Entrepreneurship development and Management	
Learners will be able to:	
ILO2023.1	Understand the concept of business plan and ownerships
ILO2023.2	Interpret key regulations and legal aspects of entrepreneurship in India
ILO2023.3	Understand government policies for entrepreneurs

ILO2024 - Human Resource Management	
Learners will be able to:	
ILO2024.1	Gain knowledge and understand the concepts about the different aspects of the human resource management.
ILO2024.2	Understand and tackle the changes and challenges in today's diverse, dynamic organizational setting and culture.
ILO2024.3	Utilize the behavioral skill sets learnt, in working with different people, teams & groups within the national and global environment.
ILO2024.4	Apply the acquired techniques, knowledge and integrate it within the engineering/ non engineering working environment emerging as future engineers and managers.

ILO2025 - Professional Ethics and Corporate Social Responsibility	
Learners will be able to:	
ILO2025.1	Understand rights and duties of business
ILO2025.2	Distinguish different aspects of corporate social responsibility

ILO2025.3	Demonstrate professional ethics
ILO2025.4	Understand legal aspects of corporate social responsibility

ILO2026 - Research Methodology	
Learners will be able to:	
ILO2026.1	Prepare a preliminary research design for projects in their Course matter areas
ILO2026.2	Accurately collect, analyze and report data
ILO2026.3	Present complex data or situations clearly
ILO2026.4	Review and analyze research findings

ILO2027 - IPR and Patenting	
Learners will be able to:	
ILO2027.1	understand Intellectual Property assets
ILO2027.2	assist individuals and organizations in capacity building
ILO2027.3	work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

ILO2028 - Digital Business Management	
Learners will be able to:	
ILO2028.1	Identify drivers of digital business
ILO2028.2	Illustrate various approaches and techniques for E-business and management
ILO2028.3	Prepare E-business plan

ILO2029 - Environmental Management	
Learners will be able to:	
ILO2029.1	Understand the concept of environmental management
ILO2029.2	Understand ecosystem and interdependence, food chain etc.
ILO2029.3	Understand and interpret environment related legislations

BML803 - Project Stage - II	
Learners will be able to:	
BML803.1	Debug/ Rectify the design incurred during implementation
BML803.2	Write Analysis, Results, Design in prescribed format
BML803.3	Learn the behavioral science by working in a group

BML801 - Biomedical Microsystems	
Learners will be able to:	
BML801.1	Select appropriate material, fabrication technique and packaging technique for given application
BML801.2	Simulate given microsystems to evaluate its performance

BML802 - Hospital Microsystems	
Learners will be able to:	

BML802.1	Understand and apply finance management concepts and the processes and strategies needed in specific hospital sectors.
BML802.2	Understand the management structure and functions in hospital. Communicate effectively and develop their leadership and team building abilities.
BML802.3	Design the layout of clinical services and supportive departments in the hospital.
BML802.4	Understand the roles and responsibilities of Biomedical Engineer in hospital.
BML802.5	Understand the functions of other Engineering services and axillary services
BML802.6	Understand and apply materials management and the purchase procedure in industry

BMDLL8041 - Healthcare Informatics	
Learners will be able to:	
BMDLL8041.1	Fabricate HL7 Messages
BMDLL8041.2	Edit and Compare DICOM file

BMDLL8042 - Robotics in Medicine	
Learners will be able to:	
BMDLL8042.1	Design basic Robotics system and formulate Kinematic, Inverse Kinematic motion planning solutions for various Robotic configurations.
BMDLL8042.2	Design Robotic systems for Medical application.

BMDLL8043 - Nuclear Medicine	
Learners will be able to:	
BMDLL8043.1	Understand essential physics of nuclear medicine such as basic concepts of radioactivity, its measurement, interaction with matter and radionuclide production.
BMDLL8043.2	Understand concepts of radiopharmaceuticals and various aspects of radiation safety.
BMDLL8043.3	Apply the principles of physics to understand working of various detectors and counting systems.
BMDLL8043.4	Study principle of operation of different scanning system and their quality control function.
BMDLL8043.5	Understand various Emission Tomography Techniques along with their Clinical Applications.
BMDLL8043.6	Understand concept of radionuclide therapy and the function of radiotherapy equipment.

Course Outcomes of Biotechnology Subjects

Dr. G. T. Thampi
PRINCIPAL
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S.E. Sem III (2016)

BTC301 Applied Mathematics III

Learners will be able to:

BTC301.1	solve initial value ODE problems.
BTC301.2	have a good understanding of real and complex analysis
BTC301.3	have a thorough grounding in matrix algebra.
BTC301.4	be ready for any further courses on optimization.

BTC302- Microbiology

Learners will be able to:

BTC302.1	carry out various microbiological techniques like staining and isolation very well.
BTC302.2	identify microbes.
BTC302.3	have detailed knowledge of various sterilization techniques, which would be useful for other courses.

BTC303- Cell Biology

Learners will be able to:

BTC303.1	grasp the fundamentals in Understanding the molecular organization of the cells, function and structure of The different organelles including transport mechanisms for processes like; Protein

	sorting, cell communication and flow of information and transport across the unit membrane, cell signaling.
BTC303.2	Students will have good knowledge of cancer, its types and etiology. Students will be able to appreciate all basic concepts which he may encounter in future courses in biotechnology engineering.
BTC303.3	Ready for application of these concepts in the field of research in biotechnology.

BTC304- Biochemistry

Learners will be able to:	
BTC304.1	strong grounding in structures and reactions of biomolecules.
BTC304.2	complete understanding of all the chemical processes associated with living cells at the molecular level.
BTC304.3	metabolic pathways of the major biomolecules.
BTC304.4	correlate biochemical processes with biotechnological applications.

BTC305- Unit Operations-I

Learners will be able to:	
BTC305.1	thorough grounding on measurement of pressure drop, velocity, flow rates etc. of fluids.
BTC305.2	operate certain flow measurement devices and size reduction equipment.

BTC305.3	select pumps and would be able to calculate power requirement for pumping as well as agitation operations.

BTC306-Process Calculations

Learners will be able to:

BTC306.1	understand basic application of various unit operations & unit processes to industrial &theoretical problems
BTC306.2	have a clear understanding of the various systems of units will be able to do the conversion of units of one system to another.
BTC306.3	do basic calculations for biological systems & access the property data from appropriate sources. Module Content

TE Sem IV(2016)

BTC401-Applied Mathematics IV

Learners will be able to:

BTC401.1	develop the proactive approach towards the selection of methods to a solution of Chemical Engineering and Biotechnology problems coming across while studying higher level of the Course. (Example: Flow of Liquid through Pipes/Gases etc.)

BTC402- Molecular Genetics

Learners will be able to:

BTC402.1	get knowledge of molecular biology and genetics of Prokaryotic and eukaryotic organisms.

BTC402.2	get insight on Replication, Transcription and translation processes in prokaryotes and eukaryotes, various mutations, their Repair mechanisms. Genetic syndromes.

BTC403- Fermentation Technology

Learners will be able to:

BTC403.1	Understand the working of a fermentation system.
BTC403.2	Integrate biological and engineering principles involved in the production and recovery of commercial products.
BTC403.3	Develop critical thinking skills and learn to employ a quantitative, scientific approach towards conversion of biological materials to value added products.

BTC404- Analytical Methods In Biotechnology

Learners will be able to:

BTC404.1	handle different instruments in the laboratory.
BTC404.2	compare different separation techniques and use them effectively in research work

BTC405- Immunology and Immunotechnology

Learners will be able to:

BTC405.1	define innate and adaptive immunity
BTC405.2	have knowledge of immune system in detail

BTC405.3	describe the interaction of antigens and antibodies in antibody mediated and cell-mediated immune responses.
BTC405.4	make familiar with the techniques involved in antigen and antibody reactions
BTC405.5	understand the concepts and principle of immunoassay techniques in routine diagnosis, research.
BTC405.6	learn principle and types of vaccines.

BTC406-Unit Operations-II

Learners will be able to:

BTC406.1	understand basic application of various unit operations &unit processes to industrial &theoretical problems
BTC406.2	have a clear understanding of the theories of Heat and Mass transfer which are used for modeling.
BTC406.3	design the fermenter and Bioreactors using the models developed.

THADOMAL SHAHANI ENGINEERING COLLEGE

T.E. Sem V (2016)

BTC501- Bioinformatics

Learners will be able to:

BTC501.1	Cast a molecular biology problem as a bioinformatics problem.
BTC501.2	Select relevant tools, optimize their settings and build pipelines to solve the set problem.
BTC501.3	Easily extract the required data from a given set of data & similarly be able to store it.
BTC501.4	Use conventional softwares and web-based applications.
BTC501.5	Analyze processed data witht he support of analytical and visualization tools.

BTC502- Genetic Engineering

Learners will be able to:

BTC502.1	Understand how recombinant molecules are created and analysed with respect to DNA, RNA, and Protein.
BTC502.2	They will also be familiar with the problems they could encounter and how to trouble shoot them.
BTC502.3	Monitor both in-vitro and in-vivo activity.
BTC502.4	Suggest more rational approach to solve problem of a living system at a molecular level.

BTC503- Thermodynamics and Biochemical Engineering

Learners will be able to:

BTC503.1	Check the feasibility of a reaction.

BTC504- Bioreactor Analysis and Technology

Learners will be able to:

BTC504.1	Understand the different types of ideal and non-ideal reactors.
BTC504.2	Design the reactors required for a particular process.

BTC505- Bussiness Communication and Ethics

Learners will be able to:

BTC505.1	Communicate effectively in both oral and written form and equip to demonstrate knowledge of professional and ethical responsibilities.
BTC505.2	Participate and succeed in campus placements and competitive examinations like GATE, TOFEL.
BTC505.3	Possess entrepreneurial approach and ability for life-long learning.
BTC505.4	Have education necessary for understanding the impact of engineering solutions on Society, and demonstrate awareness of contemporary issues.
BTC505.5	Design a technical document using precise language, suitable vocabulary and apt style.
BTC505.6	Develop the life skills/interpersonal skills to progress professionally by building stronger relationships.
BTC505.7	Demonstrate awareness of contemporary issues, knowledge of professional and ethical responsibilities.

BTC505.8	Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP.
BTC505.9	Deliver formal presentations effectively implementing the verbal and non-verbal skills.

BTE5014- Department Elective I- Pharmaceutical Technology	
Learners will be able to:	
BTE5014.1	Tell factors affecting the bioavailability and stability of dosage form. They also know the parameters for the disposition, absorption and Michaelis-Menten constants for non-linear kinetics.
BTE5014.2	Know the fabrication, design, evaluation and application of drug delivery systems.

TE Sem VI (2016)	
BTC601- Food Technology	
Learners will be able to:	
BTC601.1	Know the principles of preservation
BTC601.2	Understand the principles of food processing echniques and will be able to apply these principles to specific food commodities.

BTC602- Cell and Tissue Culture	
Learners will be able to:	
BTC602.1	Plan experiments using cultured cells.
BTC602.2	Carry out cell culture, and associated laboratory techniques.
BTC602.3	Carry out the most common analysis techniques associated with cell culture.
BTC602.4	Perform adequate statistical processing of data generated by cell culture.
BTC602.5	Present and analyse literature which covers cell culture

BTC603- Enzyme Engineering	
Learners will be able to:	
BTC603.1	Understand how Enzymes are created as functional bio-catalysts, analysed with respect to their efficiencies, their lability, and ways to make them durable.
BTC603.2	They also will be familiar with the problems they could encounter and how to trouble shoot them.
BTC603.3	Monitor both in-vitro and in-vivo activity.

BTC604- IPR, Bioethics and Biosafety	
Learners will be able to:	
BTC604.1	Be aware of rules and regulations setup at international level for various biotechnology related work so that any further research can be formulated accordingly.
BTC604.2	Know the social and legal state of the society with respect to genetically engineered products or other outcomes of biotechnology.
BTC604.3	Work according to the safety precautions set up by international bodies while handling bio hazardous material.

BTC605- Process Control and Instrumentation	
Learners will be able to:	
BTC605.1	Design the process control of a parameter.
BTC605.2	Carry out the stability analysis for a process.

BTE6023- Elective II- Cancer Biology	
Learners will be able to:	
BTE6023.1	Describe the process of tumorigenesis at the molecular and cellular level.
BTE6023.2	Describe cell cycle regulatory mechanisms in normal and tumor cells.
BTE6023.3	Describe the role of oncogenes and tumor suppressor genes and their genetic alterations in cancer formation.
BTE6023.4	Describe the importance of apoptosis in normal and tumor cells.
BTE6023.5	Describe tumorigenesis, angiogenesis, and metastasis.

B.E. Sem VII (2016)	
BTC701 - Bioseparation and Downstream Processing Technology-I	
Learners will be able to:	
BTC701.1	Describe theory, principle, design, application and possible integrations of unit operations in bioprocessing.
BTC702 - Bioprocess Modelling and Simulation	
Learners will be able to:	
BTC702.1	Formulate model for biochemical System.
BTC702.2	Solve Biochemical models
BTC703 - Agriculture Biotechnology	
Learners will be able to:	
BTC703.1	Apply the transgenic methods to develop better quality crops
BTC703.2	Understand the advantages and drawbacks of engineered plants and modify them accordingly
BTC703.3	Harness the plants for improved quality biomaterials
BTE7033 - Department Elective-III: Project Management	
Learners will be able to:	
BTE7033.1	Describe the fundamental concepts in Project management
BTE7033.2	Analyse the various scheduling and planning techniques
BTE7033.3	Understand and apply suitable strategy for any specific project
BTE7033.4	Apply project management principles in business situations to optimize resource utilization and time.

ILO7017 - Institute Level Optional Subject I- Disaster Management and Mitigation Measures	
Learners will be able to:	
ILO7017.1	Get to know natural as well as manmade disaster and their extent and possible effects on the economy
ILO7017.2	Plan of national importance structures based upon the previous history
ILO7017.3	Get acquainted with government policies, acts and various organizational structures associated with an emergency
ILO7017.4	Get to know the simple do's and don'ts in such extreme events and act accordingly

BTC801 - Environmental Biotechnology	
Learners will be able to:	
BTC801.1	Apply their knowledge of environmental science and biological systems to improve the quality of life in individual context
BTC801.2	Recognize key environmental problems and to apply the operating principles and biotic systems for remediation
BTC801.3	Design, improve and apply biotechnological systems and processes to meet practical needs of different environmental problems

BTC802 - Bioseperation and Downstream Processing technology-II	
Learners will be able to:	
BTC802.1	Describe theory, principle, design, application and possible integrations of unit operations in bioprocessing

BTC803 - Bioprocess Plant & Equipment Design	
Learners will be able to:	
BTC803.1	Learn the methods and practices followed in the design of Bioprocess equipments
BTC803.2	Draw the designed equipments to scale
BTC803.3	Learn about bioreactor design for efficient utilization of the principles in bioprocess technology

BTE8041 - Department Elective IV: Non-conventional Sources of Energy	
Learners will be able to:	
BTE8044.1	Apply their knowledge of energy generation and its conservation to improve the quality of life in individual context
BTE8044.2	Recognize key energy problems and to apply the operating principles and biotic systems for remediation
BTE8044.3	Design, improve and apply biotechnological systems and processes to meet practical needs of different problems of energy requirement

ILO8029 - Institute Level Optional Subject II- Environmental Management	
Learners will be able to:	
ILO8029.1	Understand the concept of environmental management
ILO8029.2	Understand ecosystem and interdependence, food chain etc.
ILO8029.3	Understand and interpret environment related legislations

Course Outcomes of Chemical Engineering Subjects

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PRINCIPAL
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S.E. Sem III : Course Outcomes

CHC301 - Engineering Mathematics III

Learners will be able to:

CHC301.1	Apply the concept of Laplace transform to solve the real integrals in engineering problems
CHC301.2	Apply the concept of inverse Laplace transform of various functions in engineering problems
CHC301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems
CHC301.4	Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.
CHC301.5	Apply Matrix algebra to solve the engineering problems.
CHC301.6	Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat and wave equations

CHC302 - Industrial and Engineering Chemistry – I

Learners will be able to:

CHC302.1	Understand the different theories of chemical bonding, organometallic chemistry and reactive intermediate
CHC302.2	Apply knowledge of dyes, fertilizers, analytical techniques of separation, identification and quality of fertilizers.
CHC302.3	Describe the reaction mechanisms, states of molecules, various types of dyes and reaction pathway in biological process.
CHC302.4	Justify stability of coordination compounds, kinetics and energy of reactions and importance of organometallic compounds in biological process.
CHC302.5	Express role of biomolecules, elemental constituents in fertilizers, and exchangers in industries
CHC302.6	Apply concepts of electrochemistry and its applications quantitatively.

CHC303 - Fluid Flow Operations

Learners will be able to:

CHC303.1	Acquire basic concepts and pressure measurement methods.
CHC303.2	Learn kinematics of flow, rheological behavior of fluid and boundary layer conditions
CHC303.3	Learn Bernoulli's equation and apply it in practical applications of various problems in Chemical Engineering.
CHC303.4	Learn flow equations and evaluate the losses in incompressible flow
CHC303.5	Learn the behavior of compressible fluids and Stokes Law and also able to apply these concepts for estimation of stagnation properties
CHC303.6	Gain the knowledge of various pumps, choice of pumps, valves and agitators and would be able to calculate power requirement for pumps as well as for agitators.

CHC304 - Chemical Engineering Thermodynamics I

Learners will be able to:

CHC304.1	Apply the First Law of Thermodynamics to flow and non-flow Chemical Engineering processes
CHC304.2	Compute the thermal efficiencies of various engines and machines using Second Law of Thermodynamics and Entropy concepts.
CHC304.3	Apply the concept of Exergy to engineering applications and utilize the laws of thermodynamics to analyze flow processes.
CHC304.4	Compute the properties of real fluids using different equations of state
CHC304.5	Compute property changes of non-ideal gas systems using departure functions.
CHC304.6	Use thermodynamic charts and diagrams for estimation of various thermodynamic properties.

CHC305 - Process Calculations

Learners will be able to:

CHC305.1	Identify the various systems of units and conversion and apply principles of basic chemical calculations.
CHC305.2	Apply the material balance for various unit operations for both steady and unsteady state operations.
CHC305.3	Compute the material balance of various unit processes.

CHC305.4	Evaluate recycle, bypass and purge operations and its streams
CHC305.5	Perform energy balance calculations over various processes with and without chemical reactions.
CHC305.6	Assess the material balance and energy load of a binary distillation column.

CHL301 - Industrial and Engineering Chemistry Lab-I

Learners will be able to:

CHL301.1	Prepare standard solutions, check their accuracy and present results in statistical format to calculate standard deviation.
CHL301.2	Perform titrations and determine contents of solution quantitatively.
CHL301.3	Apply knowledge of instrumental analysis like Conductometry and Potentiometry
CHL301.4	Learn methods of estimation of organic compounds quantitatively.
CHL301.5	Carry out gravimetric analysis systematically with proper understanding.
CHL301.6	Carry out synthesis of chemicals in laboratory.

CHL302 - Fluid Flow Operations Lab

Learners will be able to:

CHL302.1	Determine viscosity by stokes law.
CHL302.2	Distinguish different flow patterns and calculations involving Reynolds number
CHL302.3	Find coefficient of discharge for various flow measuring devices.
CHL302.4	Evaluate minor losses and frictional losses for various pipe fittings and network.
CHL302.5	Calculate power required and efficiency for various pumps.
CHL302.6	Find power requirement for various impellers in agitated vessel.

CHL303 - Basic Chemical Engineering Lab

Learners will be able to:

CHL303.1	Apply basic principles of chemistry and chemical engineering to solve and analyze complex industrial problems
CHL303.2	Apply mathematical skills to perform calculations on data obtained and use required formulas to do the same
CHL303.3	Evaluate sampling methods, required sampling size and reduce measurement errors for accurate experimental design
CHL303.4	Evaluate experimental data by different data analysis methods on PC using MS Excel for investigating complex problems
CHL303.5	Analyze and interpret the results obtained from experiments
CHL303.6	Design new laboratory experiments to study industrial problems which will benefit society and environment by following strict ethical standards

CHL304 - Skilled based lab: Chemical Technology Lab

Learners will be able to:

CHL304.1	Describe various manufacturing processes used in the chemical process industries
CHL304.2	Explain industrial processing and overall performance of any chemical process including the major engineering problems encountered in the process
CHL304.3	Draw and illustrate the process flow diagram for a given process.
CHL304.4	Outline laboratory procedures for the preparation of industrially important chemicals and products.
CHL304.5	Plan and perform synthesis of important chemicals in the laboratory.
CHL304.6	Demonstrate the ability to present scientific and technical information resulting from laboratory experimentation and draw conclusions from the results of the experiments.

CHM301 Mini Project 1A

Learners will be able to:

CHM301.1	Identify problems based on societal /research needs
CHM301.2	Apply Knowledge and skill to solve societal problems in a group

CHM301.3	Develop interpersonal skills to work as member of a group or leader.
CHM301.4	Draw the proper inferences from available results through theoretical/experimental/simulations.
CHM301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
CHM301.6	Use standard norms of engineering practices
CHM301.7	Excel in written and oral communication.
CHM301.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CHM301.9	Demonstrate project management principles during project work.

S.E. Sem IV : Course Outcomes

CHC401 - Engineering Mathematics IV	
Learners will be able to:	
CHC401.1	Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem
CHC401.2	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
CHC401.3	Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
CHC401.4	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities
CHC401.5	Apply the concept of probability distribution to engineering problems & Testing hypothesis of small samples using sampling theory
CHC401.6	Apply the concepts of parametric and nonparametric tests for analyzing practical problems.

CHC402 - Industrial and Engineering Chemistry – II	
Learners will be able to:	
CHC402.1	Understand the theories of aqueous, non aqueous solutions, surfactants, and colloids.
CHC402.2	Differentiate between aromatic and non-aromatic compounds.
CHC402.3	Apply different spectroscopic methods and thermal methods for the detection of compounds
CHC402.4	Analyze interpretation of spectral data and analytical techniques.
CHC402.5	Understand the reaction mechanism, its applications and synthesis of organic molecules.
CHC402.6	Express catalytic reactions and its applications in industry.

CHC403 - Numerical Method in Chemical Engineering	
Learners will be able to:	
CHC403.1	Solve linear algebraic equations.
CHC403.2	Solve nonlinear algebraic equations.
CHC403.3	Solve using Curve fitting
CHC403.4	solve Ordinary Differential equations
CHC403.5	Solve Partial Differential equations
CHC403.6	Solve Chemical engineering problems with numerical analysis techniques.

CHC404 - Solid Fluid Mechanical Operations
Learners will be able to:

CHC404.1	Apply the concept of particle size distribution and identify the equipment
CHC404.2	Explain size reduction principles
CHC404.3	Compute the fluidization and filtration parameters
CHC404.4	Design solid-fluid separation equipment
CHC404.5	Discuss the techniques for storage and handling of solids
CHC404.6	Explain solid fluid mixing

CHC405 - Chemical Engineering Thermodynamics II

Learners will be able to:

CHC405.1	Evaluate the thermodynamic properties of ideal and non-ideal solutions and mixtures.
CHC405.2	Perform calculations related to solution thermodynamics
CHC405.3	Analyze and solve the problems of phase equilibria and vapour-liquid equilibria
CHC405.4	Apply various methods for estimation of thermodynamic properties.
CHC405.5	Analyze and solve the problems of chemical reaction equilibria.
CHC405.6	Describe various types of refrigeration cycles and evaluate their performance.

CHL401 - Industrial and Engineering Chemistry Lab-II

Learners will be able to:

CHL401.1	Determine dissociation constant of dibasic acid, strength of solution and quantity of solute pH metrically.
CHL401.2	Perform the titration and find the content in terms of quantity.
CHL401.3	Detect alkali metal ions spectrophtometrically.
CHL401.4	Identify, separate and detect ions present in solvent chromatographically
CHL401.5	Identify the compound by interpreting the spectral data received from optical method.
CHL401.6	Synthesize chemical compounds in laboratory.

CHL402 - Numerical Methods in Chemical Engineering Lab

Learners will be able to:

CHL402.1	Solve Linear algebraic equations
CHL402.2	Solve Non-linear algebraic equations
CHL402.3	Apply Curve fitting
CHL402.4	Solve Ordinary Differential equations
CHL402.5	Solve Partial Differential equations
CHL402.6	Solve Chemical engineering problems with appropriate numerical analysis techniques

CHL403 - Solid Fluid Mechanical Operaion Lab

Learners will be able to:

CHL403.1	Understand the operation of various equipment used in chemical and allied process industry
CHL403.2	Acquire analytical skills for determination of particle size of solid mixture.
CHL403.3	Determine the effectiveness of vibrating screen.
CHL403.4	Apply the laws of crushing.
CHL403.5	Design a thickener
CHL403.6	Determine filtration parameters

CHL404 - Skilled based lab: : Design Calculation of Auxiliary Plant Equipment

Learners will be able to:

CHL404.1	Students will perform unit conversion and apply to chemical engineering problems
CHL404.2	Students will understand basic function and design of steam trap.
CHL404.3	Students will understand the pressure vessels and its design.
CHL404.4	Students will understand various characteristics and power requirement of pumps
CHL404.5	Students will understand use of Psychrometric chart for properties of water and steam.
CHL404.6	Students will understand the theoretical concepts from process calculation

CHM401 Mini Project 1B	
Learners will be able to:	
CHM401.1	Identify problems based on societal /research needs.
CHM401.2	Apply Knowledge and skill to solve societal problems in a group.
CHM401.3	Develop interpersonal skills to work as member of a group or leader.
CHM401.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
CHM401.5	Analyse the impact of solutions in societal and environmental context for sustainable development
CHM401.6	Use standard norms of engineering practices
CHM401.7	Excel in written and oral communication.
CHM401.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
CHM401.9	Demonstrate project management principles during project work.

T.E. Sem V : Course Outcomes

CHC501 - Computer Programming and Numericals Methods	
Learners will be able to:	
CHC501.1	The students will be able to solve linear algebraic equations.
CHC501.2	The students will be able to solve non-linear algebraic equations.
CHC501.3	The students will be able to solve differential equations
CHC501.4	The students will be able to solve partial differential equations

CHC502 - Mass Transfer Operation I	
Learners will be able to:	
CHC502.1	Demonstrate the knowledge of mass transfer by applying principles of diffusion, mass transfer coefficients, and interphase mass transfer.
CHC502.2	Understand the concept and operation of various types of gas-liquid contacts equipments.
CHC502.3	Determine NTU, HTU, HETP and height of packed bed used for Absorption and Humidification operations.
CHC502.4	Find time required for drying and design of drying equipments.

CHC503 - Heat Transfer Operations	
Learners will be able to:	
CHC503.1	Analyze Steady and Unsteady State Conduction systems.
CHC503.2	Analyze Convective Heat transfer Systems
CHC503.3	Analyze Radiative Heat Transfer Systems
CHC503.4	Analyze Extended Surfaces, Evaporators and Agitated Vessels.
CHC503.5	Basic design of DPHE and STHE.

CHC504 - Chemical Reaction Engineering - I	
Learners will be able to:	
CHC504.1	Students will be able to identify and analyze different types of homogeneous reactions.
CHC504.2	Students will be able to apply the knowledge they have gained to develop kinetic models for different types of Homogeneous reactions

| CHC504.3 | Students will be able to find the model equation and use this model to design the reactors used for Homogeneous reactions. |
| CHC504.4 | Students will be able to understand the effect of temperature on reactor performance for adiabatic and non adiabatic operation and develop kinetic model to design the reactors for adiabatic and non-isothermal operations |

CHC505 - Business Communication and Ethics	
Learners will be able to:	
CHC505.1	Communicate effectively in both oral and written form and equip to demonstrate knowledge of professional and ethical responsibilities.
CHC505.2	participate and succeed in campus placements and competitive examinations like GATE, TOFEL
CHC505.3	Possess entrepreneurial approach and ability for life-long learning
CHC505.4	Have education necessary for understanding the impact of Engineering solutions on Society, and demonstrate awareness of contemporary issues Detailed Syllabus.
CHC505.5	Design a technical document using precise language, suitable vocabulary and apt style
CHC505.6	Develop the life skills/ interpersonal skills to progress professionally by building stronger relationships.
CHC505.7	Demonstrate awareness of contemporary issues knowledge of professional and ethical responsibilities.
CHC505.8	Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP
CHC505.9	Deliver formal presentations effectively implementing the verbal and non-verbal skills
CHDE5013: Department Elective I- Advanced Material Science	
Learners will be able to:	
CHDE5013.1	Identify various types of advanced materials such as polymers, ceramics and composites
CHDE5013.2	Understand the properties of various advanced polymeric, ceramic and metallic materials and their applications in various fields
CHDE5013.3	Have knowledge of different types of composite materials and their properties and applications.
CHDE5013.4	Understand the fabrication of various composite materials.
CHDE5013.5	Have knowledge of types of nanotubes and nanosensors and their applications.
CHDE5013.6	Understand the different thin film coating methods and their applications in various fields

T.E. Sem VI : Course Outcomes

CHC601 - Environmental Engineering	
Learners will be able to:	
CHC601.1	To understand Importance of environmental pollution, such as air, water, solid, noise. Various pollutants sources, adverse effects, Environmental Legislation
CHC601.2	To understand meteorological aspects air pollutant dispersion. Sampling and measurement, Control Methods and Equipment:
CHC601.3	To understand Sampling, measurement of various water pollutants.
CHC601.4	To understand and design various Waste Water Treatments

CHC602 - Mass Transfer Operation II	
Learners will be able to:	

CHC602.1	understand equilibrium in all separation process
CHC602.2	design the mass transfer equipments for extraction, leaching and crystallization processes
CHC602.3	design distillation column
CHC602.4	choose the separation operation which will be economical for the process
CHC602.5	optimize the process parameters
CHC602.6	understand membrane separation processes principle and working

CHC603-Transport Phenomena	
Learners will be able to:	
CHC603.1	Understanding of transport processes.
CHC603.2	Student will learn to establish and simplify appropriate conservation statements for momentum, energy and mass transfer processes.
CHC603.3	Ability to do momentum, energy and mass transfer analysis.
CHC603.4	To apply conservation principles, along with appropriate boundary conditions for any chemical engineering problem.

CHC604 - Chemical Reaction Engineering - II	
Learners will be able to:	
CHC604.1	Students will be able to understand the concept of Residence Time Distribution (RTD) in various reactors and obtain the actual design parameters to design Real Reactor.
CHC604.2	Students will be able to find the model equation and use this model to design the reactors used for heterogeneous non catalytic reactions
CHC604.3	Students will be able to apply the knowledge they have gained to develop kinetic model and Design strategy for heterogeneous catalytic reactions.
CHC604.4	Students will be able to apply the knowledge they have gained to develop kinetic model and use this model to design the reactors used for Fluid-Fluid reactions.

CHC605- Plant Engineering and Industrial Safety	
Learners will be able to:	
CHC605.1	Students should be able to identify the causative and initiating factors of accidents. They should be able to make quantitative assessment of vapour release and noise impact.
CHC605.2	Students should be able to understand and evaluate situations causing industrial fire and evaluate risk. .
CHC605.3	Students should learn and understand type of boilers and be able to calculate its efficiency
CHC605.4	Students should be able to calculate work requirements for compressors and draw schematic of instrument air, plant air and venting system.

CHDE6022: Department Elective II- Operation Research	
Learners will be able to:	
CHDE6022.1	The student will be able to solve typical OR models using linear integer anddynamic programming techniques.
CHDE6022.2	The student will be able to model and solve network flow problems in OR.
CHDE6022.3	The student will be able to make decisions under various scenarios.
CHDE6022.4	The student will be able to design Queuing Systems.

B.E. Sem VII : Course Outcomes

CHC701 - Process Equipment Design	
Learners will be able to:	
CHC701.1	Design heat exchanger and evaporator
CHC701.2	Design distillation and absorption columns
CHC701.3	Design high pressure vessels.
CHC701.4	Explain different flow sheet presentation and equipment inspection methods.

CHC702 - Process Engineering	
Learners will be able to:	
CHC702.1	The graduates are expected to have ability to apply knowledge of mathematics, science and engineering.
CHC702.2	The graduates are expected to possess ability to function on multi disciplinary teams.
CHC702.3	The graduates are expected to possess ability to identify, formulate and solve engineering problems.
CHC702.4	The graduates are expected to have an understanding of professional and ethical responsibility.
CHC702.5	The graduates are expected to engage themselves in lifelong learning.
CHC702.6	The graduates are expected to posses' ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CHC703-Process Dynamics and control	
Learners will be able to:	
CHC703.1	The student will be able to model dynamical systems
CHC703.2	Will be able to study their responses in Time, Laplace and Frequency domains.
CHC703.3	The student will be able to design stable controllers, for important chemical processes.

CHDE7034:Department elective III-Food Technology	
Learners will be able to:	
CHDE7034.1	Knowledge of food essential nutrients and the various causes of food deterioration.
CHDE7034.2	Identification of appropriate processing, preservation, and packaging method.
CHDE7034.3	Students should be able to analyze product quality and effect of processing technique on it.
CHDE7034.4	They should Identify important species of pathogenic microbes and describe factors that affect their growth in various types of food.

ILO7011-Institute level optional subject I-Product Life cycle Management	
Learners will be able to:	
ILO7011.1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
ILO7011.2	Illustrate various approaches and techniques for designing and developing products.
ILO7011.3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
ILO7011.4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

B.E. Sem VIII : Course Outcomes

CHC801 - Modeling, Simulation & Optimization (MSO)

Learners will be able to:

CHC801.1	The students will be able to write and solve models of chemical engineering system.
CHC801.2	The students will be able to carry out sequential and equation oriented simulation of complete flowsheets.
CHC801.3	The student will be able to optimize typical chemical processes.

CHC802 - Project Engineering & Entrepreneurship Management

Learners will be able to:

CHC802.1	Concepts and knowledge of project management to manage projects in process industries
CHC802.2	Students should be able to prepare feasibility reports
CHC802.3	Students should be able to understand various clearances required to start industry
CHC802.4	Students should be able to prepare project organization charts and contracts
CHC802.5	Students should be able to prepare contracts
CHC802.6	Students should be able to use tools of PM to solve problems and will be motivated to become entrepreneurs

CHC803 - Energy System Design

Learners will be able to:

CHC803.1	The graduates should able to design an energy system to meet the desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability and sustainability.
CHC803.2	The graduates should able to function on multidisciplinary teams, identify, formulate and solve engineering problems.
CHC803.3	The graduates are expected to have knowledge of professional and ethical responsibility
CHC803.4	The graduates should able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CHDE8041 - Advanced Process Control

Learners will be able to:

CHCDE8041.1	The student will be able to analyze multi-loop and multi-variable control systems.
CHCDE8041.2	The student will be able to design batch controllers.
CHCDE8041.3	The student will be able to design MIMO controllers.
CHCDE8041.4	The student will be able to design Model Predictive Controllers.

ILO8021 - Project Management

Learners will be able to:

ILO8021.1	Apply selection criteria and select an appropriate project from different options.
ILO8021.2	Write work break down structure for a project and develop a schedule based on it.
ILO8021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
ILO8021.4	Use Earned value technique and determine & predict status of the project.
ILO8021.5	Capture lessons learned during project phases and document them for future reference

Course Outcomes of Computer

Engineering Subjects

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THADOMAL SHAHANI ENGINEERING COLLEGE

S. E. Sem III (REV- 2019)	
CSC301- Engineering Mathematics-III	
Learners will be able to:	
CSC301.1	Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
CSC301.2	Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
CSC301.3	Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
CSC301.4	Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
CSC301.5	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
CSC301.6	Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
CSC302- Discrete Structures and Graph Theory	
Learners will be able to:	
CSC302.1	Understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving.
CSC302.2	Ability to reason logically.
CSC302.3	Ability to understand relations, functions, Diagraph and Lattice.
CSC302.4	Ability to understand and apply concepts of graph theory in solving real world problems.
CSC302.5	Understand use of groups and codes in Encoding-Decoding
CSC302.6	Analyze a complex computing problem and apply principles of discrete mathematics to identify solutions
CSC303- Data Structure	
Learners will be able to:	
CSC303.1	Students will be able to implement Linear and Non-Linear data structures.
CSC303.2	Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.
CSC303.3	Students will be able to explain various data structures, related terminologies and its types.
CSC303.4	Students will be able to choose appropriate data structure and apply it to solve problems in various domains.
CSC303.5	Students will be able to analyze and Implement appropriate searching techniques for a given problem.
CSC303.6	Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.
CSC304- Digital Logic & Computer Organization and Architecture	
Learners will be able to:	
CSC304.1	To learn different number systems and basic structure of computer system.
CSC304.2	To demonstrate the arithmetic algorithms.
CSC304.3	To understand the basic concepts of digital components and processor organization.
CSC304.4	To understand the generation of control signals of computer.

CSC304.5	To demonstrate the memory organization.
CSC304.6	To describe the concepts of parallel processing and different Buses.
CSC305- Computer Graphics
Learners will be able to:	
CSC305.1	Describe the basic concepts of Computer Graphics.
CSC305.2	Demonstrate various algorithms for basic graphics primitives.
CSC305.3	Apply 2-D geometric transformations on graphical objects.
CSC305.4	Use various Clipping algorithms on graphical objects
CSC305.5	Explore 3-D geometric transformations, curve representation techniques and projections methods.
CSC305.6	Explain visible surface detection techniques and Animation.
CSL301 - Data Structures Lab
Learners will be able to:	
CSL301.1	Implement linear data structures & be able to handle operations like insertion, deletion, searching and traversing on them.
CSL301.2	Implement nonlinear data structures & be able to handle operations like insertion, deletion, searching and traversing on them
CSL301.3	Choose appropriate data structure and apply it in various problems
CSL301.4	Select appropriate searching techniques for given problems.
CSL302 - Digital Logic & Computer Organization and Architecture Lab
Learners will be able to:	
CSL302.1	To understand the basics of digital components
CSL302.2	Design the basic building blocks of a computer: ALU, registers, CPU and memory
CSL302.3	To recognize the importance of digital systems in computer architecture
CSL302.4	To implement various algorithms for arithmetic operations.
CSL303 - Computer Graphics Lab
Learners will be able to:	
CSL303.1	Implement various output and filled area primitive algorithms
CSL303.2	Apply transformation, projection and clipping algorithms on graphical objects.
CSL303.3	Perform curve and fractal generation methods.
CSL303.4	Develop a Graphical application/Animation based on learned concept
CSL304 - Skill based Lab Course: Object Oriented Programming with Java
Learners will be able to:	
CSL304.1	To apply fundamental programming constructs.
CSL304.2	To illustrate the concept of packages, classes and objects.
CSL304.3	To elaborate the concept of strings, arrays and vectors.
CSL304.4	To implement the concept of inheritance and interfaces.
CSL304.5	To implement the concept of exception handling and multithreading.
CSL304.6	To develop GUI based application.
CSM301 - Mini Project A

Learners will be able to:	
CSM301.1	Identify problems based on societal /research needs.
CSM301.2	Apply Knowledge and skill to solve societal problems in a group.
CSM301.3	Develop interpersonal skills to work as member of a group or leader.
CSM301.4	Draw the proper inferences from available results through theoretical/experimental/simulations.
CSM301.5	Analyze the impact of solutions in societal and environmental context for sustainable development.
CSM301.6	Use standard norms of engineering practices
CSM301.7	Excel in written and oral communication.
CSM301.8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CSM301.9	Demonstrate project management principles during project work.

S.E. Sem IV (R2019) : Course Outcomes

CSC401 - ENGINEERING MATHEMATICS - IV

Learner will be able to:	
CSC 401.1	Apply the concepts of eigenvalues and eigenvectors in engineering problems.
CSC 401.2	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
CSC 401.3	Apply the concept of Z- transformation and inverse in engineering problems.
CSC 401.4	Use the concept of probability distribution and sampling theory to engineering problems.
CSC 401.5	Apply the concept of Linear Programming Problems to optimization.
CSC 401.6	Solve Non-Linear Programming Problems for optimization of engineering problems.

CSC402 - ANALYSIS OF ALGORITHMS

Learner will be able to:	
CSC 402.1	Analyze the running time and space complexity of algorithms.
CSC 402.2	Describe, apply and analyze the complexity of divide and conquer strategy.
CSC 402.3	Describe, apply and analyze the complexity of greedy strategy.
CSC 402.4	Describe, apply and analyze the complexity of dynamic programming strategy.
CSC 402.5	Explain and apply backtracking, branch and bound.

CSC 402.6	Explain and apply string matching techniques.

CSC403 - DATABASE MANAGEMENT SYSTEM

Learner will be able to:	
CSC 403.1	Recognize the need of database management system.
CSC 403.2	Design ER and EER diagram for real life applications.
CSC 403.3	Construct relational model and write relational algebra queries.
CSC 403.4	Formulate SQL queries.
CSC 403.5	Apply the concept of normalization to relational database design.
CSC 403.6	Describe the concept of transaction, concurrency and recovery.

CSC404 - OPERATING SYSTEM

Learner will be able to:	
CSC 404.1	Understand the objectives, functions and structure of OS.
CSC 404.2	Analyze the concept of process management and evaluate performance of processscheduling algorithms.
CSC 404.3	Understand and apply the concepts of synchronization and deadlocks.
CSC 404.4	Evaluate performance of Memory allocation and replacement policies.
CSC 404.5	Understand the concepts of file management.
CSC 404.6	Apply concepts of I/O management and analyze techniques of disk scheduling.

CSC405 - MICROPROCESSOR

Learner will be able to:	
CSC 405.1	Describe core concepts of 8086 microprocessor.
CSC 405.2	Interpret the instructions of 8086 and write assembly and Mixed language programs.
CSC 405.3	Identify the specifications of peripheral chip.
CSC 405.4	Design 8086 based system using memory and peripheral chips.
CSC 405.5	Appraise the architecture of advanced processors.
CSC 405.6	Understand hyperthreading technology.

CSL401 - ANALYSIS OF ALGORITHMS LAB

Learner will be able to:

CSL 401.1	Implement the algorithms using different approaches.
CSL 401.2	Analyze the complexities of various algorithms.
CSL 401.3	Compare the complexity of the algorithms for specific problem.

CSL402 - DATABASE MANAGEMENT SYSTEM LAB

Learner will be able to:	
CSL 402.1	Design ER /EER diagram and convert to relational model for the realworld application.
CSL 402.2	Apply DDL, DML, DCL and TCL commands.
CSL 402.3	Write simple and complex queries.
CSL 402.4	UsePL / SQL Constructs.
CSL 402.5	Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity.

CSL403 - OPERATING SYSTEM LAB

Learner will be able to:	
CSL 403.1	Demonstrate basic Operating system Commands, Shell scripts, System Calls and API wrt Linux.
CSL 403.2	Implement various process scheduling algorithms and evaluate their performance.
CSL 403.3	Implement and analyze concepts of synchronization and deadlocks.
CSL 403.4	Implement various Memory Management techniques and evaluate their performance.
CSL 403.5	Implement and analyze concepts of virtual memory.
CSL 403.6	Demonstrate and analyze concepts of file management and I/O management techniques.

CSL404 - MICROPROCESSOR LAB

Learner will be able to:	
CSL 404.1	Use appropriate instructions to program microprocessor to perform various task.
CSL 404.2	Develop the program in assembly/ mixed language for Intel 8086 processor.
CSL 404.3	Demonstrate the execution and debugging of assembly/ mixed language program.

CSL405 - SKILL BASE LAB COURSE: PYTHON PROGRAMMING

Learner will be able to:	
CSL 405.1	To understand basic concepts in python.
CSL 405.2	To explore contents of files, directories and text processing with python.

CSL 405.3	To develop program for data structure using built in functions in python.
CSL 405.4	To explore django web framework for developing python-based web application.
CSL 405.5	To understand Multithreading concepts using python.

CSM401 - MINI PROJECT B

Learner will be able to:	
CSM 401.1	Identify problems based on societal /research needs.
CSM 401.2	Apply Knowledge and skill to solve societal problems in a group.
CSM 401.3	Develop interpersonal skills to work as member of a group or leader.
CSM 401.4	Draw the proper inferences from available results through theoretical/experimental/simulations.
CSM 401.5	Analyze the impact of solutions in societal and environmental context for sustainable development.
CSM 401.6	Use standard norms of engineering practices
CSM 401.7	Excel in written and oral communication.
CSM 401.8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CSM 401.9	Demonstrate project management principles during project work.

T.E. Sem V (R2016): Course Outcomes

CSC501 - Microprocessor

Learners will be able to:	
CSC501.1	Describe architecture of x86 processors.
CSC501.2	Interpret the instructions of 8086 and write assembly and Mixed language programs.
CSC501.3	Explain the concept of interrupts
CSC501.4	Identify the specifications of peripheral chip
CSC501.5	Design 8086 based system using memory and peripheral chips

CSC501.6	Appraise the architecture of advanced processors

CSC502 - Database Management System

Learners will be able to:	
CSC502.1	Understand the fundamentals of a database systems
CSC502.2	Design and draw ER and EER diagram for the real life problem.
CSC502.3	Convert conceptual model to relational model and formulate relational algebra queries.
CSC502.4	Design and querying database using SQL.
CSC502.5	Analyze and apply concepts of normalization to relational database design.
CSC502.6	Understand the concept of transaction, concurrency and recovery.

CSC503 - Computer Networks

Learners will be able to:	
CSC503.1	Demonstrate the concepts of data communication at physical layer and compare ISO - OSI model with TCP/IP model.
CSC503.2	Demonstrate the knowledge of networking protocols at data link layer.
CSC503.3	Design the network using IP addressing and subnetting / supernetting schemes.
CSC503.4	Analyze various routing algorithms and protocols at network layer.
CSC503.5	Analyze transport layer protocols and congestion control algorithms.
CSC503.6	Explore protocols at application layer

CSC504 - Theory Of Computer Science

Learners will be able to:	
CSC504.1	Identify the central concepts in theory of computation and differentiate between deterministic and nondeterministic automata, also obtain equivalence of NFA and DFA.
CSC504.2	Infer the equivalence of languages described by finite automata and regular expressions.
CSC504.3	Devise regular, context free grammars while recognizing the strings and tokens.
CSC504.4	Design pushdown automata to recognize the language.
CSC504.5	Develop an understanding of computation through Turing Machine.
CSC504.6	Acquire fundamental understanding of decidability and undecidability.

CSDLO5013 - Advance Algorithm

Learners will be able to:	
CSDLO5013.1	Describe analysis techniques for algorithms.
CSDLO5013.2	Identify appropriate data structure and design techniques for different problems
CSDLO5013.3	Identify appropriate algorithm to be applied for the various application like geometric modeling, robotics, networking, etc.
CSDLO5013.4	Appreciate the role of probability and randomization in the analysis of algorithm
CSDLO5013.5	Analyze various algorithms.
CSDLO5013.6	Differentiate polynomial and non deterministic polynomial algorithms.

CSL501 - Microprocessor Lab

Learners will be able to:	

CSL501.1	Use appropriate instructions to program microprocessor to perform various task
CSL501.2	Develop the program in assembly/ mixed language for Intel 8086 processor
CSL501.3	Demonstrate the execution and debugging of assembly/ mixed language program

CSL502 - Computer Network Lab

Learners will be able to:	
CSL502.1	Design and setup networking environment in Linux.
CSL502.2	Use Network tools and simulators such as NS2, Wireshark etc. to explore networking algorithms and protocols.
CSL502.3	Implement programs using core programming APIs for understanding networking concepts.

CSL503 - Database & Info. System Lab

Learners will be able to:	
CSL503.1	Design and draw ER and EER diagram for the real life problem with software tool.
CSL503.2	Create and update database and tables with different DDL and DML statements.
CSL503.3	Apply /Add integrity constraints and able to provide security to data.
CSL503.4	Implement and execute Complex queries.
CSL503.5	Apply triggers and procedures for specific module/task
CSL503.6	Handle concurrent transactions and able to access data through front end (using JDBC ODBC connectivity.)

CSL504 - Web Design Lab

Learners will be able to:	

CSL504.1	Understand the core concepts and features of Web Technology
CSL504.2	Design static web pages using HTML5 and CSS3
CSL504.3	Apply the concept of client side validation and design dynamic web pages using JavaScript and JQuery.
CSL504.4	Evaluate client and server side technologies and create Interactive web pages using PHP , AJAX with database connectivity using MySQL.
CSL504.5	Understand the basics of XML, DTD and XSL and develop web pages using XML / XSLT.
CSL504.6	Analyze end user requirements and Create web application using appropriate web technologies and web development framework

CSL505 -   Business Comm. & Ethics

Learners will be able to:	
CSL505.1	Design a technical document using precise language, suitable vocabulary and apt style.
CSL505.2	Develop the life skills/interpersonal skills to progress professionally by building stronger relationships.
CSL505.3	Demonstrate awareness of contemporary issues knowledge of professional and ethical responsibilities.
CSL505.4	Apply the traits of a suitable candidate for a job/higher education , upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP.
CSL505.5	Deliver formal presentations effectively implementing the verbal and non-verbal skills

T.E. Sem VI (R2016): Course Outcomes

CSC601 -   Software Engineering

Learners will be able to:	
CSC601.1	Understand and demonstrate basic knowledge in software engineering.
CSC601.2	Identify requirements, analyze and prepare models.

CSC601.3	Plan, schedule and track the progress of the projects.
CSC601.4	Design & develop the software projects.
CSC601.5	Identify risks, manage the change to assure quality in software projects.
CSC601.6	Apply testing principles on software project and understand the maintenance concepts.

CSC602 - System Programming And Compiler Construction

Learners will be able to:	
CSC602.1	Identify the relevance of different system programs.
CSC602.2	Describe the various data structures and passes of assembler design.
CSC602.3	Identify the need for different features and designing of macros.
CSC602.4	Distinguish different loaders and linkers and their contribution in developing efficient user applications.
CSC602.5	Construct different parsers for given context free grammars.
CSC602.6	Justify the need synthesis phase to produce object code optimized in terms of high execution speed and less memory usage

CSC603 - Data Warehousing and Mining

Learners will be able to:	
CSC603.1	Understand Data Warehouse fundamentals, Data Mining Principles
CSC603.2	Design data warehouse with dimensional modelling and apply OLAP operations.
CSC603.3	Identify appropriate data mining algorithms to solve real world problems
CSC603.4	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
CSC603.5	Describe complex data types with respect to spatial and web mining.

CSC603.6	Benefit the user experiences towards research and innovation.

CSC604 - Cryptography and System Security

Learners will be able to:	
CSC604.1	Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
CSC604.2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
CSC604.3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CSC604.4	Apply different digital signature algorithms to achieve authentication and design secure applications
CSC604.5	Understand network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
CSC604.6	Analyze and apply system security concept to recognize malicious code.

CSDLO6021 - Machine Learning

Learners will be able to:	
CSDLO6021.1	Gain knowledge about basic concepts of Machine Learning
CSDLO6021.2	Identify machine learning techniques suitable for a given problem
CSDLO6021.3	Solve the problems using various machine learning techniques
CSDLO6021.4	Apply Dimensionality reduction techniques.
CSDLO6021.5	Design application using machine learning techniques

CSL601 -   Software Engineering Lab

Learners will be able to:	
CSL601.1	Identify requirements and apply process model to selected case study.
CSL601.2	Analyze and design models for the selected case study using UML modeling.
CSL601.3	Use various software engineering tools.

CSL602 -   System Software Lab

Learners will be able to:	
CSL602.1	Generate machine code by using various databases generated in pass one of two pass assembler.
CSL602.2	Construct different databases of single pass macro processor.
CSL602.3	Identify and validate different tokens for given high level language code.
CSL602.4	Parse the given input string by constructing Top down /Bottom up parser.
CSL602.5	Implement synthesis phase of compiler with code optimization techniques.
CSL602.6	Explore various tools like LEX and YACC.

CSL603 -   Data Warehousing and Mining Lab

Learners will be able to:	
CSL603.1	Design data warehouse and perform various OLAP operations.
CSL603.2	Implement classification, prediction, clustering and association rule mining algorithms.
CSL603.3	Demonstrate classifications, prediction, clustering and association rule mining algorithms on a given set of data sample using data mining tools.

CSL603.4	Implement spatial and web mining algorithms.

CSL604 -   System Security Lab

Learners will be able to:	
CSL604.1	To be able to apply the knowledge of symmetric cryptography to implement simple ciphers.
CSL604.2	To be able to analyze and implement public key algorithms like RSA and El Gamal.
CSL604.3	To analyze and evaluate performance of hashing algorithms.
CSL604.4	To explore the different network reconnaissance tools to gather information about networks.
CSL604.5	To explore and use tools like sniffers, port scanners and other related tools for analysing packets in a network.
CSL604.6	To be able to set up firewalls and intrusion detection systems using open source technologies and to explore email security.
CSL604.7	To be able to explore various attacks like buffer-overflow, and web-application attacks.

CSM605 - Mini-Project

Learners will be able to:	
CSM605.1	Acquire practical knowledge within the chosen area of technology for project development.
CSM605.2	Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach
CSM605.3	Contribute as an individual or in a team in development of technical projects
CSM605.4	Develop effective communication skills for presentation of project related activities

CSC701 - Digital Signal & Image Processing	
Learners will be able to:	
CSC701.1	Apply the concept of DT Signal and DT Systems.
CSC701.2	Classify and analyze discrete time signals and systems
CSC701.3	Implement Digital Signal Transform techniques DFT and FFT.
CSC701.4	Use the enhancement techniques for digital Image Processing
CSC701.5	Differentiate between the advantages and disadvantages of different edge detection techniques
CSC701.6	Develop small projects of 1-D and 2-D Digital Signal Processing.

CSC702 - Mobile Communication & Computing	
Learners will be able to:	
CSC702.1	To identify basic concepts and principles in mobile communication & computing, cellular architecture.
CSC702.2	To describe the components and functioning of mobile networking.
CSC702.3	To classify variety of security techniques in mobile network.
CSC702.4	To apply the concepts of WLAN for local as well as remote applications.
CSC702.5	To describe and apply the concepts of mobility management
CSC702.6	To describe Long Term Evolution (LTE) architecture and its interfaces.

CSC703 - Artificial Intelligence & Soft Computing	
Learners will be able to:	
CSC703.1	Identify the various characteristics of Artificial Intelligence and Soft Computing techniques.
CSC703.2	Choose an appropriate problem solving method for an agent to find a sequence of actions to reach the goal state.
CSC703.3	Analyse the strength and weakness of AI approaches to knowledge representation, reasoning and planning.
CSC703.4	Construct supervised and unsupervised ANN for real world applications.
CSC703.5	Design fuzzy controller system.
CSC703.6	Apply Hybrid approach for expert system design.

CSDLO7032 - Big Data Analytics	
Learners will be able to:	
CSDLO7032.1	Understand the key issues in big data management and its associated applications for business decisions and strategy.
CSDLO7032.2	Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, Mapreduce and NoSQL in big data analytics.
CSDLO7032.3	Collect, manage, store, query and analyze various forms of Big Data.
CSDLO7032.4	Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
CSDLO7032.5	Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
CSDLO7032.6	Solve Complex real world problems in various applications like recommender systems, social media applications, health and medical systems, etc.

ILO 7015 - Operations Research	

Learners will be able to:	
ILO 7015.1	Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
ILO 7015.2	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
ILO 7015.3	Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
ILO 7015.4	Understand the applications of integer programming and a queuing model and compute important performance measures

CSL701 - Digital Signal and Image Processing Lab	
Learners will be able to:	
CSL701.1	Sample and reconstruct the signal.
CSL701.2	Implement and apply operations like Convolution, Correlation, DFT and FFT on DT signals
CSL701.3	Implement spatial domain Image enhancement techniques.
CSL701.4	Implement Edge detection techniques using first order derivative filters.

CSL702 - Mobile Application Development Lab	
Learners will be able to:	
CSL702.1	To develop and demonstrate mobile applications using various tools
CSL702.2	Students will articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.
CSL702.3	Students will able to carry out simulation of frequency reuse , hidden terminal problem
CSL702.4	To develop security algorithms for mobile communication network
CSL702.5	To demonstrate simulation and compare the performance of Wireless LAN
CSL702.6	To implement and demonstrate mobile node discovery and route maintains.

CSL703 - Artificial Intelligence & Soft Computing Lab	
Learners will be able to:	
CSL703.1	To realize the basic techniques to build intelligent systems
CSL703.2	To create knowledge base and apply appropriate search techniques used in problem solving.
CSL703.3	Apply the supervised/unsupervised learning algorithm.
CSL703.4	Design fuzzy controller system.

CSL704 - Computational Lab-I	
Learners will be able to:	
CSL704.1	Acquire practical knowledge within the chosen area of technology for project development.
CSL704.2	Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

B.E. Sem VIII (R2016): Course Outcomes

CSC801 - Human Machine Interaction

Learners will be able to:	
CSC801.1	Identify User Interface (UI) design principles.
CSC801.2	Analysis of effective user friendly interfaces.
CSC801.3	Apply Interactive Design process in real world applications.
CSC801.4	Evaluate UI design and justify.
CSC801.5	Create application for social and technical task.

CSC802 - Distributed Computing

Learners will be able to:	
CSC802.1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;
CSC802.2	Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
CSC802.3	Analyze the various techniques used for clock synchronization and mutual exclusion
CSC802.4	Demonstrate the concepts of Resource and Process management and synchronization algorithms
CSC802.5	Demonstrate the concepts of Consistency and Replication Management
CSC802.6	Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications.

CSDLO8012 - Natural Language Processing

Learners will be able to:	
CSDLO8012.1	Have a broad understanding of the field of natural language processing.
CSDLO8012.2	Have a sense of the capabilities and limitations of current natural language technologies,
CSDLO8012.3	Be able to model linguistic phenomena with formal grammars.
CSDLO8012.4	Be able to Design, implement and test algorithms for NLP problems
CSDLO8012.5	Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP
CSDLO8012.6	Be able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

CSILO8021 - Project Management

Learners will be able to:	
CSILO8021.1	Apply selection criteria and select an appropriate project from different options.
CSILO8021.2	Write work break down structure for a project and develop a schedule based on it.
CSILO8021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
CSILO8021.4	Use Earned value technique and determine & predict status of the project.
CSILO8021.5	Capture lessons learned during project phases and document them for future reference

CSL801 - Human Machine Interactions Lab

Learners will be able to:	

CSL801.1	To design user centric interfaces.
CSL801.2	To design innovative and user friendly interfaces.
CSL801.3	To apply HMI in their day-to-day activities.
CSL801.4	To criticize existing interface designs, and improve them.
CSL801.5	To Design application for social Task.
CSL801.6	To Design application for Technical Tasks

CSL802 - Distributed Computing Lab

Learners will be able to:	
CSL802.1	Develop, test and debug RPC/RMI based client-server programs.
CSL802.2	Implement the main underlying components of distributed systems (such as IPC, name resolution, file systems etc.)
CSL802.3	Implement various techniques of synchronization.
CSL802.4	Design and implement application programs on distributed systems.

CSL803 - Cloud Computing Lab

Learners will be able to:	
CSL803.1	Adapt different types of virtualization and increase resource utilization.
CSL803.2	Build a private cloud using open source technologies.
CSL803.3	Analyze security issues on cloud.
CSL803.4	Develop real world web applications and deploy on commercial cloud.
CSL803.5	Demonstrate various service models.

Course Outcomes of Electronics & Telecommunication Subjects

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	S.E. Sem III (R2019): Course Outcomes
	ECC301 - : Applied Mathematics-III
ECC301.1	Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
ECC301.2	Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
ECC301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
ECC301.4	Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function.
ECC301.5	Use matrix algebra to solve the engineering problems.
ECC301.6	Apply the concepts of vector calculus in real life problems.
	ECC302 - : Electronic Devices and Circuits-I
ECC302.1	Know functionality and applications of various electronic devices.
ECC302.2	Explain working of various electronics devices with the help of V-I characteristics.
ECC302.3	Derive expressions for performance parameters of BJT and MOSFET circuits.
ECC302.4	Evaluate performance of Electronic circuits (BJT and MOSFET based).
ECC302.5	Select appropriate circuit for given application.
ECC302.6	Design electronic circuit (BJT, MOSFET based) circuits for given specifications.
	ECC303 - : Digital System Design
ECC303.1	Understand types of digital logic, digital circuits and logic families.
ECC303.2	Analyze, design and implement combinational logic circuits.
ECC303.3	Analyze, design and implement sequential logic circuits.
ECC303.4	Develop a digital logic and apply it to solve real life problems.
ECC303.5	Classify different types of memories and PLDs.
ECC303.6	Simulate and implement basic combinational and sequential circuits using VHDL/Verilog.
	ECC304: Network Theory
ECC304.1	Analyze complex networks involving dependent and independent sources using network theorems.
ECC304.2	Apply the time and frequency method of analysis.
ECC304.3	Evaluate circuit using graph theory.
ECC304.4	Find the various parameters of two port network.
ECC304.5	Apply network topology for analyzing the circuit.
ECC304.6	Synthesize the network using passive elements.
	ECC305 -: Electronic Instrumentation & Control Systems

ECC305.1	Identify various sensors, transducers and their brief performance specification.
ECC305.2	Understand the principle of working of various transducer used to measure temperature, displacement, level, pressure and their application in industry.
ECC305.3	Determine the models of physical systems in forms suitable for use in the analysis and design of control systems.
ECC305.4	Obtain the transfer functions for a given Control system.
ECC305.5	Understand the analysis of systems in time domain and frequency domain.
ECC305.6	Predict stability of given system using appropriate criteria.

ECL 301: Electronic devices & Circuits-I (Lab)

ECL 301.1	Know various equipments, electronics devices and components, and measuring instruments used to perform laboratory work.
ECL 301.2	Students will be able to explain functionality of various equipments, electronics devices and components and neasu6 instruments used to perform laboratory work.
ECL 301.3	Students will be able connect various equipments, devices, components and measuring devices using bread board as per the circuit diagram for experiment to be performed.
ECL 301.4	Students will able to perform experiment to gather appropriate data.
ECL 301.5	Students will able to analyze data obtained from experiment to relate theory with experiment results.
ECL 301.6	Students will able to prepare laboratory report (Journal) to summarise the outcome each experiment.

ECL 302:   Digital System Design Lab

ECL302.1	Identify various Digital ICs and basic building blocks of digital system design
ECL302.2	Design and implement combinational circuits like adder, subtractor, multiplexer, code converters etc.
ECL302.3	Identify and understand working of various types of flip flops and their inter conversions.
ECL302.4	Design and implement basic sequential circuits such as counters, registers etc.
ECL302.5	Acquire basic knowledge of VHDL/Verilog basic programming.

ECL303 - : Electronic Instrumentation & Control Systems Lab.

ECL 303.1	Plot and validate the performance characteristics of transducers.
ECL 303.2	Validate the characteristics of various temperature, pressure and level transducers.
ECL 303.3	Plot frequency response of first-order electrical system.
ECL 303.4	Plot time response of second-order electrical system and calculate the steady-state error.

ECL 303.5	Validate the effect of damping factor on the response of second order system.
ECL 303.6	Inspect the frequency response specifications of systems by using bode-plot, Polar plot, Nyquist-plot techniques, and comment on the stability of system

ECL304 - : Skill Lab: C++ and Java Programming	
ECL 304.1	Describe the basic principles of OOP.
ECL 304.2	Design and apply OOP principles for effective programming.
ECL 304.3	Develop programming applications using OOP language.
ECL 304.4	Implement different programming applications using packaging.
ECL 304.5	Analyze the strength of OOP.
ECL 304.6	Percept the Utility and applicability of OOP.

ECM301 - : Mini Project 1A	
ECM 301.1	Identify problems based on societal /research needs.
ECM 301.2	Apply Knowledge and skill to solve societal problems in a group.
ECM 301.3	Develop interpersonal skills to work as member of a group or leader.
ECM 301.4	Draw the proper inferences from available results through theoretical/ experimental/simulations
ECM 301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
ECM 301.6	Use standard norms of engineering practices
ECM 301.7	Excel in written and oral communication.
ECM 301.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
ECM 301.9	Demonstrate project management principles during project work.

ECM301 - : Mini Project 1A: Analog & Digital Circuit Design based Projects	
ECM301.1	Create the electronics circuit for particular application/experiment.
ECM 301.2	Design and simulate the circuits by putting together the analog and digital components
ECM 301.3	Learn the technique of soldering and circuit implementation on general purpose printed circuit board (GPP).
ECM 301.4	Realize the PCB design process and gain up-to-date knowledge of PCB design software.
ECM 301.5	Utilize the basic electronic tools and equipment's (like DMM, CRO, DSO etc.)
ECM 301.6	Analysis of hardware fault (Fault detection and correction)

S.E. Sem IV (R2019): Course Outcomes	
ECC401: Engineering Mathematics-IV	
ECC401.1	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
ECC401.2	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI.

ECC401.3	Apply the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
ECC401.4	Apply the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
ECC401.5	Apply the concept of vector spaces and orthogonalization process in Engineering Problems.
ECC402 : Micro controllers	
ECC402.1	Understand Computer and its memory System,
ECC402.2	To analyse/ design various linear and non-linear applications of operational amplifier Circuits.
ECC402.3	Write programs for 8051 microcontrollers.
ECC402.4	Design an applications using microcontroller.
ECC403 -: Linear Integrated Circuits	
ECC403.1	Outline and classify all types of integrated circuits.
ECC403.2	Understand the fundamentals and areas of applications for the integrated circuits.
ECC403.3	Develop the ability to design practical circuits that perform the desired operations.
ECC403.4	Understand the differences between theoretical & practical results in integrated circuits.
ECC403.5	Use appropriate concepts and computational methods in various Signals and systems applications
ECC 404 - : Signals and Systems	
ECC 404.1	Classify and Analyze different types of signals and systems
ECC 404.2	Analyze continuous time LTI signals and systems in transform domain
ECC 404.3	Analyze and realize discrete time LTI signals and systems in transform domain
ECC 404.4	Represent signals using Fourier Series and Analyze the systems using the Fourier Transform.
ECC 405- : Principles of Communication Engineering	
ECC 405.1	Understand the basic components and types of noises in communication system.
ECC 405.2	Analyze the concepts of amplitude modulation and demodulation.
ECC 405.3	Analyze the concepts of angle modulation and demodulation.
ECC 405.4	Compare the performance of AM and FM receivers
ECL401-: Micro controllers Lab	
ECL401.1	Understand different development tools required to develop microcontroller based systems.
ECL401.2	Write assembly language programs for arithmetic and logical operations, code conversion & data transfer operations.
ECL401.3	Write assembly language programs for general purpose I/O, Timers & Interrupts.

ECL401.4	Interface & write programs for Input and Output devices

ECL402-: Linear Integrated Circuits Laboratory	
ECL402.1	Understand the differences between theoretical, practical and simulated results in integrated circuits.
ECL402.2	Apply the knowledge to do simple mathematical operations.
ECL402.3	Apply knowledge of op-amp, timer and voltage regulator ICs to design simple applications.
ECL402.4	To analyse and design voltage regulators for given specifications.
ECL402.5	Report and present experimental study conducted with valid conclusions.

ECL 403 -: Principles of Communication Engineering laboratory	
ECL 403.1	Operate the required test and measuring equipment, components, laboratory accessories/ hardware platforms to prepare the required experimental set up
ECL 403.2	Demonstrate digital pulse modulation and demodulation techniques.
ECL 403.3	Carry out necessary investigations in the assembled circuits, infer from the results obtained and correlate/ present observations with theoretical interpretations/ calculations; at individual level and also as a part of team during laboratory hours.
ECL 403.4	Use simulation tools (SIMULINK) for simulating and analysing modulated signals and its relevant parameters.

ECL 404-: Skill Lab: Python Programming	
ECL 404.1	Describe syntax and semantics in Python
ECL 404.2	Illustrate different file handling operations
ECL 404.3	Design GUI Applications in Python
ECL 404.4	Express proficiency in the handling Python libraries for data science

ECM401 - : Mini Project 1B	
ECM301.1	Identify problems based on societal /research needs.
ECM 301.2	Draw the proper inferences from available results through theoretical/ experimental/simulations.
ECM 301.3	Analyse the impact of solutions in societal and environmental context for sustainable development.
ECM 301.4	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
ECM 301.5	Demonstrate project management principles during project work.

ECM401 - : Mini-Project 1B: Arduino & Raspberry Pi based Projects	
ECM301.1	Write basic codes for the Arduino board using the IDE for utilizing the onboard resources.
ECM 301.2	Apply the knowledge of interfacing different devices to the Arduino board to accomplish a given task.

ECM 301.3	Design Arduino based projects for a given problem.
ECM 301.4	Apply the knowledge of interfacing different devices to raspberry Pi board to accomplish a given task.
ECM 301.5	Design Raspberry Pi based projects for a given problem.

T. E. Sem V : Course Outcomes

ECC501 - Microprocessor and Peripherals Interfacing

Learners will be able to:

ECC501.1	Identify different functionalities, architecture and software aspects of microcomputer systems and need of assembler and compiler.
ECC501.2	Study architecture of microprocessor 8086.
ECC501.3	Write programs for 8086 microprocessor based systems with the help of appropriate instructions and study of asssembler directives.
ECC501.4	Interfacing of 8086 with 8255, 8254 and 8259A.
ECC501.5	Interfacing ADC0809, DSC0808 with 8086 and its applications.
ECC501.6	Interfacing of 8086 with 8087 math co-processor.

ECC502 - Digital Communication

Learners will be able to:

ECC502.1	Understand random variables and random processes of signal.
ECC502.2	Encode the messages for the given information source and compare various source coding algorithms for the given information source and to quantify the average information content of it.
ECC502.3	Apply different error control coding techniques, design encoders for the given specifications and study cyclic codes and convolution codes.
ECC502.4	Compare and analyse various modulation techniques on the basis of signal space representation, power spectral density , spectral efficiency and probability of error
ECC502.5	Apply appropriate baseband processing and filtering techniques at transmitting and receiving end.
EEC502.6	To study the optimum reception of digital signals.

ECC503 - Electromagnetic Engineering

Learners will be able to:

ECC503.1	Study of electrostatic term such as coloumb's law, Electric Field Intensity, Gauss's Law
ECC503.2	Analyse the behaviour of EM waves in free space and material media involving multiple boundary conditions by solving wave equation.
ECC503.3	Explain polarization behaviour in dielectrics. Study of stead magnetic field concepts
ECC503.4	Explain Electromagnetic radiation and propagation in space and Maxwell's Equation
ECC503.5	Study of Transmission Lines
EEC503.6	Applications of Electromagnetics

ECC504 - Discrete Time Signal Processing

Learners will be able to:

ECC504.1	Study of Discrete Fourier Transform & Fast Fourier Transfrom
ECC504.2	Design different types of IIR filters
ECC504.3	Design different types of FIR filters
ECC504.4	Evaluate the effects of Finite Word Length in design of digital filters.
ECC504.5	Realize the architecture of different DSP Processors
ECC504.6	Explain the applications of Digital Signal Processing in different areas of Telecommunication.

ECCDLO5014 - Data Compression and Encryption (Elective)

Learners will be able to:	
ECCDLO5014.1	Apply various compression techniques for compression of text, image, audio and video.
ECCDLO5014.2	Study various techniques of Image Compression Algorithm.
ECCDLO5014.3	Study various techniques of Video and Audio Compression Algorithm
ECCDLO5014.4	Study various types of Data Security
ECCDLO5014.5	Number Theory and Asymmetric Key Cryptography Algorithm
ECCDLO5014.6	Network Security

ECL501- Microprocessor and Peripherals Interfacing Laboratory

Learners will be able to:	
ECL501.1	Identify different hardware components and relevant software for programming of microprocessor 8086 based development system.
ECL501.2	Use structural programming to solve the problems.
ECL501.3	Write and debug assembly language programs using 8086.
ECL501.4	Write and present the experimental study conducted along with valid conclusion as per the specified.

ECL502 - Digital Communication Laboratory

Learners will be able to:	
ECL502.1	Select the appropriate Communication System.
ECL502.2	Compare various encoding schemes, modulation techniques and channel encoding schemes to implement the Communication System.
ECL502.3	Carry out necessary investigations in the designed Communication system or in the simulated process, infer from the results obtained and correlate them with theoretical interpretations at individual level or as a part of team during laboratory hours.
ECL502.4	Report and present the experimental study conducted along with valid conclusions as per the specified format.

ECL503 - Business Communication and Ethics

Learners will be able to:	
ECL503.1	Prepare a project report by assimilating, analysing, organizing and formatting data in the prescribed format.
ECL503.2	Prepare a technical proposal according to the prescribed format.
ECL503.3	Understand the various interpersonal skills and their function in an everyday business environment Prepare an inventory of interpersonal skills based on self-assessment Prepare notice agenda and minutes of a meeting and plan and conduct an effective meeting

ECL503.4	Prepare notice agenda and minutes of a meeting and plan and conduct an effective meeting
ECL503.5	Understand the concept and application of corporate ethics / soft skills in real life situations
ECL503.6	Participate in group discussions and interviews and write a cover letter and resume Apply presentation techniques to deliver power point presentations in the latest formats

ECL504 - Open Source Communication Laboratory

Learners will be able to:	
ECL504.1	Introduction to open source tools and matlab tools for communication lab
ECL504.2	To simulate and analyze the various parameters of communication lab
ECL504.3	Understand and implement the communication system/ sub-system

T. E. Sem VI : Course Outcomes

ECC601 – Microcontrollers and Applications

Learners will be able to:	
ECC601.1	Identify different functionalities and architecture of 8051 microcontroller
ECC601.2	Write programs for 8051 microcontroller based systems with the help of appropriate instruction set.
ECC601.3	Interface different I/Os with 8051 microcontroller for various applications.
ECC601.4	Identify different functionalities and architecture of ARM 7
ECC601.5	Write assembly language programs for ARM 7
ECC501.6	ARM programming with Embedded C

ECC602 - Computer Communication Networks

Learners will be able to:	
ECC602.1	Differentiate functions of various layers of OSI model and compare the layered architecture with TCP/IP protocol suite.
ECC602.2	Define characteristics of different physical media and differentiate other communication networks and multiplexing techniques.
ECC602.3	Differentiate various components in data link layer, various random access techniques,wired and wireless networks.
ECC602.4	Differentiate various channel allocation and access protocols used in networking.
ECC602.5	Design a network and subnetwork on the basis of network protocol and routing algorithms
ECC602.6	Distinguish transport layer protocols based on application and will be able to describe flow and congestion control mechanism used in transport layer.

ECC603 – Antenna & Radio Wave Propagation

Learners will be able to:	
ECC603.1	Discuss the concepts of antenna fundamentals like radiation pattern, directivity and gain.
ECC603.2	Analyse the basic radiating elements like linear wire antenna and loop antenna.
ECC603.3	Design Antenna Arrays For Isotropic And Directional Sources.
ECC603.4	Design special type of antennas like micro strip antennas, frequency independent antennas and reflectors.

ECC603.5	Measure antenna parameters and Identify modes of signal propagation over varying frequencies through wireless channel.
ECC603.6	Study of Antenna Measurement and Wave propagation

ECC604 – Image Processing and Machine vision

Learners will be able to:	
ECC604.1	Analyze the effect of sampling, quantization in 2D and 3D signals.
ECC604.2	Compare various 2-D Orthogonal and Unitary transforms for compression and energy conservation of an image.
ECC604.3	Implement various image enhancement algorithms in spatial domain as well as frequency domain in context with filtering.
ECC604.4	Justify the need of image restoration and implement it by using different filters as well as morphological techniques for object linking and detection.
ECC604.5	Apply quantitative models of image processing for segmentation and boundary representation.
ECC604.6	Recognize different shapes using various representation techniques and classify the object using different classification methods.

ECCDLO6023: Data Base Management Systems

Learners will be able to:	
ECCDLO6023.1	Understand the different issues involved in the design and implementation of a database system
ECCDLO6023.2	Transform an information model into a relational database schema and to use a data definition language and/or utility to implement the schema using a DBMS.
ECCDLO6023.3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
ECCDLO6023.4	Study of Relational Algebra and Calculus
ECCDLO6023.5	Study of Constraints, Views and basic of SQL
ECCDLO6023.6	Understand the concepts of constraints, views, concurrency control, deadlock

ECL601 – Microcontrollers and Applications Lab

Learners will be able to:	
ECL601.1	Identify different hardware components and use relevant software for programming of microcontroller based development system.
ECL601.2	Use structural programming concept to solve the problems.
ECL601.3	Write and Debug assembly language and embedded C programs using 8051/ARM 7.
ECL601.4	Write and present the experimental study conducted along with valid conclusion as per the specified format.

ECL602 - Computer Communication Networks Lab

Learners will be able to:	
ECL602.1	Select a software tool to design computer networks and configure protocols/servers/firewalls to achieve desired performance of the network
ECL602.2	Select a software tool to design computer networks and configure algorithms to achieve desired performance of the network
ECL602.3	Select a software tool to design computer networks and configure different applications of network.
ECL602.4	Select a software tool to design and configure different sliding window protocols.
ECL602.5	Write and present the experimental study conducted along with valid conclusion as per thespecified format.

ECL603 – Antenna & Radio Wave Propagation Lab

Learners will be able to:

ECL603.1	Demonstrate the structure and operation of various antennas and plot radiation patterns using MATLAB
ECL603.2	Design and fabricate Linear wire antennas such as monopoles and dipoles and special antennas like MSAs, Horn and Yagi-Uda antennas for a given frequency
ECL603.3	Design Antenna Arrays for Isotropic and Directional sources.
ECL603.4	Use antenna simulation software in design of various antennas.

ECL604 – Image Processing and Machine vision Lab

Learners will be able to:

ECL604.1	Carry out different transformation operations in various domains on image.
ECL604.2	Simulate basic segmentation as well as morphological operations on image and apply them for object linking , detection and recognition.
ECL604.3	Model image restoration using appropriate de-blurring filters.
ECL604.4	Report and present the experimental study conducted along with valid conclusions as per the specified format.

ECLDLO6023: Data Base Management Systems Lab

Learners will be able to:

ECLDLO6023.1	To understand the SQL and basic commands of SQL like CREATE, INSERT, UPDATE
ECLDLO6023.2	Apply the Constraints and different keys on table.
ECLDLO6023.3	Implement the queries, JOIN, VIEW, and Library Function.
ECLDLO6023.4	Perform the queries and Triggers.
ECLDLO6023.5	Design own Database Management System.
ECLDLO6023.6	Report and present the experimental study conducted along with valid conclusion as per the specified format.

B.E. Sem VII Course Outcomes

ECC702 - Mobile Communication Systems

Learners will be able to:

ECC702.1	Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.
ECC702.2	Classify different types of propagation models and analyze the link budget.
ECC702.3	Illustrate the fundamentals and system architecture of GSM, 2.5G and IS-95.
ECC702.4	Apply the concepts of 3G technologies of UMTS and CDMA 2000.
ECC702.5	Identify the emerging technologies for upcoming mobile communication systems. Elaborate the principles of 3GPP LTE.

ECC703 - Optical Communication and Networks

Learners will be able to:

ECC703.1	Analyse propagation of light in optical fiber in different fiber types using the ray theory and electromagnetic mode theory.
ECC703.2	List, write and explain fundamentals and transmission characteristics of optical fiber Communication.
ECC703.3	List, write and explain principles and characteristics of various sources ,detectors and various fiber optic components
ECC703.4	Calculate parameters for optical link budgeting and analyze the link

ECC703.5	Compare principles of different classes of OTDM networks, Optical access networks and future access network.
ECC703.6	Apply concepts of optical network in modern optical system design and management.

ECC701 – Microwave Engineering	
Learners will be able to:	
ECC701.1	Characterize devices at higher frequencies.
ECC701.2	Design and analyze microwave circuits.
ECC701.3	Design and analyze amplifiers and oscillators at microwave frequencies.
ECC701.4	Demonstrate skills of planning, design and deployment of microwave networks.
ECC701.5	Analyse Microwave Tubes and derive expressions of necessary performance parameters for them.
ECC701.6	Explain various application of Microwave frequency including Radar.

ECCDLO 7032 - Big Data Analytics	
Learners will be able to:	
ECCDLO 7032.1	Understand the key issues in big data management.
ECCDLO 7032.2	Acquire fundamental enabling techniques using tools in big data analytics.
ECCDLO 7032.3	Achieve adequate perspectives of big data analytics in various applications like sensor, recommender systems, social media applica

ECCILO 7016 Cyber Security and Laws	
Learners will be able to:	
ECCILO 7016 .1	Understand the concept of cybercrime and its effect on outside world
ECCILO 7016 .2	Interpret and apply IT law in various legal issues
ECCILO 7016.3	Apply Information Security Standards compliance during software design and development
ECCILO 7016 .4	Distinguish different aspects of cyber law

ECCILO 7011 Product Lifecycle Management	
Learners will be able to:	
ECCILO 7011.1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
ECCILO 7011.2	Illustrate various approaches and techniques for designing and developing products.
ECCILO 7011.3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
ECCILO 7011.4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

ECCILO 7015 Operations Research	
Learners will be able to:	
ECCILO 7015.1	Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.

ECCILO 7015.2	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
ECCILO 7015.3	Understand the applications of integer programming and a queuing model and compute important performance measures
ECCILO 7015.4	Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.

ECCILO 7013 Management Information System
Learners will be able to:

ECCILO 7013.1	Explain how information systems Transform Business
ECCILO 7013.2	Identify the impact information systems have on an organization
ECCILO 7013.3	Describe IT infrastructure and its components and its current trends
ECCILO 7013.4	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses
ECCILO 7013.5	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making

ECCILO 7017 Disaster Management and Mitigation Measures
Learners will be able to:

ECCILO 7017.1	Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
ECCILO 7017.2	Plan of national importance structures based upon the previous history.
ECCILO 7017.3	Get acquainted with government policies, acts and various organizational structure associated with an emergency.
ECCILO 7017.4	Get to know the simple do's and don'ts in such extreme events and act accordingly.

B.E. Sem VIII Course Outcomes
ECC801 RF Design
Learners will be able to:

ECC801.1	Design impedance matching networks and passive RF filters.
ECC801.2	Design and appraise RF amplifiers and oscillators.
ECC801.3	Analyze EMI and EMC in RF circuits.

ECC802 Wireless Networks
Learners will be able to:

ECC802.1	Explain the working of different wireless technologies like bluetooth and zigbee.
ECC802.2	Understand the working of wireless LAN, PAN & MAN
ECC802.3	Analyze the different types of Wireless Networks like LAN,PAN & MAN
ECC802.4	Comprehend the working of Femtocells.

ECCDLO 8043 Satellite Communication
Learners will be able to:

ECCDLO 8043.1	Explain basics of satellite communication, space segment and earth segment
ECCDLO 8043.2	Understand different satellite orbits and orbital parameters
ECCDLO 8043.3	Explain and analyze link budget of satellite signal for proper communication

ECCDLO 8043.4	Understand various applications of satellite communications

ECCDLO 8044 Network Management in TeleCommunication

Learners will be able to:

ECCDLO 8044.1	Continuously improve their technology knowledge and communication skills.
ECCDLO 8044.2	Apply basic of telecommunication, networking and information technologies and architect and implement networked informative systems.
ECCDLO 8044.3	Describe the concepts and architecture behind standards based network management associated with SNMP and CMIP.
ECCDLO 8044.4	Explain the need for interoperable network management & analyze the trends and development of the Telecommunications Network Management.
ECCDLO 8044.5	Demonstrate broad knowledge of fundamental principles and technical standards underlying.

ECCILO 8021 Project Management

Learners will be able to:

ECCILO 8021.1	Apply selection criteria and select an appropriate project from different options
ECCILO 8021.2	Write work break down structure for a project and develop a schedule based on it.
ECCILO 8021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
ECCILO 8021.4	Use Earned value technique and determine & predict status of the project.
ECCILO 8021.5	Capture lessons learned during project phases and document them for future reference

ECCILO 8022 Finance Management

Learners will be able to:

ECCILO 8022.1	Understand Indian finance system and corporate finance
ECCILO 8022.2	Take investment, finance as well as dividend decisions

Course Outcomes of Information Technology Subjects

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THADOMAL SHAHANI ENGINEERING COLLEGE

S.E. Sem III (R2019): Course Outcomes ITC301 - ENGINEERING MATHEMATICS-III	
Learners will be able to:	
ITC301.1	Apply the concept of Laplace transform to solve the real integrals in engineering problems.
ITC301.2	Apply the concept of inverse Laplace transform of various functions in engineering problems.
ITC301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
ITC301.4	Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.
ITC301.5	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI.
ITC301.6	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.

ITC302 - Data Structure and Analysis	
Learners will be able to:	
ITC302.1	Classify and Apply the concepts of stacks, queues and linked list in real life problem solving.
ITC302.2	Classify, apply and analyze the concepts trees in real life problem solving.
ITC302.3	Illustrate and justify the concepts of graphs in real life problem solving.
ITC302.4	List and examine the concepts of sorting, searching techniques in real life problem solving.
ITC302.5	Use and identify the concepts of recursion, hashing in real life problem solving.
ITC302.6	Examine and justify different methods of stacks, queues, linked list, trees and graphs to various applications

ITC303 - Database Management System	
Learners will be able to:	
ITC303.1	Identify the need of Database Management System.
ITC303.2	Design conceptual model for real life applications.
ITC303.3	Create Relational Model for real life applications
ITC303.4	Formulate query using SQL commands.
ITC303.5	Apply the concept of normalization to relational database design.
ITC303.6	Demonstrate the concept of transaction, concurrency and recovery.

ITC304 - Principle of Communication	
Learners will be able to:	
ITC304.1	Describe analog and digital communication systems
ITC304.2	Differentiate types of noise, analyses the Fourier transform of time and frequency domain.
ITC304.3	Design transmitter and receiver of AM, DSB, SSB and FM
ITC304.4	Describe Sampling theorem and pulse modulation systems.
ITC304.5	Explain multiplexing and digital band pass modulation techniques.
ITC304.6	Describe electromagnetic radiation and propagation of waves.

ITC305 - Paradigms and Computer Programming Fundamentals

Learners will be able to:	
ITC305.1	Understand and Compare different programming paradigms.
ITC305.2	Understand the Object Oriented Constructs and use them in program design.
ITC305.3	Understand the concepts of declarative programming paradigms through functional and logic programming.
ITC305.4	Design and Develop programs based on declarative programming paradigm using functional and/or logic programming.
ITC305.5	Understand the role of concurrency in parallel and distributed programming.
ITC305.6	Understand different application domains for use of scripting languages.

ITL301 - Data Structure Lab

Learners will be able to:	
ITL301.1	Understand and use the basic concepts and principles of various linked lists, stacks and queues.
ITL301.2	Understand the concepts and apply the methods in basic trees
ITL301.3	Use and identify the methods in advanced trees.
ITL301.4	Understand the concepts and apply the methods in graphs
ITL301.5	Understand the concepts and apply the techniques of searching, hashing and sorting
ITL301.6	Illustrate and examine the methods of linked lists, stacks, queues, trees and graphs to various real time problems

ITL302 - SQL Lab

Learners will be able to:	
ITL302.1	Define problem statement and Construct the conceptual model for real life application
ITL302.2	Create and populate a RDBMS using SQL.
ITL302.3	Formulate and write SQL queries for efficient information retrieval
ITL302.4	Apply view, triggers and procedures to demonstrate specific event handling
ITL302.5	Demonstrate database connectivity using JDBC.
ITL302.6	Demonstrate the concept of concurrent transactions

ITL303 - Computer programming Paradigms Lab

Learners will be able to:	
ITL303.1	Implement Object Oriented concepts in C++.
ITL303.2	Design and Develop solution based on declarative programming paradigm using functional and logic programming.
ITL303.3	Understand the multi threaded programs in Java and C++
ITL303.4	Understand the need and use of exception handling and garbage collection in C++ and JAVA
ITL303.5	Implement a solution to the same problem using multiple paradigms.
ITL303.6	Compare the implementations in multiple paradigms at coding and execution level.

ITL304 - Java Lab (SBL)

Learners will be able to:

ITL304.1	Explain the fundamental concepts of Java Programing.
ITL304.2	Use the concepts of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
ITL304.3	Demonstrate how to extend java classes and achieve reusability using Inheritance, Interface and Packages.
ITL304.4	Construct robust and faster programmed solutions to problems using concept of Multithreading, exceptions and file handling
ITL304.5	Design and develop Graphical User Interface using Abstract Window Toolkit and Swings along with response to the events.
ITL304.6	Develop Graphical User Interface by exploring JavaFX framework based on MVC architecture.

ITM301 - Mini Project – 1 A for Front end /backend Application using JAVA	
Learners will be able to:	
ITM306.1	Identify problems based on societal /research needs.
ITM306.2	Apply Knowledge and skill to solve societal problems in a group.
ITM306.3	Develop interpersonal skills to work as member of a group or leader.
ITM306.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
ITM306.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
ITM306.6	Use standard norms of engineering practices
ITM306.7	Excel in written and oral communication.
ITM306.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning
ITM306.9	Demonstrate project management principles during project work

	S.E. Sem IV (R2019): Course Outcomes ITC401 - ENGINEERING MATHEMATICS-IV
Learners will be able to:	
ITC401.1	Apply the concepts of eigen values and eigen vectors to solve engineering problems.
ITC401.2	Illustrate the use of concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
ITC401.3	Apply the concept of Z- transformation and its inverse in engineering problems.
ITC401.4	Apply the concept of probability distribution to engineering problems & testing hypothesis of small samples using sampling theory.
ITC401.5	Apply the concept of Linear Programming to solve the optimization problems.
ITC401.6	Use the Non-Linear Programming techniques to solve the optimization problems.

ITC402 - COMPUTER NETWORK AND NETWORK DESIGN	
Learners will be able to:	
ITC402.1	Describe the functionalities of each layer of the models and compare the Models.
ITC402.2	Categorize the types of transmission media and explain data link layer concepts, design issues and protocols.
ITC402.3	Analyze the routing protocols and assign IP address to networks.

ITC402.4	Explain the data transportation and session management issues and related protocols used for end to end delivery of data.
ITC402.5	List the data presentation techniques and illustrate the client/server model in application layer protocols.
ITC402.6	Use of networking concepts of IP address, Routing, and application services to design a network for an organization.

ITC403 - OPERATING SYSTEM	
Learners will be able to:	
ITC403.1	Understand the basic concepts related to Operating System.
ITC403.2	Describe the process management policies and illustrate scheduling of processes by CPU.
ITC403.3	Explain and apply synchronization primitives and evaluate deadlock conditions as handled by Operating System.
ITC403.4	Describe and analyze the memory allocation and management functions of Operating System.
ITC403.5	Analyze and evaluate the services provided by Operating System for storage management.
ITC403.6	Compare the functions of various special-purpose Operating Systems.

ITC404 - AUTOMATA THEORY	
Learners will be able to:	
ITC404.1	Explain, analyze and design Regular languages, Expression and Grammars.
ITC404.2	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.
ITC404.3	Analyze and design Context Free languages and Grammars.
ITC404.4	Design different types of Push down Automata as Simple Parser.
ITC404.5	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.
ITC404.6	Develop understanding of applications of various Automata.

ITC405 - COMPUTER ORGANIZATION AND ARCHITECTURE	
Learners will be able to:	
ITC405.1	Demonstrate the fundamentals of Digital Logic Design.
ITC405.2	Describe basic organization of computer, the architecture of 8086 microprocessor and implement assembly language programming for 8086 microprocessors.
ITC405.3	Demonstrate control unit operations and conceptualize instruction level parallelism.
ITC405.4	List and Identify integers and real numbers and perform computer arithmetic operations on integers.
ITC405.5	Categorize memory organization and explain the function of each element of a memory hierarchy.
ITC405.6	Examine different methods for computer I/O mechanism.

ITL401 - NETWORKING LAB	
Learners will be able to:	
ITL401.1	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.

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ITL401.2	Demonstrate the installation and configuration of network simulator.
ITL401.3	Demonstrate and measure different network scenarios and their performance behavior.
ITL401.4	Implement the socket programming for client server architecture.
ITL401.5	Analyze the traffic flow of different protocols.
ITL401.6	Design a network for an organization using a network design tool.

ITL402 - UNIX LAB	
Learners will be able to:	
ITL402.1	Understand the architecture and functioning of Unix.
ITL402.2	Identify the Unix general purpose commands.
ITL402.3	Apply Unix commands for system administrative tasks such as file system management and user management.
ITL402.4	Execute Unix commands for system administrative tasks such as process management and memory management.
ITL402.5	Implement basic shell scripts for different applications.
ITL402.6	Implement advanced scripts using awk & perl languages and grep, sed, etc. commandsfor performing various tasks.

ITL403 - MICROPROCESSOR LAB	
Learners will be able to:	
ITL403.1	Demonstrate various components and peripheral of computer system.
ITL403.2	Analyze and design combinational circuits.
ITL403.3	Build a program on a microprocessor using arithmetic & logical instruction set of 8086.
ITL403.4	Develop the assembly level programming using 8086 loop instruction set.
ITL403.5	Write programs based on string and procedure for 8086 microprocessor.
ITL403.6	Design interfacing of peripheral devices with 8086 microprocessor.

ITL404 - PYTHON LAB (SBL)	
Learners will be able to:	
ITL404.1	Understand the structure, syntax, and semantics of the Python language.
ITL404.2	Interpret advanced data types and functions in python.
ITL404.3	Illustrate the concepts of object-oriented programming as used in Python.
ITL404.4	Create Python applications using modules, packages, multithreading and exception handling.
ITL404.5	Gain proficiency in writing File Handling programs ,also create GUI applications and evaluate database operations in python.
ITL404.6	Design and Develop cost-effective robust applications using the latest Python trends and technologies.
ITM401 - MINI PROJECT – 1 B FOR PYTHON BASED AUTOMATION PROJECTS	
Learners will be able to:	
ITM401.1	Identify problems based on societal /research needs.
ITM401.2	Apply Knowledge and skill to solve societal problems in a group.
ITM401.3	Develop interpersonal skills to work as member of a group or leader.

ITM401.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
ITM401.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
ITM401.6	Use standard norms of engineering practices .
ITM401.7	Excel in written and oral communication.
ITM401.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
ITM401.9	Demonstrate project management principles during project work.

T.E. Sem V (R2016): Course Outcomes
ITC501 - MICROCONTROLLER AND EMBEDDED PROGRAMMING

Learners will be able to:	
ITC501.1	Explain the embedded system concepts and architecture of embedded system.
ITC501.2	Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontroller.
ITC501.3	Design the interfacing for 8051 microcontroller.
ITC501.4	Understand the concepts of ARM architecture.
ITC501.5	Demonstrate the open source RTOS and solve the design issues for the same.
ITC501.6	Select elements for an embedded systems tool.

ITC502 - INTERNET PROGRAMMING

Learners will be able to:	
ITC502.1	Implement interactive web page(s) using HTML,CSS and JavaScript.
ITC502.2	Design a responsive web site using HTML5 and CSS3.
ITC502.3	Demonstrate Rich Internet Application.
ITC502.4	Build Dynamic web site using server side PHP Programming and Database connectivity.
ITC502.5	Describe and differentiate different Web Extensions and Web Services.
ITC502.6	Demonstrate web application using Python web Framework-Django.

ITC503 - ADVANCED DATA MANAGEMENT TECHNOLOGY

Learners will be able to:	
ITC503.1	Explain and understand the concept of a transaction and how ACID properties are maintained when concurrent transaction occur in a database.
ITC503.2	Measure query costs and design alternate efficient paths for query execution.
ITC503.3	Apply sophisticated access protocols to control access to the database.
ITC503.4	Implement alternate models like Distributed databases and Design applications using advanced models like mobile, spatial databases.
ITC503.5	Organize strategic data in an enterprise and build a data Warehouse.
ITC503.6	Analyze data using OLAP operations so as to take strategic decisions.

ITC504 - CRYPTOGRAPHY & NETWORK SECURITY

Learners will be able to:	
ITC504.1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
ITC504.2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.

ITC504.3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
ITC504.4	Apply different digital signature algorithms to achieve authentication and create secure applications.
ITC504.5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
ITC504.6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.

ITL501 -   INTERNET PROGRAMMING LAB

Learners will be able to:	
ITL501.1	Design a basic web site using HTML5 and CSS3 to demonstrate responsive web design.
ITL501.2	Implement dynamic web pages with validation using JavaScript objects by applying different event handling mechanism.
ITL501.3	Use AJAX Programming Technique to develop RIA.
ITL501.4	Develop simple web application using server side PHP programing and Database Connectivity using MySQL.
ITL501.5	Build well-formed XML Document and implement Web Service using Java.
ITL501.6	Demonstrate simple web application using Python Django Framework.

ITL502 - SECURITY LAB

Learners will be able to:	
ITL502.1	Apply the knowledge of symmetric cryptography to implement simple ciphers.
ITL502.2	Analyze and implement public key algorithms like RSA and El Gamal.
ITL502.3	Analyze and evaluate performance of hashing algorithms.
ITL502.4	Explore the different network reconnaissance tools to gather information about networks.
ITL502.5	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.
ITL502.6	Apply and set up firewalls and intrusion detection systems using open source technologies and to explore email security.

ITL503 -   OLAP LAB

Learners will be able to:	
ITL503.1	Implement simple query optimizers and design alternate efficient paths for query execution.
ITL503.2	Simulate the working of concurrency protocols, recovery mechanisms in a database.
ITL503.3	Design applications using advanced models like mobile, spatial databases.
ITL503.4	Implement a distributed database and understand its query processing and transaction processing mechanisms.
ITL503.5	Build a data warehouse.
ITL503.6	Analyze data using OLAP operations so as to take strategic decisions.

ITL504 -   IOT (MINI PROJECT) LAB

Learners will be able to:	
ITL504.1	Identify the requirements for the real world problems.
ITL504.2	Conduct a survey of several available literatures in the preferred field of study.

ITL504.3	Study and enhance software/ hardware skills.
ITL504.4	Demonstrate and build the project successfully by hardware requirements, coding, emulating and testing.
ITL504.5	To report and present the findings of the study conducted in the preferred domain.
ITL504.6	Demonstrate an ability to work in teams and manage the conduct of the research study.

ITL505 - BUSINESS COMMUNICATION AND ETHICS	
Learners will be able to:	
ITL505.1	Design a technical document using precise language, suitable vocabulary and apt style.
ITL505.2	Develop the life skills/ interpersonal skills to progress professionally by building stronger relationships.
ITL505.3	Demonstrate awareness of contemporary issues knowledge of professional and ethical responsibilities.
ITL505.4	Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP.
ITL505.5	Deliver formal presentations effectively implementing the verbal and non-verbal skills.
ITDLO5011 - ADVANCED DATA STRUCTURES & ANALYSIS OF ALGORITHMS	
Learners will be able to:	
ITDLO5011.1	Choose appropriate advanced data structure for given problem.
ITDLO5011.2	Calculate complexity.
ITDLO5011.3	Select appropriate design techniques to solve real world problems.
ITDLO5011.4	Apply the dynamic programming technique to solve the problems.
ITDLO5011.5	Apply the greedy programming technique to solve the problems.
ITDLO5011.6	Select a proper pattern matching algorithm for given problem.
ITDLO5013 - E-COMMERCE	
Learners will be able to:	
ITDLO5013.1	Define and differentiate various types of E-commerce
ITDLO5013.2	Describe Hardware and Software Technologies for E-commerce
ITDLO5013.3	Explain payment systems for E -commerce
ITDLO5013.4	Describe the process of Selling and Marketing on web
ITDLO5013.5	Define and Describe E-business and its Models
ITDLO5013.6	Discuss various E-business Strategies
T.E. Sem VI (R2016): Course Outcomes ITC601 - SOFTWARE ENGINEERING WITH PROJECT MANAGEMENT	
Learners will be able to:	
ITC601.1	Define various software application domains and remember different process model used in software development
ITC601.2	Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques

ITC601.3	Convert the requirements model into the design model and demonstrate use of software and user-interface design principles
ITC601.4	Distinguish among SCM and SQA and can classify different testing strategies and tactics and compare them
ITC601.5	Justify role of SDLC in Software Project Development and they can evaluate importance of Software Engineering in PLC
ITC601.6	Generate project schedule and can construct, design and develop network diagram for different type of Projects. They can also organize different activities of project as per Risk impact factor

ITC602 - DATA MINING AND AND BUSINESS INTELLIGENCE

Learners will be able to:	
ITC602.1	Demonstrate an understanding of the importance of data mining and the principles of business intelligence
ITC602.2	Organize and Prepare the data needed for data mining using pre preprocessing techniques
ITC602.3	Perform exploratory analysis of the data to be used for mining.
ITC602.4	Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
ITC602.5	Define and apply metrics to measure the performance of various data mining algorithms.
ITC602.6	Apply BI to solve practical problems : Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

ITL603 - CLOUD COMPUTING & SERVICES

Learners will be able to:	
ITL603.1	Define Cloud Computing and memorize the different Cloud service and deployment models
ITL603.2	Describe importance of virtualization along with their technologies.
ITL603.3	Use and Examine different cloud computing services.
ITL603.4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing.
ITL603.5	Describe the key components of Amazon web Service.
ITL603.6	Design & develop backup strategies for cloud data based on features.

ITC604 - WIRELESS NETWORK

Learners will be able to:	
ITC604.1	Explain the basic concepts of wireless network and wireless generations.
ITC604.2	Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc
ITC604.3	Appraise the importance of Ad-hoc networks such as MANET and VANET and Wireless Sensor networks
ITC604.4	Describe and judge the emerging wireless technologies standards such as WLL,WLAN, WPAN, WMAN.
ITC604.5	Explain the design considerations for deploying the wireless network infrastructure.

ITC604.6	Differentiate and support the security measures, standards. Services and layer wise security considerations.

ITL601 - SOFTWARE DESIGN LAB

Learners will be able to:	
ITL601.1	Sketch a Modeling with UML.
ITL601.2	Deploy Structural Modeling.
ITL601.3	Deploy Behavioural Modeling.
ITL601.4	Deploy Architectural Modeling.
ITL601.5	Examine estimation about schedule and cost for project development.
ITL601.6	Select project development tool.

ITL602 - BUSINESS INTELLIGENCE LAB

Learners will be able to:	
ITL602.1	Identify sources of Data for mining and perform data exploration
ITL602.2	Organize and prepare the data needed for data mining algorithms in terms of attributes and class inputs, training, validating, and testing files.
ITL602.3	Implement the appropriate data mining methods like classification, clustering or association mining on large data sets using open source tools like WEKA
ITL602.4	Implement various data mining algorithms from scratch using languages like Python/ Java etc.
ITL602.5	Evaluate and compare performance of some available BI packages
ITL602.6	Apply BI to solve practical problems : Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

ITL603 - CLOUD SERVICE DESIGN LAB

Learners will be able to:	
ITL603.1	Define & implement Virtualization using different types of Hypervisors
ITL603.2	Describe steps to perform on demand Application delivery using Ulteo .
ITL603.3	Examine the installation and configuration of Open stack cloud
ITL603.4	Analyze and understand the functioning of different components involved in Amazon web services cloud platform.
ITL603.5	Describe the functioning of Platform as a Service
ITL603.6	Design & Synthesize Storage as a service using own Cloud

ITL604 - SENSOR NETWORK LAB

Learners will be able to:	
ITL604.1	Identify the requirements for the real world problems.
ITL604.2	Conduct a survey of several available literatures in the preferred field of study.
ITL604.3	Study and enhance software/ hardware skills.
ITL604.4	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.
ITL604.5	To report and present the findings of the study conducted in the preferred domain
ITL604.6	Demonstrate an ability to work in teams and manage the conduct of the research study.

ITM605 - MINI-PROJECT

Learners will be able to:	
ITM605.1	Discover potential research areas in the field of IT

ITM605.2	Conduct a survey of several available literature in the preferred field of study
ITM605.3	Compare and contrast the several existing solutions for research challenge
ITM605.4	Demonstrate an ability to work in teams and manage the conduct of the research study.
ITM605.5	Formulate and propose a plan for creating a solution for the research plan identified
ITM605.6	To report and present the findings of the study conducted in the preferred domain

ITDLO6023 -   DIGITAL FORENSICS

Learners will be able to:	
ITDLO6023.1	Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
ITDLO6023.2	Underline the need of digital forensic and role of digital evidences.
ITDLO6023.3	Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.
ITDLO6023.4	Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.
ITDLO6023.5	Apply the knowledge of IDS to secure network and performing router and network analysis
ITDLO6023.6	List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.

B.E. Sem VII (R2016): Course Outcomes
ITC701 -   ENTERPRISE NETWORK DESIGN

Learners will be able to:	
ITC701.1	Understand the customer requirements and Apply a Methodology to Network Design.
ITC701.2	Structure and Modularize the Network.
ITC701.3	Design Basic Campus and Data Center Network.
ITC701.4	Design Remote Connectivity.
ITC701.5	Design IP Addressing and Select suitable Routing Protocols for the Network.
ITC701.6	Compare Openflow controllers and switches with other enterprise networks.

ITC702 -   INFRASTRUCTURE SECURITY

Learners will be able to:	
ITC702.1	Understand the concept of vulnerabilities, attacks and protection mechanisms.
ITC702.2	Analyze and evaluate software vulnerabilities and attacks on databases and operating systems.
ITC702.3	Explain the need for security protocols in the context of wireless communication.
ITC702.4	Understand and explain various security solutions for Web and Cloud infrastructure.
ITC702.5	Understand, and evaluate different attacks on Open Web Applications and Web services.
ITC702.6	Design appropriate security policies to protect infrastructure components.

ITC703 -   ARTIFICIAL INTELLIGENCE

Learners will be able to:	
ITC703.1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
ITC703.2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.

ITC703.3	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
ITC703.4	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
ITC703.5	Formulate and solve problems with uncertain information using Bayesian approaches.
ITC703.6	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

ITDL07032 -   MOBILE APPLICATION DEVELOPMENT

Learners will be able to:	
ITDL07032.1	Describe Android platform, Architecture and features.
ITDL07032.2	Design User Interface and develop activity for Android App.
ITDL07032.3	Use Intent , Broadcast receivers and Internet services in Android App.
ITDL07032.4	Design and implement Database Application and Content providers.
ITDL07032.5	Use multimedia, camera and Location based services in Android App.
ITDL07032.6	Discuss various security issues in Android platform.

ITDLO7035 -   SOFT COMPUTING

Learners will be able to:	
ITDLO7035.1	List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.
ITDLO7035.2	Explain the concepts and meta-cognitive of soft computing.
ITDLO7035.3	Apply Soft computing techniques the solve character recognition, pattern classification, regression and similar problems.
ITDLO7035.4	Outline facts to identify process/procedures to handle real world problems using soft computing.
ITDLO7035.5	Evaluate various techniques of soft computing to defend the best working solutions.
ITDLO7035.6	Describe Electromagnetic Radiation and propagation of waves.

ILO7013 -   MANAGEMENT INFORMATION SYSTEM

Learners will be able to:	
ILO7013.1	Explain how information systems Transform Business.
ILO7013.2	Identify the impact information systems have on an organization.
ILO7013.3	Describe IT infrastructure and its components and its current trends.
ILO7013.4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making.
ILO7013.5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.

ILO7015 -   OPERATIONS RESEARCH

Learners will be able to:	

ILO7015.1	Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
ILO7015.2	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
ILO7015.3	Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
ILO7015.4	Understand the applications of integer programming and a queuing model and compute important performance measures

ILO7016 -   CYBER SECURITY AND LAWS

Learners will be able to:	
ILO7016.1	Understand the concept of cybercrime and its effect on outside world.
ILO7016.2	Interpret and apply IT law in various legal issues.
ILO7016.3	Distinguish different aspects of cyber law.
ILO7016.4	Apply Information Security Standards compliance during software design and development.

ITL701 -   NETWORK DESIGN LAB

Learners will be able to:	
ITL701.1	Understand the requirements of an enterprise and outline its major design areas.
ITL701.2	Identify functional areas to construct high level modules for enterprise architecture and analyze them.
ITL701.3	Identify the networking devices, prepare a bill of materials and configure the devices as per the Core, Acess and Distribution layers.
ITL701.4	Design the Server Farm for an enterprise network and discuss up gradations if needed.
ITL701.5	Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.
ITL701.6	Test and monitor the enterprise network using a tool.

ITL702 -   ADVANCE SECURITY LAB

Learners will be able to:	
ITL702.1	Implement and analyze program and database vulnerabilities Buffer overflow and SQL Injection.
ITL702.2	Explore and analyze different security tools to secure mobile devices, web browser, wireless network and router.
ITL702.3	Explore reconnaissance, attack and forensics tools in Kali Linux.
ITL702.4	Learn security of system using personal firewall installation.
ITL702.5	Understand AAA using RADUIS.
ITL702.6	Understand AAA using TACACS.

ITL703 - INTELLIGENCE SYSTEM LAB

Learners will be able to:	
ITL703.1	Design the building blocks of an Intelligent Agent using PEAS representation.
ITL703.2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
ITL703.3	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
ITL703.4	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
ITL703.5	Formulate and solve problems with uncertain information using Bayesian approaches.
ITL703.6	Apply concept Natural Language processing and cognitive computing for creation of domain specific ChatBots.

ITL704 - ANDROID APPS DEVELOPMENT LAB

Learners will be able to:	
ITL704.1	Experiment on Integrated Development Environment for Android Application Development.
ITL704.2	Design and Implement User Interfaces and Layouts of Android App.
ITL704.3	Use Intents for activity and broadcasting data in Android App.
ITL704.4	Design and Implement Database Application and Content Providers.
ITL704.5	Experiment with Camera and Location Based service.
ITL704.6	Develop Android App with Security features.

ITM705 - PROJECT - I

Learners will be able to:	
ITM705.1	Discover potential research areas in the field of IT
ITM705.2	Conduct a survey of several available literature in the preferred field of study
ITM705.3	Compare and contrast the several existing solutions for research challenge
ITM705.4	Demonstrate an ability to work in teams and manage the conduct of the research study.
ITM705.5	Formulate and propose a plan for creating a solution for the research plan identified
ITM705.6	To report and present the findings of the study conducted in the preferred domain

B.E. Sem VIII (R2016): Course Outcomes
ITC801 - BIG DATA ANALYTICS

Learners will be able to:	
ITC801.1	Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
ITC801.2	Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.
ITC801.3	Implement several Data Intensive tasks using the Map Reduce Paradigm.
ITC801.4	Apply several newer algorithms for Clustering Classifying and finding associations in Big Data

| ITC801.5 | Design algorithms to analyze Big data like streams, Web Graphs and Social Media data. |
| ITC801.6 | Design and implement successful Recommendation engines for enterprises. |

ITC802 - INTERNET OF EVERYTHING

Learners will be able to:	
ITC802.1	Apply the concepts of IOT.
ITC802.2	Identify the different technology.
ITC802.3	Apply IOT to different applications.
ITC802.4	Analysis and evaluate protocols used in IOT.
ITC802.5	Design and develop smart city in IOT.
ITC802.6	Analysis and evaluate the data received through sensors in IOT.

ITDLO8041 - USER INTERACTION DESIGN

Learners will be able to:	
ITDLO8041.1	Students will be able to identify and criticize bad features of interface designs.
ITDLO8041.2	Students will be able to predict good features of interface designs.
ITDLO8041.3	Students will be able to illustrate and analyze user needs and formulate user design specifications.
ITDLO8041.4	Students will be able to interpret and evaluate the data collected during the process.
ITDLO8041.5	Students will be able to evaluate designs based on theoretical frameworks and methodological approaches.
ITDLO8041.6	Students will be able to produce/show better techniques to improve the user interaction design interfaces.

ILO8021 - PROJECT MANAGEMENT

Learners will be able to:	
ILO8021.1	Apply selection criteria and select an appropriate project from different options.
ILO8021.2	Write work break down structure for a project and develop a schedule based on it.
ILO8021.3	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
ILO8021.4	Use Earned value technique and determine & predict status of the project.
ILO8021.5	Capture lessons learned during project phases and document them for future reference.

ITL801- BIG DATA LAB

Learners will be able to:	
ITL801.1	Demonstrate capability to use Big Data Frameworks like Hadoop.
ITL801.2	Program applications using tools like Hive, pig, , NO SQL and MongoDB for Big data Applications.
ITL801.3	Construct scalable algorithms for large Datasets using Map Reduce techniques.
ITL801.4	Implement algorithms for Clustering, Classifying and finding associations in Big Data.
ITL801.5	Design and implement algorithms to analyze Big data like streams, Web Graphs and Social Media data and construct recommendation systems.

| ITL801.6 | Apply the knowledge of Big Data gained to fully develop a BDA applications for real life applications. |

ITL802 - INTERNET OF EVERYTHING LAB

Learners will be able to:	
ITL802.1	To learn different types of sensors from Motes families.
ITL802.2	To design the problem solution as per the requirement analysis done using Motes sensors.
ITL802.3	To study the basic concepts of programming/sensors/ emulator like cooja etc.
ITL802.4	To design and implement the mini project intended solution for project based learning.
ITL802.5	To build and test the mini project successfully.
ITL802.6	To improve the team building, communication and management skills of the students.

ITL803 - DevOps LAB

Learners will be able to:	
ITL803.1	Remember the importance of DevOps tools used in software development life cycle.
ITL803.2	Understand the importance of Jenkins to Build, Deploy and Test Software Applications.
ITL803.3	Examine the different Version Control strategies.
ITL803.4	Analyze & Illustrate the Containerization of OS images and deployment of applications over Docker.
ITL803.5	Summarize the importance of Software Configuration Management in DevOps.
ITL803.6	Synthesize the provisioning using Chef/Puppet/Ansible or Saltstack.

ITL804 - R PROGRAMMING LAB

Learners will be able to:	
ITL804.1	Install and use R for simple programming tasks.
ITL804.2	Extend the functionality of R by using add-on packages.
ITL804.3	Extract data from files and other sources and perform various data manipulation tasks on them.
ITL804.4	Code statistical functions in R.
ITL804.5	Use R Graphics and Tables to visualize results of various statistical operations on data.
ITL804.6	Apply the knowledge of R gained to data Analytics for real life applications.

ITM805 - PROJECT II

Learners will be able to:	
ITM805.1	Discover potential research areas in the field of IT.
ITM805.2	Conduct a survey of several available literature in the preferred field of study.
ITM805.3	Compare and contrast the several existing solutions for research challenge.
ITM805.4	Demonstrate an ability to work in teams and manage the conduct of the research study.
ITM805.5	Formulate and propose a plan for creating a solution for the research plan identified.
ITM805.6	To report and present the findings of the study conducted in the preferred domain.