Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai – 50.

2.6.1. Programme and Course outcomes for all programmes offered by the Institute are stated and displayed on website and communicated to teachers and students.

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Fr. Conceicao Rodrigues College of Engineering
Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
First Year Engineering

CO NUM	COURSE OUTCOME
	SEMESTER - 1
FEC101	**Engineering Mathematics - I**
FEC101.1	Use the concept of rank of matrix to solve the given system of homogeneous and non-homogeneous linear equations
FEC101.2	Apply Numerical Methods to solve the given system of equations.
FEC101.3	Apply the basic concepts of Complex numbers, obtain roots of complex numbers using De Moivre's theorem and also real and imaginary parts of a given complex number
FEC101.4	Find the nth derivative of a given function using Leibnitz's theorem [Successive differentiation]
FEC101.5	Use partial differentiation to obtain the extremum value of the given function of two or three variables
FEC102	**Engineering Physics - I**
FEC102.1	Illustrate the fundamentals of Quantum mechanics and its application.
FEC102.2	Illustrate the knowledge of Crystal planes, X-ray diffraction and its application.
FEC102.3	Illustrate the knowledge of Fermi level in semiconductors and applications of semiconductors in electronic devices.
FEC102.4	Illustrate the knowledge of Interference in thin films and its various applications
FEC102.5	Illustrate the basic knowledge of Superconductors and super capacitors.
FEC103	**Engineering Chemistry - I**
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 polymers, fabrication methods, conducting polymers in variousindustrial fields.
FEC103.4	interpret various phase transformations using thermodynamics
FEC103.5	Illustrate the knowledge of polymers, fabrication methods, conducting polymers in variousindustrial fields.
FEC103.6	Analyze the quality of water and suggest suitable methods of treatment.

FEC104	**Engineering Mechanics**
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 & Electronics Engineering**
FEC105.1	Apply various network theorems to determine the circuit response/behavior.
FEC105.2	Evaluate and analyze single phase AC circuit.
FEC105.3	Analyze three phase circuit.
FEC105.4	Explain the constructional features and operation of single phase Transformer.
FEC105.5	Illustrate the working principle of single phase and three phase machines.
FEL103	**ENGINEERING MECHANICS LAB**
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...
	SEMESTER- 2
FEC201	**Engineering Mathematics-II**
FEC201.1	Solve first order and higher order differential Equations
FEC201.2	Apply Beta-Gamma functions to solve integration problems.
FEC201.3	Rectify the given curve using Cartesian, polar form)
FEC201.4	Apply the concept of multiple integrals to find area of the given region.
FEC202	**Engineering Physics-II**

FEC202.1	Illustrate the knowledge of diffraction through slits and its applications.
FEC202.2	Explain working principle of various lasers and their applications in different fields, the concepts of optical fibre and its applications in communication system.
FEC202.3	Describe fundamentals of electrodynamics with required mathematical concepts.
FEC202.4	Explain fundamentals of relativity.
FEC202.5	Discuss knowledge of synthesis, characterisation and applications of nonmaterials
FEC203	**Engineering Chemistry -II**
FEC203.1	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
FEC203.2	Explain the concept of electrode potential and nernst theory and relate it to electrochemical cells.
FEC203.3	Identify different types of corrosion and suggest control measures in industries.
FEC203.4	Illustrate the principles of green chemistry and study environmental impact
FEC203.5	Explain the knowledge of determining the quality of fuel and quantify the oxygen required for combustion of fuel
FEC204	**Engineering Graphics**
FEC204.1	Learners will be able to apply the basic principles of projections in Projection of Lines and Planes
FEC204.2	Learners will be able to apply the basic principles of projections in Projection of Solids.
FEC204.3	Learners will be able to apply the basic principles of sectional views in Section of solids.
FEC204.4	Learners will be able to apply the basic principles of projections in converting 3D view to 2D drawing.
FEC204.5	Learners will be able to read a given drawing.
FEC204.6	Learners will be able to visualize an object from the given two views
FEC205	**C-Programming**
FEC205.1	Formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language
FEC205.2	Implement, test and execute programs comprising of control structures.
FEC205.3	Decompose a problem into functions and synthesize a complete program.
FEC205.4	Demonstrate the use of arrays, strings and structures in C language.
FEC205.5	Understand the concept of pointers
FEC206	**Professional Communication and Ethics 1**

FEC206.1	Effectively use their LSRW skills in the communication process
FEC206.2	To structure Business correspondences
FEC206.3	To expand their vocabulary in correct grammatical form
FEC206.4	To comprehend and summarize technical and industry-oriented passages
FEC206.5	To write technical expositions
FEL105 & FEL206	**BASIC WORKSHOP PRACTICE 1 & 2**
FEL105.1/206.1	Students will be able to develop the necessary skill required to handle/use different fitting tools.
FEL105.2/206.2	Students will be able to develop skill required for hardware maintenance.
FEL105.3/206.3	Students will be able to install an operating system and system drives.
FEL105.4/206.4	Students will be able to identify the network components and perform basic networking and crimping.
FEL105.5/206.5	Students will be able to demonstrate the turning operation with the help of a simple job.
FEL105.6/206.6	Students will be able to develop the necessary skill required to handle/use different carpentry tools.
FEL105.7/206.7	Students will be able to identify and understand the safe practices to adopt in electrical environment.
FEL105.8/206.8	Students will be able to demonstrate the wiring practices for the connection of simple electrical load/ equipment.
FEL105.9/206.9	Students will be able to design, fabricate and assemble pcb.
FEL105.10/206.10	Develop the necessary skill required to use different sheet metal and brazing tools.

Fr. Conceicao Rodrigues College of Engineering
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Department of Computer Engineering

CO NUM	COURSE OUTCOME
	SEMESTER 3
CSC301	**Applied Maths III SE COMPS A&B**
CSC301.1	Obtain Laplace Transform of given functions and also evaluate the integral (in standard form) using Laplace Transform
CSC301.2	Obtain inverse Laplace Transform of given functions
CSC301.3	Expand the given periodic function in terms of sine and cosine terms in the given interval
CSC301.4	Construct the analytic function and also determine the orthogonal trajectories of the given family of curves
CSC301.5	Obtain the best estimate for the dependent variable using regression lines and determine the trend between the given aspects
CSC301.6	Able to apply Bayes' theorem to practical problems and also obtain mean, variance and higher order moments of random variables
CSC303	**Discrete Structures and Graph Theory SE COMPS A & B**
CSC303.1	Ability to reason logically
CSC303.2	Ability to explain relations, functions, Diagraph and Lattice
CSC303.3	Ability to apply concepts of graph theory in solving real world problems. (Apply)
CSC303.4	Demonstrate use of groups and codes in Encoding-Decoding (Analyze)
CSC303.5	Analyze a complex computing problem to find solution using principles of discrete mathematics (Analyze)
CSC 303	**Data Structures SE COMPS A & B**
CSC 303.1	Implement various linear data structures.(APPLY)
CSC 303.2	Implement various non linear data structures.(APPLY)
CSC 303.3	Implement appropriate searching technique for a given problem (Apply)
CSC 303.4	Choose appropriate data structure and apply it to solve problems in various domains (Apply)
CSC 304	**Digital Logic and Computer Architectures Organisation SE COMPS A & B**
CSC 304.1	To learn different number systems and basic structure of computer system.
CSC 304.2	To demonstrate the arithmetic algorithms.
CSC 304.3	To understand the basic concepts of digital components and processor organization.

CSC 304.4	To understand the generation of control signals of computer.
CSC 304.5	To demonstrate the memory organization.
CSC 304.6	To describe the concepts of parallel processing and different Buses.
CSC305	**Computer Graphics SE COMPS A & B**
CSC305.1	Compute pixel positions along the given graphics output primitive.
CSC305.2	Apply transformations on graphical objects in 2-D and 3-D space.
CSC305.3	Apply clipping algorithms on 2-D graphical objects.
CSC305.4	Explain Viewing and Modelling techniques used in 2-D & 3-D space.
CSC305.5	Explain visible surface detection techniques applied to 3-D space.
CSL304	**Object Oriented Programming Methodology SE COMPS A & B**
CSL304.1	To apply fundamental programming constructs
CS L304.2	To illustrate the concept of packages, classes and objects
CS L304.3	To elaborate the concept of strings , arrays and vectors
CS L304.4	To implement the concept of inheritance and interfaces
CS L304.5	To implement the concept of exception handling and multithreading
CS L304.6	To develop GUI based application
CS L304.7	Devloped read world application using libraries/GUI,Database in java
CSM301	**Mini Project SE COMPS A & B**
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 a member of a group or leader.
CSM301.4	Use standard norms of engineering practices
CSM301.5	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CSM301.6	Excel in written and oral communication
	SEMESTER 4
CSM 401	**MINI Project SE COMPS A & B**
CSM 401.1	Demonstrate project management principles during project work to deliver succesful projects
CSM 401.2	Apply the relevant knowledge and skills, which are acquired within the technical area, to a given problem
CSM 401.3	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CSM 401.4	Document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage.
CSC401	**Applied Mathematics IV SE COMPS A & B**

CSC401.1	Demonstrate the basics of complex numbers, and obtain the roots of a complex number using De Movire's theorem and separate the complex number into real and imaginary parts.
CSC402.2	Obtain the nth derivative of a function using successive differentiation.
CSC402.3	Apply partial differentiation technique to obtain the extremum of the given function
CSC401.4	Apply the concepts of matrices to solve the system of linear equations.
CSC401.5	Apply the concept of Numerical Methods for solving engineering problems with the help of SCILAB software.
CSC402	**Analysis of Algorithms SE COMPS A & B**
CSC402.1	Analyze the running time and space complexity of algorithms.
CSC402.2	Analyze the complexity of divide and conquer strategy.
CSC402.3	Analyze the complexity of greedy strategy.
CSC402.4	Analyze the complexity of dynamic programming strategy.
CSC402.5	Analyze backtracking, branch and bound strategy.
CSC402.6	Analyze string matching techniques.
CSC403	**Database Management System SE COMPS A & B**
CSC403.1	Recognize the need of database management system
CSC403.2	Design and draw ER and EER diagram for the real life problem.
CSC403.3	Construct relational model and write relational algebra queries.
CSC403.4	Formulate SQL queries
CSC403.5	Analyze and apply concepts of normalization to relational database design.
CSC403.6	Describe and apply the concept of transaction, concurrency and recovery.
CSC404	**Operating System SE COMPS A & B**
CSC404.1	Describe the objectives, functions and structure of OS
CSC404.2	Analyze the concept of process management and evaluate performance of process Scheduling algorithms.
CSC404.3	Apply the concepts of synchronization and deadlocks
CSC404.4	Evaluate performance of Memory allocation and replacement policies
CSC404.5	Describe the concepts of file management.
CSC404.6	Apply concepts of I/O management and analyze techniques of disk scheduling.
CSC405	**Microprocessor SE COMPS A & B**
CSC405.1	Describe core concepts of 8086 microprocessor
CSC405.2	Apply the instructions of 8086 and write assembly language programs
CSC405.3	Design 8086 based system using memory and peripheral chips.
CSC405.4	Appraise the architecture of advanced processors
CSL405	**Open Source Technology Lab SE COMPS A & B**

CSL405.1	Demonstrate basic concepts of python such as control statements, basic data structures,functions, oops and multithreading in python.
CSL405.2	Explore file handling and text processing in python
CSL405.3	Develop program for data structure using built in functions in python.
CSL405.4	Develop python based GUI and Explore networking concepts.
CSL405.5	Develop real world application using frameworks/libraries in python
	SEMESTER 5
CSC501	**Theoretical Computer science TE COMPS A & B**
CSC501.1	Identify the central concepts in theory of computation and differentiate between deterministic and non deterministic automata, also obtain equivalence between NFA and DFA [Application/Analysis]
CSC501.2	Infer the equivalence of languages described by finite automata and regular expressions.[Comprehension]
CSC501.3	Devise regular, context free grammars while recognizing the strings and tokens [Synthesis]
CSC501.4	Design pushdown automata to recognize the language.[Synthesis]
CSC501.5	Develop an understanding of computation through Turing Machine. [Synthesis]
CSC501.6	Acquire fundamental understanding of decidability and undecidability. [Knowledge]
CPC502	**Software Enggineering TE COMPS A**
CPC502.1	Recognize software requirements and various process models.
CPC502.2	Develop project Plan, schedule and track the progress of the given project
CPC502.3	Formulate software project designs of the given project
CPC502.4	Conduct software project testing of the given project.
CPC502.5	Analyze potential risks, implement changes, and ensure software project quality of the given project
CSC502	**Software Enggineering TE COMPS B**
CSC502.1	Identify requirements and assess the process models. (Analyze)
CSC502.2	Plan, schedule and track the progress of the projects.(Apply)
CSC502.3	Design the software projects. (Apply)
CSC502.4	Apply software testing techniques to a selected case study. (Apply)
CSC502.5	Identify risks, manage the change to assure quality in software projects. (Analyze)
CSC503	**Computer Network TE COMPS A & B**
CSC503.1	Comprehend the design issues and enumerate the functions of the different layers of Network Software Models.
CSC503.2	Identify the characteristics of network devices and media used to design network

CSC503.3	Analyze the design issues of Data link layer, Network layer and Transport Layer
CSC503.4	Compare the state-of-the-art network protocols in Data Link Layer, Network Layer and Transport Layer
CSC503.5	Explore protocols at application layer
CSC504	**Data Warehousing and Mining TE COMPS A & B**
CSC504.1	Recognize the need of Data Warehouse and Data Mining principles
CSC504.2	Design data warehouse with dimensional modeling and apply OLAP operations
CSC504.3	Demonstrate data mining principles and perform Data preprocessing and Visualization
CSC504.4	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
CSC504.5	Describe complex data types wrt to special and web mining
CSC504.6	Benefit the user experiences towards research and innovation.
CSDLO5012	**Internet Programming TE COMPS A & B**
CSDLO5012.1	Implement interactive web page(s) using HTML and CSS.
CSDLO5012.2	Design a responsive web site using JavaScript and demonstrate database connectivity using JDBC.
CSDLO5012.3	Demonstrate Rich Internet Application using Ajax and demonstrate various web extensions
CSDLO5012.4	Demonstrate web application using ReactJs
CSL504	**Professional Communication and Ethics-2 TE COMPS A & B**
CSL504 .1	Ability to integrate LSRW skills in business communication effectively
CSL504 .2	Develop Employability skills on vocabulary and grammar
CSL504 .3	Comprehend technical and industry-oriented literature
CSL504 .4	Draft effective business letter and emails
CSL504 .5	Frame well-constructed Technical Expositions
CSM501	**Mini Project A TE COMPS A & B**
CSM501.1	Identify societal/research/innovation/entrepreneurship problems through appropriate literature survey
CSM501.2	Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it
CSM501.3	Validate, Verify the results using test cases/benchmark data/theoretical/ inferences/experiments/simulations
CSM501.4	Use standard norms of engineering practices and project management principles during project work
CSM501.5	Demonstrate the capability of self learning leading to lifelong learning
CSM501.6	Develop interpersonal skills to work as a member of a group or as leader

	SEMESTER 6
CSC601	**System Programmimg and Compiler construction TE COMPS A & B**
CSC601.1	Explain the design of two pass assembler.
CSC601.2	Explain the design of two pass macroprocessor.
CSC601.3	Distinguish between different loaders and linkers schemes.
CSC601.4	Explore analysis phase of the compiler.
CSC601.5	Describe synthesis phase of compiler.
CSC602	**Cryptography and System Security TE COMPS A & B**
CSC602.1	Explain system security goals and its concepts, acquire and apply knowledge on the concepts of modular arithmetic and number theory to classical encryption techniques.
CSC602.2	Describe and compare different techniques for encryption, decryption and, authentication
CSC602.3	. Discuss various hash functions, digital signature algorithms to verify integrity and their cryptanalysis
CSC602.4	Discuss various attacks on network security, and the security protocols.
CSC602.5	Differentiate between various malicious programs.
CSC603	**Mobile Computing TE COMPS A & B**
CSC603.1	Identify basic concepts and principles of mobile computing and cellular architecture.
CSC603.2	Describe the components and functioning of GSM and CDMA architecture.
CSC603.3	To classify variety of security techniques in mobile network
CSC603.4	Describe and apply the concepts of WLAN for local as well as remote applications.
CSC603.5	Describe Long Term Evolution (LTE) architecture and its interfaces.
CSC604	**Artificial Intelligence TE COMPS A & B**
CSC604.1	To grasp the fundamental concepts and methods involved in creating intelligent systems.
CSC604.2	Ability to choose an appropriate problem solving method and knowledge representation technique.
CSC604.3	Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving
CSC604.4	Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
CSC604.5	Ability to design and develop AI applications in real world scenarios
CSL605	**Cloud Computing TE COMPS A & B**

CSL605.1	Implement different types of virtualization techniques.
CSL605.2	Analyze various cloud computing service models and implement them to solve the given problems
CSL605.3	Design and develop real world web applications and deploy them on commercial cloud(s)
CSL605.4	Demonstrate major security issues in the cloud and mechanisms to address them
CSL605.5	Design and develop real world web applications and deploy them on commercial cloud(s)
CSL605.6	Implement the concept of containerization
CSDLO6013/CSDL601	**Quantitative Analysis TE COMPS A & B**
CSDLO6013/CSDL601.1	Recognize the need of Statistics and Quantitative Analysis
CSDLO6013/CSDL601.2	Apply the data collection and the sampling methods.
CSDLO6013/CSDL601.3	Analyze using concepts of Regression, Multiple Linear Regression.
CSDLO6013/CSDL601.4	Formulate Statistical inference drawing methods.
CSDLO6013/CSDL601.5	Apply Testing of hypotheses
CSDLO6011/CSDL602	**Internet of Things TE COMPS A & B**
CSDLO6011/CSDL602.1	Explain the architecture of IoT ,Identify and Analyse the Components of IoT.
CSDLO6011/CSDL602.2	Emphasize core IoT functional Stack and compare the application protocols for IoT
CSDLO6011/CSDL602.3	Apply IoT knowledge to key industries/domains that IoT is revolutionizing
CSDLO6011/CSDL602.4	Compare the various IoT hardware platforms and software platforms used to implement an IoT system.
CSM601	**Mini Project 2B TE COMPS A & B**
CSM601.1	Identify problems through appropriate literature surveys
CSM601.2	Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it
CSM601.3	Validate, Verify the results using test cases
CSM601.4	Analyze and evaluate the impact of solution
CSM601.5	Use standard norms of engineering practices and project management principles during project work
CSM601.6	Communicate through technical report writing and oral presentation
CSM601.7	Gain technical competency towards participation in Competitions, Hackathons, etc.
CSM601.8	Demonstrate capabilities of self-learning, leading to lifelong learning.
CSM601.9	Develop interpersonal skills to work as a member of a group or as leader
	SEMESTER -7
CSC701	**Machine Learning BE COMPS A & B**
CSC701.1	To acquire fundamental knowledge of developing machine learning models.

CSC701.2	To select, apply and evaluate an appropriate machine learning model for the given problem statement
CSC701.3	To demonstrate ensemble techniques to combine predictions from different models.
CSC701.4	To demonstrate the dimensionality reduction techniques.
CSC702	**Big Data Analytics BE COMPS A & B**
CSC702.1	Understand the building blocks of Big Data Analytics.
CSC702.2	Apply fundamental enabling techniques like Hadoop and MapReduce in solving real world problems
CSC702.3	Understand different NoSQL systems and how it handles big data.
CSC702.4	Apply advanced techniques for emerging applications like stream analytics.
CSC702.5	Achieve adequate perspective of big data analytics in various applications like recommender system,social media applications,etc.
CSC702.6	Apply stastical computing techniques and graphics for analyzing big data
ILO7013/CSILO701	**Management Information System (MIS) (Institute level Elective) BE COMPS A & B**
ILO7013/CSILO701.1	Explain how information systems Transform Businesses. (B2 - Comprehensive)
ILO7013/CSILO701.2	Outline the role of the ethical, social, and security issues in managing information systems. (B3 – Analysis)
ILO7013/CSILO701.3	Apply the principal tools and technologies for accessing information from data sources to improve business performance and decision making. (B3 – Analysis)
ILO7013/CSILO701.4	Illustrate the impact of social media on businesses, including marketing and customer engagement. (B3 – Analysis)
ILO7013/CSILO701.5	Compare the processes of developing and implementing information systems for any business organization. (B3 – Analysis)
CSDC7013	**Natural Language Processing (Department level Elective) BE COMPS A & B**
CSDC7013.1	To describe the field of natural language processing. (Understand)
CSDC7013.2	To design language model for word level analysis for text processing. (Apply)
CSDC7013.3	To design various POS tagging techniques and parsers. (Apply)
CSDC7013.4	To design, implement and test algorithms for semantic and pragmatic analysis. (Apply)
CSDC7013.5	To formulate the discourse segmentation and anaphora resolution. (Apply)
CSDC7013.6	To apply NLP techniques to design real world NLP applications (Apply)
CSDC7022	**Block Chain (Department level Elective) BE COMPS A & B**
CSDC7022.1	Explain Blockchain concepts.
CSDC7022.2	Associate knowledge of consensus and mining in blockchain.
CSDC7022.3	Apply the concepts of smart contact for an application

CSDC7022.4	Explore Hyperledger Fabric and its working
CSDC7022.5	Explain design principles of Ethereum
CSDC7022.6	Analyze various tools of BCT.
ILO7016	**Cybersecurity and Laws (Institute level Elective) BE COMPS A & B**
ILO7016.1	Comprehend the concepts 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
CSP701	**Project 1 BE COMPS A & B**
CSP701.1	Explore a wide range of domain and develop the understanding of the problem.
CSP701.2	Identify and analyze the problem in detail through extensive literature survey to define its scope with problem specific data.
CSP701.3	Apply problem solving approaches studied in various engineering courses and design solutions for problem at hand with positive impact on society and environment.
CSP701.4	Showcase thier oral and written communication skill
CSP701.5	Inculcate professional and ethical behaviour.
	SEMESTER-8
CSC801	**Distributed Computing BE COMPS A & B**
CSC801.1	Identify the need of the basic elements and concepts related to distributed systems & technologies
CSC801.2	Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
CSC801.3	Analyze the various techniques used for clock synchronization and mutual exclusion
CSC801.4	Evaluate the tasks of Resource and Process management, and Fault Tolerance techniques
CSC801.5	Assess the significance of Consistency and Replication Management models
CSC801.6	Apply the knowledge of Distributed File System in building large-scale distributed applications
CSDC8013	**Applied Data Science (department Level Elective) BE COMPS A**
CSDC8013.1	Describe data science process.
CSDC8013.2	Apply data exploration and visualization techniques to a specific problem.
CSDC8013.3	Apply anomaly detection techniques to a specific problem.

CSDC8013.4	Discover essentials of time-series forecasting.
CSDC8013.5	Apply different methodologies and evaluation strategies to a specific problem
CSDC8023	**Social Media Analytics (department Level Elective)- BE COMPS A & B**
CSDC8023.1	Explain the concept of social media
CSDC8023.2	Explain the concept of social media analytics and its significance.
CSDC8023.3	Analyze the effectiveness of social media.
CSDC8023.4	use different tools effectively and efficiently.
CSDC8023.5	Use different effective visualization techniques to represent social media analytics.
ILO8021	**Project Management (Institute Level Elective)-BE COMPS A & B**
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
ILO8022	**Finance Management (Institute Level Elective) - BE COMPS A & B**
ILO8022.1	Gain comprehension of the Indian financial system and corporate finance
ILO8022.2	Make choices regarding investments, finances, and dividend distribution
CSP801	**Project II BE COMPS A & B**
CSP801.1	Implement solutions for the selected problem by applying technical and professional skills.
CSP801.2	Analyze impact of solutions in societal and environmental context for sustainable development.
CSP801.3	Explore and apply various modern tools to solve the chosen problem.
CSP801.4	Develop proficiency in oral and written communication with effective leadership and teamwork.
CSP801.5	Nurture professional and ethical behavior and develop expertise in life-long learning.

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Department of Electronics and Computer Science

CO NUM	COURSE OUTCOME
	SEMESTER 3
ECC 301	**Applied Maths III**
ECC301.1	Apply the concept of Laplace transform to solve the real integrals in engineering problems.
ECC301.2	Apply the concept of inverse Laplace transform of various functions in engineering problems.
ECC301.3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
ECC301.4	Find orthogonal trajectories and analytic function by using basic concepts of complex variables.
ECC301.5	Illustrate the use of matrix algebra to solve the engineering problems.
ECC301.6	Apply the concepts of vector calculus in real life problems.
ECC 302	**Electronic Devices**
ECC 302.1	Explain the working of semiconductor devices
ECC 302.2	Interpret the characteristics of semiconductor devices
ECC 302.3	Analyze electronic circuits using BJT & FET (DC & AC analysis)
ECC 302.4	Compare various biasing circuits & configurations of BJT & MOSFET
ECC 302.5	Select the best circuit for the given specification/application
ECC 302.6	Describe the working of advanced nano-electronic devices
ECC 303	**Digital Electronics**
ECC303.1	Perform code conversion and binary arithmetic.
ECC303.2	Apply Boolean algebra and K-Map for the minimization of logic functions.
ECC303.3	Analyze and design Combinational and Sequential logic circuits using gates, flipflops as well as MSI chips.
ECC303.4	Distinguish between TTL & CMOS logic families w.r.t. their characteristic parameters and will be able to interface the ICs of the two families
ECC303.5	Describe the structure of PLDs, CPLD and FPGA and the concepts of digital design with programmable devices
ECC303.6	Illustrate the use of HDL (Verilog) for designing Digital circuits
ECC 304	**Data Structures and Algorithms**
ECC304.1	Implement various linear an non linear data structures
ECC304.2	Select appropriate sorting and searching techniques for a given problem and use them
ECC304.3	Develop solutions for real world problems by selecting appropriate data structues and algorithms
ECC304.4	Analyze complexity of the given algrithm

ECC 305	**Database Management Systems**
ECC305.1	Recognize the need of database management system
ECC305.2	Design ER and EER diagram for real life applications
ECC305.3	Construct a relational model and write relational algebra queries.
ECC305.4	Formulate SQL queries
ECC305.5	Apply the concept of normalization to relational database design.
ECC305.6	Describe the concepts of transaction, concurrency and recovery.
ECL 301	**Electronic Devices Laboratory**
ECL 301.1	Explain the working of semiconductor devices
ECL 301.2	Interpret the characteristics of semiconductor devices.
ECL 301.3	Analyse electronics circuits using BJT and FET (DC & AC analysis)
ECL 301.4	Simulate basic circuits using electronic devices through software simulation
ECL302	**Digital Electronics Laboratory**
ECL302.1	ECL 302. 1. To describe the functionality of basic logic gates
ECL302.2	ECL 302. 2. To construct combinational and verify their functionality
ECL302.3	ECL 302.3. To describe the functionality of flipflops and their conversions
ECL302.4	ECL 302.4. To design and implement synchronous and asynchronous counters, shift registers
ECL302.5	ECL 302.5. To simulate various combinational and sequential circuits and analyze the results on Verilog HDL
ECL 303	**Data Strcutures and Algorithms Lab**
ECL303.1	Implement linear data structures like stacks queues using arrays and linked list
ECL303.2	Implement non linear data structures like trees and graphs using linked list
ECL303.3	Implement and Compare various searching techniques based on time complexity.
ECL303.4	Implement and Compare various sorting techniques based on time complexity.
ECL 304	**Database Management Systems Lab**
ECL304.1	Design ER /EER diagram and convert it to a relational model for real-world application
ECL304.2	Apply DDL, DML, DCL, and TCL commands and write simple as well as complex queries.
ECL304.3	Implement PL/SQL Constructs.
ECL304.4	Demonstrate the concept of concurrent transaction execution and frontend-backend connectivity.
ECL305	**Skill-base Lab - OOPM: (C++ and Java)**
ECL305.1	Use C++ in programming.
ECL305.2	Use different control structures.

ECL305.3	Understand fundamental features of an object-oriented language: object classes and interfaces,Exceptions and libraries of object collections.
ECL305.4	Understand Java Programming.
ECL305.5	To develop a program that efficiently implements the features and packaging concept of java in the laboratory
ECL305.6	To implement Exception handling and Applets using Java.
ECM301	**Mini-project -1 A**
ECM301.1	Identify problems based on societal /research needs.
ECM301.2	Apply knowledge and skill to solve societal problems in a group.
ECM301.3	Develop interpersonal skills to work as member of a group or leader.
ECM301.4	Draw the proper inferences from available results through theoretical/ experimental/simulations
ECM301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
ECM301.6	Use standard norms of engineering practices
ECM301.7	Excel in written and oral communication.
ECM301.8	Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
ECM301.9	Demonstrate project management principles during project work.
Semester 4	
ECC 401	**Engineering Mathematics - IV**
ECC401.1	Apply the concepts of Complex Integration for evaluating integrals, computing residues & evaluate
ECC401.2	Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science
ECC401.3	Apply the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
ECC401.4	Apply the concept of probability distribution to engineering problems & testing hypothesis of small samples using sampling theory.
ECC401.5	Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem
ECC401.6	Apply the concepts of parametric and nonparametric tests for analyzing practical problems.
ECC 402	**Electronic Circuits**
ECC402.1	Evaluate the performance of amplifiers through frequency response.
ECC402.2	Choose appropriate circuit for the given specifications/applications.
ECC402.3	Choose appropriate circuit for the given specifications/applications.
ECC402.4	Design an application with the use of integrated circuits
ECC 403	**Controls and Instrumentation**

ECC 403.1.	Derive the Transfer of the given control Systems
ECC 403.2.	Analyze the performance of control systems based on the time domain and frequency domain specifications with suitable methods
ECC 403.3.	Analyze the stability of the given control systems using appropriate stability criteria
ECC 403.4.	Explain the working principle of sensors and transducers
ECC 403.5.	Explain various parameters of Data Acquisition Systems
ECC 403.6.	Describe instrument communication standards
ECC 404	**Microprocessors and Microcontrollers**
ECC 404.1	Explain 16-bit Microprocessor architectures and fundamental concepts of Microcontrollers
ECC 404.2	Develop programming skills for Microprocessors and Microcontrollers
ECC 404.3	Interface various peripherals in Microprocessor and Microcontroller systems.
ECC 404.4	Design and implement Microprocessor and Microcontroller based systems.
ECC 405	**Discrete Structures and Automata Theory**
ECC405.1	Perform operations with sets, relations, functions ,graphs and their applications
ECC405.2	Pushdown Automata with an understanding of power and limtations
ECC 405.3	normal forms
ECC405. 4	Apply discrete structures and automata theory concepts to solving real world computing problems in the doman of formal specification ,verification and artificial intelligence
ECL401	**Electronic Circuits Laboratory**
ECL402.1	Experimentally evaluate performance of amplifiers through frequency response.
ECL402.2	Analyze differential amplifiers for various performance parameters
ECL402.3	Implement practically various applications and circuits based on operational amplifiers.
ECL402.4	Design an application with the use of integrated circuits as per the given specifications
ECL402	**Controls and Instrumentation Laboratory**
ECL402.1	To simulate performance of control systems
ECL402.2	To analyse stability of control systems
ECL402.3	To develop the applications of instrumentation systems
ECL 403	**Microprocessors and Microcontrollers Lab**
ECL 403.1	To develop programming skills for Microprocessors and Microcontrollers
ECL 403.2	To interface various devices in Microprocessor and Microcontroller systems
ECL 404	**Skill-base Lab: Python programming**
ECL404.1	Describe syntax and semantics in Python
ECL404.2	Illustrate different file handling opearations

ECL404.3	Interprete Object oriented programming in Python
ECL404.4	Describe GUI Applications in Python
ECL404.5	Express proficiency in handling python libraries for data science
ECL404.6	Develop machine learning aplication using python
ECM 401	**Mini-project -1 B**
ECM301.1	Identify problems based on societal /research needs.
ECM301.2	Apply knowledge and skill to solve societal problems in a group.
ECM301.3	Develop interpersonal skills to work as member of a group or leader.
ECM301.4	Draw the proper inferences from available results through theoretical/ experimental/simulations
ECM301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
ECM301.6	Use standard norms of engineering practices
ECM301.7	Excel in written and oral communication.
ECM301.8	Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
ECM301.9	Demonstrate project management principles during project work.
Semester 5	
ECC 501	**Communication Engineering**
ECC501.1	Analyse various noise parameters and analog modulation methods.
ECC501.2	Explain various pulse modulation techniques.
ECC501.3	Evaluate the impact of Inter Symbol Interference in Baseband transmission and methods to mitigate its effect.
ECC501.4	Derive performance parameters of Digital modulation methods.
ECC501.5	Analyse the characteristics of radio receivers.
ECC 502	**Computer Organization and Architecture**
ECC 502.1	Define the performance metrics of a Computer
ECC 502.2	Explain the design considerations of Processor, Memory and I/O in Computer systems
ECC 502.3	Interpret the objectives and functions of an Operating System
ECC 502.4	Analyse the concept of process management and evaluate performance of process scheduling algorithms
ECC 502.5	Evaluate the advantages and limitations of Parallelism in systems
ECC 502.6	Discuss the various architectural enhancements in modern processors
ECC 503	**Software Engineering**
ECC 503.1	Apply software engineering concept and choose process models for a software project development
ECC 503.2	Analyse and specify software requirement specification (SRS) for software system

ECC 503.3	Convert requirement model into the design model and demonstrate the use of software and userinterface design principles
ECC 503.4	Generate the project schedule and estimate the cost of software system
ECC 503.5	Identify risks and prepare RMMM plan for quality software system
ECC 503.6	Apply testing strategies and tactics for software system
ECC 504	**Web Technologies**
ECC 504.1	Design static web pages using HTML5.
ECC 504.2	Design the layout of web pages using CSS3
ECC 504.3	Apply the concepts of client-side validation and scripts to static web pages using JavaScript and JQuery
ECC 504.4	Build responsive web pages using front-end framework Bootstrap
ECC 504.5	Build dynamic web pages using server -side scripting
ECC 504.6	Develop a web application using appropriate web development framework
ECC DO501	**Software Testing and Quality Assurance**
ECC DO501.1	Analyse the systems using the principles of software testing to prevent and remove bugs
ECC DO501.2	Apply different software testing methods and strategies
ECC DO501.3	Manage the test processes
ECC DO501.4	Apply the software testing techniques in the commercial environment
ECC DO501.5	Use the knowledge of quality attributes in software testing
ECL 501	**Communication Engineering Lab**
ECL501.1	Implement and analyze various analog modulation methods.
ECL501.2	Illustrate generation and detection of various pulse modulation techniques.
ECL501.3	Apply techniques to insert Inter Symbol Interference and methods to mitigate its effect.
ECL501.4	Simulate various digital modulation methods.
ECL501.5	Illustrate the effect of sampling frequency on the reconstructed signal
ECL502	**Software Engineering and Web Technologies Lab**
ECL502.1	Identify requirements and apply process model to selected case study.
ECL502.2	Analyze and design models for the selected case study using UML modelling
ECL502.3	Use various Software Engineering and Project Management Tools
ECL502.4	Design static web pages using HTML5, CSS3, Bootstrap
ECL502.5	JavaScript and JQuery
ECL502.6	Build dynamic web pages using Server-Side Scripting
ECL 503	**Software Testing and Quality Assurance Lab**
ECL 503.1	Recognize failures in the system
ECL 503.2	Design test cases
ECL 503.3	Design test plan
ECL 503.4	Execute test cases manually and using automated tools

ECL 503.5	Manage the test process.
ECL504	**Professional Communication and Ethics-II**
ECL504.1	Draft different types of report in the correct language and style
ECL504.2	Frame a technical and business proposal
ECL504.3	Demonstrate interpersonal skills with ethical responsibilities in their personal and professional life
ECL504.4	Conduct and document the meetings efficiently
ECL504.5	Prepare for campus placement and competitive examinations
ECM501	**Mini project - 2A**
ECM501.1	Identify problems based on societal and research needs.
ECM 501.2	Apply knowledge and skill to solve problems in a group
ECM 501.3	Develop interpersonal skills to work as member of a group or leader.
ECM 501.4	experimental/simulations.
ECM 501.5	Excel in written and oral communication.
ECM 501.6	learning.
Semester 6	
ECC 601	**Embedded Systems and RTOS**
ECC 601.1	Identify and describe various characteristic features and applications of Embedded systems.
ECC 601.2	Analyze and select hardware for Embedded system implementation.
ECC 601.3	Evaluate various communication protocols for Embedded system implementation.
ECC 601.4	Compare GPOS and RTOS and analyze the concepts of RTOS.
ECC 601.5	Evaluate and use various tools for testing and debugging embedded systems
ECC 601.6	Design a system for different requirements based on life-cycle for the embedded system, keeping oneself aware of ethics and environmental issues
ECC 602	**Artificial Intelligence**
ECC 602.1	agent architectures.
ECC 602.2	Apply the most suitable search strategy to design problem solving agents.
ECC 602.3	inference rules to design Knowledge Based agents.
ECC 602.4	Apply a probabilistic model for reasoning under uncertainty.
ECC 602.5	of an expert system for a given real world problem.
ECC 603	**Computer Networks**
ECC603.1	Enumerate the layers of OSI and TCP/IP model and describe their functions.
ECC603.2	devices.
ECC603.3	Analyze the various flow control and error control techniques.
ECC603.4	netting schemes.
ECC603.5	Explain protocols used at transport and application layer.

ECC 604	**Data Warehousing and Mining**
ECC604.1	Understand Data Warehousing fundamentals and Dimensionality modelling principles
ECC604.2	Understand the use of ETL techniques and apply OLAP operations.
ECC604.3	Perceive the importance of data pre-processing and basics of data mining techniques.
ECC604.4	Relate to the concepts of market basket analysis in real world applications.
ECC604.5	Apply classification algorithms in real world dataset for classification and prediction.
ECC604.6	Visualize the concept of clustering and its application
ECC DO601	**Machine Learning**
ECCDO601.1	Comprehend the basics on machine learning
ECCDO601.2	Build mathematical foundation for machine learning
ECCDO601.3	Understand various machine learning models and select suitable machine learning model for a given problem
ECCDO601.4	Build neural network based model
ECL 601	**Embedded Systems and RTOS Lab**
ECL 601.1	Interface various sensors and actuators to embedded cores.
ECL 601.2	Write code using RTOS for multi-tasking Embedded systems
ECL 601.3	Design applications using different embedded cores
ECL 602	**AI CN Lab**
ECL 602.1	Identify suitable Agent Architecture for a given real world AI problem
ECL 602.2	Implement simple programs using Prolog.
ECL 602.3	Implement various search techniques for a Problem-Solving Agent.
ECL 602.4	Represent natural language description as statements in Logic and apply inference rules to it.
ECL 602.5	Construct a Bayesian Belief Network for a given problem and draw probabilistic inferences from it.
ECL603	**Data Warehousing and Mining Lab**
ECL603.1	Design data warehouse using dimensional modelling
ECL603.2	Perform different OLAP operations
ECL603.3	Differentiate among different data mining techniques and decide the applicability for each.
ECL603.4	Demonstrate classifications, prediction, etc. on datasets using open source tools
ECL603.5	Perform Market basket analysis in real world data using data mining tools
ECL603.6	Appreciate and visualize clustering techniques
ECL 604	**Skill-based Laboratory(LINUX)**

ECL604.1	Learn various Linux Command Line administration tasks and perform file, user, group and process management tasks
ECL604.2	Learn various Linux Command Line utilities to perform storage and network management tasks
ECL604.3	Learn Linux Server administration tasks and configure servers for front and backend services
ECL604.4	Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem
ECM601	**Mini Project 2B**
ECM 601.1	Identify problems based on societal and research needs.
ECM 601.2	Apply knowledge and skill to solve problems in a group
ECM 601.3	Develop interpersonal skills to work as member of a group or leader.
ECM 601.4	Draw the proper inferences from available results through theoretical/ experimental/simulations
ECM 601.5	Excel in written and oral communication.
ECM 601.6	Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
Semester 7	
ECC 701	**VLSI Design**
ECC701.1	Demonstrate a clear understanding of VLSI Design flow, technology trends, scaling and MOSFET models.
ECC701.2	Design and analyse MOS based inverters.
ECC701.3	Realise MOS based circuits using different design styles.
ECC701.4	Realise semiconductor memories, adder, multiplier and shifter circuits using CMOS logic.
ECC701.5	Understand the flow of IC Fabrication
ECC 702	**Internet of Things**
ECC 702 .1	Understand concepts, functional blocks and communication methodology relevant to IoT
ECC 702 .2	Identify various components of IoT
ECC 702 .3	Understand various methods for data handling in IoT-based systems
ECC 702 .4	Compare various communication protocols for IoT
ECC 702 .5	Design basic applications based on IoT using specific components
ECC 702 .6	Introduce various security issues in IoT
ECC DO701	**Deep Learning**
DO701.1	Explain the basic knowledge of neural networks
DO701.2	networks
DO701.3	Design supervised models for DNN

DO701.4	Design unsupervised model for DNN
DO701.5	Select and apply a suitable DNN model for a given application
ECC DO702	**Cloud Computing**
ECCDO702.1	models
ECCDO702.2	Implement different types of virtualization
ECCDO702.3	Use several cloud computing services
ECCDO702.4	Design of open source cloud
ECCDO702.5	Identification of threats & cloud based risks for cloud security
ECCDO702.6	Understand cloud applications & recent trends
ECCIO701	**Management Information System**
ILO 7013.1	Explain how information systems transform business
ILO 7013.2	Identify the impact information systems have on an organization
ILO 7013.3	Describe the IT infrastructure & its components with current trends
ILO 7013.4	Understand the principal tools & technologies for accessing information from databases to improve business performance & decision making
ILO 7013.5	how they provide value for businesses
ECL701	**VLSI LAB**
ECL701.1	Demonstrate transfer, dynamic characteristics of various digital circuits.
ECL701.2	Understand the circuit design using various simulation tools
ECL701.3	Demonstrate layouts for various circuits and doing simulations.
ECL 702	**Internet of Things Lab**
ECL 702.1	Interface various sensors to any IoT device and push data onto cloud.
ECL 701.2	Remotely control various devices using Blynk App and Node-red environment.
ECL 701.3	Implement IoT protocols to control devices remotely.
ECL 701.4	IoT.
ECL7031	**Deep Learning Lab**
ECL7031.1	Implement basic neural network models to learn logic functions
ECL7031.2	Design and train feedforward neural networks using various learning algorithms
ECL7031.3	and, LSTM to solve a real-world problem
ECL7031.4	problem and evaluate the performance of the model with respect to the bias-
ECC DO7013	**Big data Analytics**
ECC DO7013.1	1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
ECC DO7013.2	2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, MapReduce & NoSQL in big data analytics.
ECC DO7013.3	3. Interpret business models and scientific computing paradigms, and apply software tools for big data Analytics. .

ECC DO7013.4	4. Achieve adequate perspectives of big data analytics in various applications like recommender systems,social media applications etc.
ECC DO7013.5	5. Develop applications for Big Data analysis using Hadoop and NoSQL etc.
ECL7033	**BIG Data Analytics Lab**
ECL7033.1	Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, Mapreduce and NoSQL in big data analytics.
ECL7033.2	Collect, manage, store, query and analyze various forms of Big Data.
ECL7033.3	Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
ECL7033.4	Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
ECC DO7024	**Blockchain technology**
ECCDO7024.1	Describe the primitives of the cryptography related to blockchain.
ECCDO7024.2	Understand and explore the working of Blockchain technology
ECCDO7024.3	Illustrate the concepts of Bitcoin and their usage
ECCDO7024.4	Implement Ethereum block chain contract.
ECCDO7024.5	Explore Hyperledger Fabric and its working.
ECCDO7024.6	Investigate security features in blockchain technologies
ECP701	**Major Project - I**
EPC701.1	Explore a wide range of domain and develop the understanding of the problem.
EPC701.2	Identify and analyze the problem in detail through extensive literature survey to define its scope with problem specific data.
EPC701.3	Apply problem solving approaches studied in various engineering courses and design solutions for problem at hand with positive impact on society and environment
EPC701.4	Develop clarity of presentation based on communication, team work and leader ship skills
EPC701.5	Inculcate professional and ethical behavior.
Semester 8	
ECC 801	**Robotics**
ECC801.1	Describe the basics of Robotics
ECC801.2	Describe and derive kinematics and dynamics of stationary and mobile robots.
ECC801.3	Apply trajectory planning algorithms
ECC801.4	Describe concepts of robot motion planning algorithms
ECC801.5	Apply image processing in robotic vision
ECC801.6	Identify suitable Robot language based on applications
ECC DO8012	**Natural Language Processing**
ECC DO8012.1	Explain the mathematical and linguistic preliminaries necessary for various processes in NLP.

ECC DO8012.2	Perform Word-Level and Syntax-Level analysis on a text
ECC DO8012.3	Analyze the text at Semantic Level
ECC DO8012.4	Develop a basic understanding of Pragmatics in NLP
ECC DO8012.5	Apply NLP techniques to design real-world NLP applications
ECC DO8024	**System Security**
ECC DO8024.1	Understand the concept of vulnerabilities, attacks and protection mechanisms and working of various crypto algorithms.
ECC DO8024.2	Analyze various controls available for protection against internet attacks.
ECC DO8024.3	Evaluate different attacks on Open Web Applications and Web services
ECC DO8024.4	Analyze mechanisms used to provide security in different infrastructure and networks
ECC DO8024.5	Perform security monitoring and testing of system
ECCIO 801	**Project Management**
ILO8021.1 (CO-1)	Apply selection criteria and select an appropriate project from different options.
ILO8021.2 (CO-2)	Write work break down structure for a project and develop a schedule based on it.
ILO8021.3 (CO-3)	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
ILO8021.4 (CO-4)	Use Earned value technique and determine & predict status of the project.
ILO8021.5 (CO-5)	Capture lessons learned during project phases and document them for future reference
ECL 801	**Robotics Laboratory**
ECL 801.1	Use the acquired knowledge in solving direct and inverse kinematics problems
ECL 801.2	Select and Implement suitable task and trajectory planning algorithms.
ECL 801.3	Develop suitable programming tools for Robotic applications
ECL8022	**Natural Language Processing lab**
ECL8022.1	Apply the mathematical and linguistic foundations and underlying approaches to solve the various NLP problems
ECL8022.2	Design, implement, and test algorithms to solve NLP problems.
ECL8022.3	Apply NLP techniques to design real-world NLP applications
ECP 801	**Major Project II**
ECP 801.1	Implement solutions for the selected problem by applying technical and professional skills.
ECP 801.2	Analyze impact of solutions in societal and environmental context for sustainable development.
ECP 801.3	Explore and apply various modern tools to solve the chosen problem
ECP 801.4	Develop proficiency in oral and written communication with effective leadership and teamwork.

ECP 801.5	Nurture professional and ethical behavior and develop expertise in life-long learning

Fr. Conceicao Rodrigues College of Engineering
Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
Department of Production Engineering

CO NUM	COURSE OUTCOME
	SEMESTER- 3
PEC301	**Engineering Mathematics III**
PEC301.1	obtain Laplace Transform of given functions and also evaluate the integral (in standard form) using Laplace Transform.
PEC301.2	obtain inverse Laplace Transform of given functions.
PEC301.3	expand the given periodic function in terms of sine and cosine terms in the given interval.
PEC301.4	construct the analytic function and also determine the orthogonal trajectories of the given family of curves.
PEC301.5	diagonalize the given matrix (if diagonalizable)
PEC301.6	solve one dimensional heat&wave equations using numerical &analytical methods
PEC302	**Applied Thermodynamics and Fluid Mechanics**
PEC302.1	Demonstrate application of the laws of thermodynamics to a wide range of systems.
PEC302.2	Compute heat and work interactions in thermodynamic systems
PEC302.3	Demonstrate the interrelations between thermodynamic functions to solve practical problems.
PEC302.4	Compute thermodynamic interactions using the steam table and Mollier chart
PEC302.5	Compute efficiencies of heat engines, power cycles.
PEC302.6	Apply the fundamentals of compressible fluid flow to the relevant systems
PEC303	**Mechanics of Materials**
PEC303.1	Illustrate stress-strain behavior of various materials under load
PEC303.2	Demonstrate the basic concepts related to material properties and stress strain behavior of material.
PEC303.3	Illustrate the basic concept of Bending moment and Shear force
PEC303.4	Develop skills to analyze the stresses and deformation due to axial loading.
PEC303.5	Illustrate basic concepts of bending, torsion, buckling, deflection and strain energy

PEC303.6	Develop skills to visualize with analysis of stresses under various loading conditions.
PEC304	**Manufacturing Process**
PEC304.1	To describe types of machine tools, their classification and specifications.
PEC304.2	To identify features and applications of threading and gear manufacturing processes.
PEC304.3	To understand and analyse machining operations on CNC machines and the related programming details.
PEC304.4	To demonstrate finishing processes, like grinding and reaming.
PEC305	**Engineering Materials and Metallurgy**
PEC305.1	Demonstrate the process of solidification of metals along with various types of crystal imperfections.
PEC305.2	Distinguish between various modes of material failure.
PEC305.3	Analyze various alloy phase diagrams including iron-iron carbide diagram.
PEC305.4	Select proper heat treatment process for steel in order to attain desirable properties.
PEC305.5	Describe the properties with application of alloy steels/non-ferrous metals.
PEC305.6	Describe the properties with application of composites/nano structured materials.
PEL301	**Computer Aided Machine Drawing Lab.**
PEL301.1	Identify machine elements
PEL301.2	Demonstrate application of Limits, Fits and Tolerances
PEL301.3	Prepare detailed drawing using CAD software
PEL301.4	Prepare assembly drawing using CAD software
PEL302	**Python Lab**
PEL302.1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
PEL302.2	Express different Decision Making statements and Functions.
PEL302.3	Interpret Object oriented programming in Python.
PEL302.4	Understand and summarize different File handling operations.
PEL302.5	Explain how to design GUI Applications in Python and evaluate different database operations.
PEL302.6	Design and develop Client Server network applications using Python.
PEL303	**Material Testing Lab**
PEL303.1	Conduct tensile and torsion tests on mild steel specimens.

PEL303.1	Determine the Young's modulus using deflection test on different structural specimens.
PEL303.1	Prepare sample for metallographic observations.
PEL303.1	Conduct impact testing, hardness and hardenability testing of given specimen.
PEL303.1	Conduct NDT test on materials.
PEL303.1	Perform the heat treatment processes with its relevance in the manufacturing industry.
PEL304	**Skill based lab 1/2**
PEL304.1	Develop the necessary skill required to handle/use different fitting tools.
PEL304.2	Develop skill required for hardware maintenance.
PEL304.3	Able to install an operating system and system drives.
PEL304.4	Able to identify the network components and perform basic networking and crimping.
PEL304.5	Demonstrate the turning operation with the help of a simple job.
PEL304.6	Develop the necessary skill required to handle/use different carpentry tools.
PEL304.7	Identify and understand the safe practices to adopt in electrical environment.
PEL304.8	Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
PEL304.9	Design, fabricate and assemble pcb.
	SEMESTER - 4
PEC401	**Engineering mathematics -IV**
PEC401.1	Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem.
PEC401.2	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
PEC401.3	Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
PEC401.4	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.

PEC401.5	Apply the concept of probability distribution to engineering problems & Testing hypothesis of small samples using sampling theory
PEC401.6	Apply the concepts of parametric and nonparametric tests for analyzing practical problems.
PEC402	**Mould and Metal Forming Technology**
PEC402.1	Illustrate intricacies involved in sand mould castings, pressure die castings, rolled products and forged products.
PEC402.2	Illustrate various forming and casting processes used in manufacturing.
PEC402.3	Illustrate various forming and rolling processes used in manufacturing.
PEC402.4	Classify equipment and machines used in manufacturing processes, such as casting, rolling, forging, extrusion and drawing.
PEC402.5	Identify melting units used in casting.
PEC402.6	Identify process defects and their remedies.
PEC403	**Theory of Machines**
PEC403.1	Understand the common mechanisms used in machines, correlate the concepts of kinematics with kinetics of rigid body dynamics and Design of four bar mechanisms, gyroscopic devices etc.
PEC403.2	Analyze the velocity and acceleration of various links in motion.
PEC403.3	Illustrate different types of cams, followers with their different motions for their application and Develop profiles of cams for engineering applications.
PEC403.4	Illustrate various types of gears/ their terminology areas of application along with parameters pertaining to spur gears and gear trains.
PEC403.5	Develop basic concepts pertaining to balancing/vibrations in evaluation of simple machine components.
PEC403.6	Illustrate different types of clutches, brakes and dynamometers for evaluation of braking force.
PEC404	**Applied Electrical and Electronics**
PEC404.1	Understand the principles of operation and the main features of different types of electrical machines.
PEC404.2	Interpret various characteristics of ac, dc machines, brushless dc motor, stepper motor and servomotor.

PEC404.3	Understand the complete layout of generation, transmission and distribution of power system and the importance of solar and wind energy resources.
PEC404.4	Explain different types of power electronic devices.
PEC404.5	Classify application areas for various ac machines, dc machines, stepper motor, brushless dc motor, OP-AMP, SCR, DIAC-TRIAC.
PEC404.6	Explain different types of sensors and transducers, control system devices for automation.
PEC405	**Advanced Manufacturing Processes**
PEC405.1	Differentiate between traditional and additive manufacturing techniques including solid- based, liquid-based and powder-based techniques.
PEC405.2	Describe the working principle, material removal mechanism and process parameters for Hybrid machining.
PEC405.3	Illustrate the MEMS and Non-MEMS based manufacturing techniques.
PEC405.4	Describe basic Nano finishing techniques.
PEC405.5	Describe metal joining processes along with their advantages, disadvantages and applications.
PEC405.6	Illustrate the Composite manufacturing and powder metallurgy process along with its advantages, disadvantages and applications.
PEL401	**Mould and Metal Forming Technology Lab**
PEL401.1	Illustrate various forming and casting processes used in manufacturing of various components.
PEL401.2	Classify the equipments and machines used in manufacturing processes, such as casting, rolling, forging, extrusion and wire drawing.
PEL401.3	Design and draw the moulds required for castings processes.
PEL401.4	Design and draw the dies required for forging processes.
PEL401.5	Design and draw the grooves required for rolling processes.
PEL401.6	Demonstrate various trends in the foundry/forging industries.
PEL402	**Theory of Machines Lab**
PEL402.1	Compute the natural frequency of 1 DOF system
PEL402.2	Apply the working principles of gyroscope and Cam.
PEL402.3	Demonstrate the understanding of static and dynamic balancing.

PEL402.4	Compute velocity and acceleration in mechanisms.
PEL402.5	Carry out Cam analysis
PEL402.6	Demonstrate the practical significance of interference and undercutting in gears.
PEL403	**Applied Electrical and Electronics Lab**
PEL403.1	To design and simulate different types of electrical machines
PEL403.2	Explain and interpret various characteristics of ac, dc machines, brushless dc motor, stepper motor and servomotor
PEL403.3	Classify application areas for various ac machines, dc machines, stepper motor, brushless dc motor, OP-AMP, SCR, DIAC-TRIAC
PEL403.4	Explain different types of power electronic devices.
PEL404	**Skill based Lab. Course-II**
PEL404.1	Perform machining of composite jobs involving different operations.
PEL404.2	Apply significance of maintaining tolerance level during machining to facilitate assembly
PEL404.3	requirement.
PEL404.4	Practice basic understanding of safe machine shop practices and safe working.
PEL404.5	Select the right tool and set up the machine, job and tool for machining practices.
PEL404.6	Demonstrate practical aspects involved in operation and applications of milling, shaping, grinding and boring etc.
PEM401	**Mini Project – 1B**
PEM401.1	Identify problems based on societal /research needs.
PEM401.2	Apply Knowledge and skill to solve societal problems in a group.
PEM401.3	Develop interpersonal skills to work as member of a group or leader.
PEM401.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
PEM401.5	Analyze the impact of solutions in societal and environmental context for sustainable development.
PEM401.6	Use standard norms of engineering practices
PEM401.7	Excel in written and oral communication
PEM401.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning
PEM401.9	Demonstrate project management principles during project work

	SEMESTER - 5
PEC501	**Production Tooling**
PEC501.1	Select location and clamping faces/points on jobs.
PEC501.2	Design and develop simple productive and cost effective jigs.
PEC501.3	Design and develop simple productive and cost effective fixture.
PEC501.4	Demonstrate the principles of blank devlopement
PEC502	**Machine Design - I**
PEC502.1	PEC503. 1 Apply basic principles of machine design.
PEC502.2	PEC503.2 Design joints such as knuckle joint/turn buckle.
PEC502.3	PEC503.3 Design machine elements such keys, shafts, couplings/springs.
PEC502.4	PEC503.4 Design pressure vessels.
PEC502.5	PEC503.5 Design weld joint.
PEC502.6	PEC503.6 Design rivet/bolt joints
PEC503	**Machining Science and Technology**
PEC503.1	Analyse tooling aspects of manufacturing from a perspective of productivity and economy
PEC503.2	Follow process of designing a single point and multi point cutting tool.
PEC503.3	Explain the role and importance of cutting tools in a manufacturing environment
PEC503.4	Explain various cutting tool materials and cutting fluids used in manufacturing operations
PEC503.5	Explain tool geometry and various tool signature systems
PEC504	**Metrology & Quality Engineering**
PEC504.1	Able to understand precision ,accuracy, need for inspection and different standards
PEC504.2	Able to understand limits, fits and tolerances and solve problems based on the design of gauges.
PEC504.3	Able to understand construction, working principle and applications of different comparators.
PEC504.4	Able to understand principle, application and use of interferometry and surface roughness parameter in metrology.
PEC504.5	Able to understand screw threads terminology , gear terminology and measurement of individual elements of screw and gear.
PEC504.6	Able to understand and use tool makers microscope, CMM and applications of different transducers.

PEDO5012	**DLOC - Sustainable Manufacturing**
PEDO5012.1	Illustrate the agenda of indigenous and global sustainability to fulfill green expectations.
PEDO5012.2	Demonstrate the know ledge about management of waste, pollution &energy conservation.
PEDO5012.3	Demonstrate the knowledge of sustainability issues with its implementation in manufacturing.
PEDO5012.4	Illustrate the relevance and implications of environment friendly materials.
PEDO5012.5	Illustrate the implications of environment management in the context of modern industrial practices.
PEDO5012.6	Develop the sustainability approach in environmental strategy and manufacturing.
PEL501	**Production Tooling lab**
PEL501.1	Select location and clamping faces/points on jobs.
PEL501.2	Design and develop simple productive and cost effective jigs.
PEL501.3	Design and develop simple productive and cost effective fixture.
PEL501.4	Build working drawings, including bill of materials and setup for economic production of sheet metal components.
PEL502	**Machine Design - I lab**
PEL502.1	PEL502.1. Demonstrate various design considerations.
PEL502.2	PEL502.2. Apply basic principles of machine design.
PEL502.3	PEL502.3. Design machine elements.
PEL502.4	PEL502.4. Use design data books and various standard codes of practices.
PEL502.5	PEL502.5. Prepare drawings pertaining to various designs.
PEL502.6	PEL502.6. Design various joints used in engineering applications
PEL503	**Machining Science and Technology lab**
PEL503.1	1. Select a proper force measurement method for the required machining operation.
PEL503.2	2. Select a proper temperature measurement method for the required machining operation.
PEL503.3	3. Distinguish surface integrity after parametrical changes in machining operation.
PEL503.4	4. Apply Taguchi's Design of Experiments and ANOVA for various machining operations.
PEL503.5	5. Design multi point cutting tool like Broach. 6. Design of Flat Form Tool and Circular Form Tool.

PEL503.6	6. Design of Flat Form Tool and Circular Form Tool.
PEL504	**Metrology & Quality Engineering lab**
PEL504.1	Measure linear and angular measurements.
PEL504.2	Measure thread and gear dimensions.
PEL504.3	Design Go and Not Go gauge for given assembly.
PEL504.4	Analyze simple machined components for dimensional stability & functionality.
PEL504.5	Use proper quality tools and quality approaches in various manufacturing /service problems
PEL504.6	Comprehend and apply Quality standards in different situations
PEL505	**Professional Communication & EthicsII**
PEL505.1	Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
PEL505.2	Strategize their personal and professional skills to build a professional image and meet the demands of the industry.
PEL505.3	Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
PEL505.4	Deliver persuasive and professional presentations.
PEL505.5	Deliver persuasive and professional presentations.
PEL505.6	Apply codes of ethical conduct, personal integrity and norms of organizational behavior.
PEM501	**Mini Project - 2A**
PEM501.1	Identify problems based on societal /research needs.
PEM501.2	Apply Knowledge and skill to solve societal problems in a group.
PEM501.3	Develop interpersonal skills to work as member of a group or leader.
PEM501.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
PEM501.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
PEM501.6	Use standard norms of engineering practices
PEM501.7	Excel in written and oral communication.
PEM501.8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
PEM501.9	Demonstrate project management principles during project work.

	SEMESTER -6
PEC601	**Process Engineering**
PEC601.1	To analyse Part print.
PEC601.2	To predict Tolerance chart.
PEC601.3	To design Cams for single spindle automat.
PEC601.4	To develop process sheet.
PEC602	**Machine Design - II**
PEC602.1	Design machine tool structures, drive elements/drives.
PEC602.2	Design speed and feed gear boxes.
PEC602.3	Design power screws and clutches.
PEC602.4	Design bearings.
PEC602.5	Demonstrate the requirements like maintaining of expected accuracy levels, parametric optimization,managing wear and tear problems.
PEC602.6	Illustrate the safety aspects/ acceptance tests in machining tools.
PEC603	**Industrial Engineering**
PEC603.1	Analyze implications of Industrial Engineering in industries.
PEC603.2	Demonstrate the role of Production Management in creating competitive advantage for business organizations
PEC603.3	Analyze various constituents of production operations in manufacturing and service.
PEC603.4	Plan and control various production related activities.
PEC603.5	Illustrate various inventory management procedures with the tools employed there in.
PEC603.6	Demonstrate role of JIT, MRP, and ERP with their contribution towards Industrial Engineering.
PEC604	**Operations research**
PEC604.1	Formulate and solve linear programming models, transportation, assignment models and sequencing problems.
PEC604.2	Solve queuing model problems as well as replacement model problems.
PEC604.3	Solve game theory problems.
PEC604.4	Solve dynamic programming problems.
PEC604.5	Solve simulation related problems.
PEC604.6	Solve project management related problems like CPM and PERT.
PEDO6013	**DLOC- Rapid prototyping**

PEDO6013.1	Demonstrate an importance of rapid prototyping/additive manufacturing techniques.
PEDO6013.2	Design and develop of products using rapid manufacturing technology.
PEDO6013.3	Design and develop of products using additive manufacturing technology.
PEDO6013.4	Illustrate the concept of Direct Digital Manufacturing.
PEDO6013.5	Select appropriate Reverse engineering techniques for a particular case.
PEDO6013.6	Select appropriate Rapid tooling techniques for a particular case.
PEDO6014	**DLOC - Logistics and Supply Chain Management**
PEDO6014.1	To prepare for understanding of the role of Industrial Engineering in the overall business strategy of the firm.
PEDO6014.2	To prepare for understanding of the interdependence of the operating system with other key functional areas of the firm.
PEDO6014.3	To familiarize with the key factors and interdependence of these factors in the design of effective operating systems.
PEDO6014.4	To prepare for identification and evaluation of tools appropriate for analysis of operating systems of the firm.
PEDO6014.5	To familiarize with the application of production and operations management policies and techniques to the service sector as well as manufacturing firms.
PEL601	**Process Engineering Lab**
PEL601.1	Analyze Part print
PEL601.2	Design Cams for Traub automat
PEL601.3	Develop Operation sheet
PEL601.4	Estimation of Process time
PEL602	**Machine Design - II Lab**
PEL602.1	1. Use codes and hand books to retrieve relevant data for design and selection.
PEL602.2	2. Design machine tool structures.
PEL602.3	3. Select drive elements and drives for machine tools.
PEL602.4	4. Design feed gear boxes for a machine tool.
PEL602.5	5. Design bearings and clutches for a machine tool.
PEL602.6	6. Design power screws for a machine tool.
PEL603	**Additive Manufacturing Lab**
PEL603.1	Demonstrate an importance of rapid prototyping/additive manufacturing techniques.
PEL603.2	Illustrate the concept of Direct Digital Manufacturing.

PEL603.3	Select appropriate Rapid tooling techniques for a particular case.
PEL604	**Data Analytics Lab**
PEL604.1	1. Develop relevant programming abilities.
PEL604.2	2. Demonstrate proficiency with statistical analysis of data.
PEL604.3	3. Develop the ability to build and assess data-based models.
PEL604.4	4. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.
PEM601	**Mini Project - 2B**
PEM601.1	Identify problems based on societal /research needs.
PEM601.2	Apply Knowledge and skill to solve societal problems in a group.
PEM601.3	Develop interpersonal skills to work as member of a group or leader.
PEM601.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
PEM601.5	Analyze the impact of solutions in societal and environmental context for sustainable development.
PEM601.6	Use standard norms of engineering practices
PEM601.7	Excel in written and oral communication.
PEM601.8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
PEM601.9	Demonstrate project management principles during project work.
	SEMESTER -7
PEC701	**Industrial Training and B.E. Project**
PEC701.1	Get familiarized with various technological trends, approaches and applications along with managerial exposure.
PEC701.1	Appreciate and realize the size and scale of operations in Industry.
PEC701.1	Apply their knowledge in problem solving and eventually develop that skill.
PEC701.1	Demonstrate understanding of relevant application oriented subjects in a better prospective.
PEC701.1	Demonstrate understanding of various constraints of time and cost, within which goods are produced and services rendered in a specified quantum.

PEC701.1	Describe the scope, functions and job responsibilities in various departments of an organization. Develop a positive attitude, which will bring in a visible change in their approach while dealing with technical and interpersonal issues.
	SEMESTER- 8
PEC801	**Automation & Control Engineering**
PEC801.1	Illustrate the basic concept of Industrial automation in different manufacturing set-ups.
PEC801.2	Design and develop pneumatic control circuits of medium complexity.
PEC801.3	Design and develop hydraulic control circuits of medium complexity
PEC801.4	Illustrate the use of PLC in control systems.
PEC801.5	Illustrate the basic application of Microprocessor and Microcontroller.
PEC801.6	Model the system and check with stability of a mechanical system.
PEC802	**Computer Aided Engineering**
PEC802.1	Understandsoftwareconfigurationofgraphicpackages.
PEC802.2	UnderstanduseofComputergraphicsindesign.
PEC802.3	Solvephysical andengineeringproblemswithemphasisonStructural andThermal Engineeringapplications.
PEC802.4	Understandtheconcept ofComputerIntegrated Manufacturing.
PEC803	**Engg Economics, Finance, Costing Accounting**
PEC803.1	Learner should be able to Correlate various micro and macro-economic variables.
PEC803.2	Learner should be able to Analyze various market/business strategies.
PEC803.3	Learner should be able to Illustrate concept of Economic policies and their implications.
PEC803.4	Learner should be able to Demonstrate the roles played by various financial institutions/banks.
PEC803.5	Learner should be able to Analyze various accounting and costing practices.
PEC803.6	Learner should be able to Select best investment method.
PEDO8012	**Product Design and Industrial Marketing**
PEDO8012.1	Design and develop products right from the conceptual level.

PEDO8012.2	Demonstrate concept of computer aided product design approach.
PEDO8012.3	Illustrate various modern approaches like concurrent engineering, product life cycle management, robust design, rapid prototyping / rapid tooling.
PEDO8012.4	Analyze products based on ergonomics and aesthetic aspects.
PEDO8012.5	Apply appropriate strategies in industrial marketing.
PEDO8012.6	Demonstrate various aspects related to Industrial Marketing Communication, Advertising, Sales promotion, Publicity Media Plan.
ILO8022	**ILOC - Finance Management**
ILO8022.1	Learner will be able to Understand Indian finance system and corporate finance
ILO8022.2	Learner will be able to Take investment, finance as well as dividend decisions
PEL801	**Automation & Control Engineering Lab**
PEL801.1	Designing of the basic Pneumatic circuit – minimum 3 circuits
PEL801.2	Designing of the basic Pneumatic circuit including flow control valves - minimum 3 circuits
PEL801.3	Multiple cylinder pneumatic circuits with Simulation in any software- minimum 3 circuits
PEL801.4	Designing of the basic Electro-Pneumatic circuit- minimum 3 circuits
PEL801.5	Designing of the basic Electro-Pneumatic circuit including timer and counters-minimum 3 circuits
PEL801.6	PLC based Circuit design - minimum 2 circuits
PEL802	**Computer Aided Engineering Lab**
PEL802.1	Understand software configuration of graphic packages.
PEL802.2	Understand use of Computer graphics in design.
PEL802.3	Identify proper modeling techniques for geometric modeling
PEL802.4	Solve physical and engineering problems with emphasis on Structural and Thermal Engineering applications.

Fr. Conceicao Rodrigues College of Engineering
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Department of Mechanical Engineering

CO NUM	COURSE OUTCOME
	SEMESTER-3
MEC301	**Engineering Mathematics-III**
MEC301.1	obtain Laplace Transform of given functions and also evaluate the integral (in standard form) using Laplace Transform.
MEC301.2	obtain inverse Laplace Transform of given functions.
MEC301.3	expand the given periodic function in terms of sine and cosine terms in the given interval.
MEC301.4	construct the analytic function and also determine the orthogonal trajectories of the given family of curves.
MEC301.5	diagonalize the given matrix (if diagonalizable)
MEC301.6	solve one dimensional heat&wave equations using numerical &analytical methods
MEC302	**Strength of Materials**
MEC302.1	Demonstrate fundamental knowledge about various types of loading and stresses induced.
MEC302.2	Draw the SFD and BMD for different types of loads and support conditions.
MEC302.3	Analyse the bending and shear stresses induced in beam
MEC302.4	Analyse the deflection in beams and stresses in shaft
MEC302.5	Analyse the stresses and deflection in beams and Estimate the strain energy in mechanical elements
MEC302.6	Analyse buckling phenomenon in columns.
MEC303	**Production Processes**
MEC303.1	Demonstrate an understanding of casting process
MEC303.2	Illustrate principles of forming processes.
MEC303.3	Demonstrate applications of various types of welding processes.
MEC303.4	Differentiate chip forming processes such as turning, milling, drilling, etc.
MEC303.5	Illustrate the concept of producing polymer components and ceramic components.
MEC303.6	Illustrate principles and working of non-traditional manufacturing and Understand the manufacturing technologies enabling Industry 4.0
MEC304	**Materials and Metallurgy**
MEC304.1	Identify the various classes of materials and comprehend their properties.

MEC304.2	Apply phase diagram concepts to engineering applications.
MEC304.3	Apply particular heat treatment for required property development.
MEC304.4	Identify the probable mode of failure in materials and suggest measures to prevent them.
MEC304.5	Choose or develop new materials for better performance.
MEC304.6	Decide an appropriate method to evaluate different components in service.
MEC305	**Thermodynamics**
MEC305.1	Demonstrate application of the laws of thermodynamics to a wide range of systems.
MEC305.2	Compute heat and work interactions in thermodynamic systems
MEC305.3	Demonstrate the interrelations between thermodynamic functions to solve practical problems.
MEC305.4	Compute thermodynamic interactions using the steam table and Mollier chart
MEC305.5	Compute efficiencies of heat engines, power cycles.
MEC305.6	Apply the fundamentals of compressible fluid flow to the relevant systems
MEL301	**Materials Testing**
MEL301.1	Prepare metallic samples for studying its microstructure following the appropriate procedure.
MEL301.2	Identify effects of heat treatment on microstructure of medium carbon steel and hardenability of
	steel using Jominy end Quench test
MEL301.3	Perform Fatigue Test and draw S-N curve
MEL301.4	Perform Tension test to Analyze the stress - strain behaviour of materials
MEL301.5	Measure torsional strength, hardness and impact resistanceof the material
MEL301.6	Perform flexural test with central and three point loading conditions
MEL302	**Machine Shop Practice**
MEL302.1	Learner shall be able to Know the specifications, controls and safety measures related to machines and machining operations.
MEL302.2	Learner shall be able to Use the machines for making various engineering jobs.
MEL302.3	Learner shall be able to Perform various machining operations
MEL302.4	Learner shall be able to Perform Tool Grinding.
MEL302.5	Learner shall be able to Perform welding operations.
MESBL301	**CAD –Modeling**
MESBL301.1	Learner shall be able to Illustrate basic understanding of types of CAD model creation.
MESBL301.2	Learner shall be able to Visualize and prepare 2D modeling of a given object using modeling software.
MESBL301.3	Learner shall be able to Build solid model of a given object using 3D modeling software.

MESBL301.4	Learner shall be able to Visualize and develop the surface model of a given object using modeling software.
MESBL301.5	Learner shall be able to Generate assembly models of given objects using assembly tools of a modeling software
MESBL301.6	Learner shall be able to Perform product data exchange among CAD systems.
MEPBL301	**Mini Project - 1A**
MEPBL301.1	Identify problems based on societal /research needs.
MEPBL301.2	Apply Knowledge and skill to solve societal problems in a group.
MEPBL301.3	Develop interpersonal skills to work as member of a group or leader.
MEPBL301.4	Draw the proper inferences from available results through theoretical/ experimental/simulations.
MEPBL301.5	Analyse the impact of solutions in societal and environmental context for sustainable development.
MEPBL301.6	Use standard norms of engineering practices
MEPBL301.7	Excel in written and oral communication.
MEPBL301.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
MEPBL301.9	Demonstrate project management principles during project work.
	SEMESTER -4
MEC401	**Engineering Mathematics-IV**
MEC401.1	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate
MEC401.2	Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science
MEC401.3	Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
MEC401.4	Apply the concept of probability distribution to engineering problems & testing hypothesis of small samples using sampling theory.
MEC401.5	Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem
MEC401.6	Apply the concepts of parametric and nonparametric tests for analyzing practical problems.
MEC402	**Fluid Mechanics**
MEC402.1	Define properties of fluids, classify fluids and evaluate hydrostatic forces on various surfaces.
MEC402.2	Illustrate understanding ofdimensional analysis of Thermal and Fluid systems.
MEC402.3	Differentiate velocity potential function and stream function and solve for velocity and acceleration of a fluid at a given location in a fluid flow.

MEC402.4	Formulate and solve equations of the control volume for fluid flow systems and Apply Bernoulli's equation to various flow measuring devices.
MEC402.5	Calculate pressure drop in laminar and turbulent flow, evaluate major and minor losses in pipes.
MEC402.6	Calculate resistance to flow of incompressible fluids through closed conduits and over surfaces.
MEC403	**Kinematics of Machinery**
MEC403.1	Identify various components of mechanisms
MEC403.2	Develop mechanisms to provide specific motion
MEC403.3	Draw velocity and acceleration diagrams of various mechanisms
MEC403.4	Choose a cam profile for the specific follower motion
MEC403.5	Predict condition for maximum power transmission in the case of a belt drive
MEC403.6	Illustrate requirements for an interference-free gear pair
MEC404	**CAD/CAM**
MEC404.1	Identify suitable computer graphics techniques for 3D modeling.(Understand-2)
MEC404.2	Transform, manipulate objects (Analysis-4)
MEC404.3	Develop 3D model using various types of available biomedical data.(Create-6)
MEC404.4	Create the CAM Toolpath for specific given operations.(Create-6)
MEC404.5	Build 3D printing of any given object using rapid prototyping and tooling processes
MEC404.6	Illustrate understanding of various cost effective alternatives for manufacturing products.(Analyze-4)
MEC405	**INdustrial Electronics**
MEC405.1	Illustrate construction, working principles and applications of power electronic switches.
MEC405.2	Explain the operation of rectifiers and inverters and their use for dc and ac motor speed control.
MEC405.3	Develop circuits using Op-amp and Timer IC 555.
MEC405.4	Identify digital circuits for industrial applications.
MEC405.5	Demonstrate the knowledge of basic functioning of micro controllers.
MEC405.6	Identify various types of electric motors for industrial applications.
MEL402	**Kinematics of Machinery**
MEL402.1	Draw velocity diagram using Instantaneous Centre method
MEL402.2	Find velocity and acceleration of a point on a four-bar mechanism by using Relative method.
MEL402.3	Analyze velocity and acceleration of a specific link of a slider crank mechanism using graphical approach by Relative method.

MEL402.4	Plot displacement-time, velocity-time, and acceleration-time diagrams of follower motion.
MEL402.5	Draw cam profile for the specific follower motion.
MEL402.6	Develop and build mechanisms to provide specific motion.
MEL403	**Python Programming**
MEL403.1	CO1. Demonstrate and understand of basic concepts of python programming.
MEL403.2	CO2. Identify, install and utilize python packages
MEL403.3	CO3. Develop and execute python programs for specific applications.
MEL403.4	CO4. Develop and build python program to solve real-world engineering problems
MEL403.5	CO5. Prepare a report on case studies selected.
MESBL401	**CNC and 3D Printing**
MESBL401.1	Write programme for CNC Lathe
MESBL401.2	Write programme for CNC Mill
MESBL401.3	Simulate Tool path
MESBL401.4	Post process code
MEPBL401	**Mini Project 1B**
MEPBL401.1	Identify problems based on societal /research needs
MEPBL401.2	Apply Knowledge and skill to solve societal problems in a group
MEPBL401.3	Develop interpersonal skills to work as member of a group or leader.
MEPBL401.4	Draw the proper inferences from available results through theoretical/experimental/simulations
MEPBL401.5	Analyse the impact of solutions in societal and environmental context for sustainable development
MEPBL401.6	Use standard norms of engineering practices
MEPBL401.7	Excel in written and oral communication
MEPBL401.8	Demonstrate capabilities of self-learning in a group, which leads to life long learning.
MEPBL401.9	Demonstrate project management principles during project work
	SEMESTER- 5
MEC501	**Mechanical Measurements and Controls**
MEC501.1	1. Handle, operate and apply the precision measuring instruments / equipment's.
MEC501.2	2. Analyze simple machined components for dimensional stability & functionality.
MEC501.3	3. Classify various types of static characteristics and types of errors occurring in the system.

MEC501.4	4. Classify and select proper measuring instrument for displacement, pressure, flow and temperature measurements.
MEC501.5	5. Design mathematical model of system/process for standard input responses and analyse error and differentiate various types of control systems and time domain specifications
MEC501.6	6. Analyse the problems associated with stability.
MEC502	**Thermal Engineering**
MEC502.1	Estimate thermal conductivity of engineering materials
MEC502.2	Evaluate performance parameters of extended surfaces
MEC502.3	Analyze heat transfer parameters in various engineering applications
MEC502.4	Analyze engine performance and emission parameters at different operating conditions
MEC503	**Dynamics of Machinery**
MEC503.1	Demonstrate working principle of different types of governor and gyroscopic effect on the mechanical system
MEC503.2	Illustrate basic of static and dynamic forces
MEC503.3	Determine natural frequency of element / system
MEC503.4	Determine vribration response of mechanical element / system
MEC503.5	Design vibration isolation system for a specific application
MEC503.6	Demonstrate basic concepts of balancing of forces and couples
MEC504	**Finite Element Analysis**
MEC504.1	Solve differential equations using weighted residual methods
MEC504.2	Develop the finite element equations to model engineering problems governed by second
	order differential equations.
MEC504.3	Apply the basic finite element formulation techniques to solve engineering problems by
	using one dimensional elements.
MEC504.4	Apply the basic finite element formulation techniques to solve engineering problems by
	using two dimensional elements
MEC504.5	Apply the basic finite element formulation techniques to find natural frequency of single
	degree of vibration system.
MEC504.6	Use commercial FEA software, to solve problems related to mechanical engineering
MEDLO5011	**Optimization Techniques**
MEDLO5011.1	Identify the types of optimization problems and apply the calculus method to single variable problems.

MEDLO5011.2	Formulate the problem as Linear Programming problem and analyse the sensitivity of a decision variable.
MEDLO5011.3	Apply various linear and non-linear techniques for problem solving in various domain.
MEDLO5011.4	Apply multi-objective decision making methods for problem in manufacturing environment and other domain.
MEDLO5012	**Design of Experiments**
MEDLO5012.1	Learner will be able to obtain clear understanding of use of statistics in experimentation
MEDLO5012.2	Learner will be able to plan , design and conduct experimental investigations efficiently and effectively
MEDLO5012.3	Learner will be able to understand strategy in planning and conducting experiments
MEDLO5012.4	Learner will be able to obtain clear understanding of scheme of experimentation and its effect on accuracy of experimentation
MEDLO5012.5	Learner will be able to use methods for experimental investigation for robustness and optimization
MEDLO5012.6	Learner will be able to analyze results from investigations to obtain conclusions
MEL501	**Thermal Engineering**
MEL501.1	Estimate thermal conductivity of engineering materials
MEL501.2	Evaluate performance parameters of extended surfaces
MEL501.3	Analyze heat transfer parameters in various engineering applications
MEL501.4	Analyze engine performance and emission parameters at different operating conditions
MEL502	**Dynamics of Machinery**
MEL502.1	Plot and analyze governor characteristics
MEL502.2	Analyze gyroscopic effect on laboratory model
MEL502.3	Estimate natural frequency of mechanical systems
MEL502.4	Analyze vibration response of mechanical systems
MEL502.5	Determine damping coefficient of a system
MEL502.6	Balance rotating mass
MEL503	**Finite Element Analysis**
MEL503.1	Select appropriate element for given problem
MEL503.2	Select suitable meshing and perform convergence test
MEL503.3	Select appropriate solver for given problem
MEL503.4	Interpret the result
MEL503.5	Apply basic aspects of FEA to solve engineering problems
MEL503.6	Validate FEA solution

MESBL501	**Professional communication and Ethics II**
MESBL501.1	Plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles.
MESBL501.2	Strategize their personal and professional skills to build a professional image and meet the
	demands of the industry.
MESBL501.3	Emerge successful in group discussions, meetings and result-oriented agreeable solutions in
	group communication situations.
MESBL501.4	Deliver persuasive and professional presentations.
MESBL501.5	Develop creative thinking and interpersonal skills required for effective professional
	communication.
MESBL501.6	Apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
	SEMESTER -6
MEC601	**Machine Design**
MEC601.1	Use design data book/standard codes to standardise the designed dimensions
MEC601.2	Design Knuckle Joint, cotter joint, bolted and welded joints, and Screw Jack
MEC601.3	Design shaft under various conditions and couplings
MEC601.4	Select bearings for a given applications from the manufacturers catalogue.
MEC601.5	Select and/or design belts and flywheel for given applications
MEC601.6	Design springs, clutches and brakes
MEC602	**Turbo Machinery**
MEC602.1	Define various parameters associated with steam generators and turbo machines.
MEC602.2	Identify various components and mountings of steam generators with their significance.
MEC602.3	Identify various turbo machines and explain their significance.
MEC602.4	Apply principles of thermodynamics and fluid mechanics to estimate various parameters like mass flow rate power, torque, efficiency, temperature, etc
MEC602.5	Evaluate performance of SG and Turbo machines and apply various techniques to enhance performance.
MEC602.6	Evaluate various phenomena related to performance like cavitation, choking, surging.
MEC603	**Heating, Ventilation, Air conditioning and Refrigeration**
MEC603.1	Illustrate the fundamental principles and applications of refrigeration and air conditioning systems
MEC603.2	Identify various HVAC&R components
MEC603.3	Evaluate performance of various refrigeration system

MEC603.4	estimate cooling and heating loads for an airconditioning system.
MEC603.5	Select air handling unit & design air distribution system
MEC603.6	Apply the knowledge of HVAC for the sustainable development of refrigeration and airconditioning systems.
MEC604	**Automation and Artificial Intelligence**
MEC604.1	Demonstrate understanding of fundamentals of industrial automation and AI.
MEC602.2	Design & develop pneumatic / hydraulic circuits.
MEC603.3	Design and develop electropneumatic circuits and PLC ladder logics.
MEC604.4	Demonstrate understanding of robotic control systems and their applications.
MEC605.5	Demonstrate understanding of various AI and machine learning technologies.
MEDLO6022	**Tool Engineering**
MEDLO6022.1	1. Calculate the values of various forces involved in the machining operations.
MEDLO6022.2	2. Design various single and multipoint cutting tools.
MEDLO6022.3	3. Analyze heat generation in machining operation and coolant operations.
MEDLO6022.4	4. Illustrate the properties of various cutting tool materials and hence select an appropriate tool material for particular machining application.
MEDLO6022.5	5. Demonstrate the inter-relationship between cutting parameters and machining performance measures like power requirement, cutting time, tool life and surface finish.
MEDLO6022.6	6. Analyze economics of machining operations
MEDLO6023	**Metal Forming Technology**
MEDLO6023.1	Understand the concept of different metal formingprocess.
MEDLO6023.2	Approach metal forming processes both analytically and numerically
MEDLO6023.3	Design metal forming processes
MEDLO6023.4	Develop approaches and solutions to analyze metal forming processes and the associated problems andflaws.
MEL601	**Machine Design**
MEL601.1	Design shaft under various conditions
MEL601.2	Design Knuckle Joint / cotter joint
MEL601.3	Design Screw Jack
MEL601.4	Design Flexible flange couplings/ Leaf spring
MEL601.5	Convert design dimensions into working/manufacturing drawing
MEL601.6	Use design data book/standard codes to standardise the designed dimensions.
MEL602	**Turbo Machinery**
MEL602.1	Differentiate boiler, boiler mountings and accessories
MEL602.2	Conduct a trial on reciprocating compressor / centrifugal compressor.
MEL602.3	Conduct a trial on impulse turbine and analyze its performance
MEL602.4	. Conduct a trail on reaction turbine and analyze its performance

MEL602.5	Conduct a trial on Centrifugal pump and analyze its performance
MEL602.6	Conduct a trial on Reciprocating pump and analyze its performance
MEL602.6	Conduct a trial on gear pump
MEL603	**Heating, Ventilation, Air Conditioning and Refridgeration**
MEL603.1	1. Aware of the roles and ethics of HVAC &R engineers in related industries.
MEL603.2	2. Present the impact of professional engineering solutions in societal and environmental contexts
MEL603.3	3. Evaluate performance of HVAC &R systems
MEL603.4	4. Develop awareness of the engineering and technological aspects in the HVAC &R
	industries.
MEL603.5	5. Communicate effectively through the preparation of report and practical presentation.
MEL603.6	6. Analysis of HVAC&R in various applications.
MESBL601	**Measurements and Automation**
MESBL601.1	Apply inspection gauge to check or measure surface parameters.
MESBL601.2	Measure surface parameters using precision measurement tools and equipment.
MESBL601.3	Measure different mechanical parameters by using sensors.
MESBL601.4	Analyse the response of a control systems.
MESBL601.5	Demonstrate use of automated controls using pneumatic and hydraulic systems.
MESBL601.6	Implement program on PLC system and demonstrate its application
	SEMESTER- 7
MEC701	**Design of Mechanical System**
MEC701.1	MEC701.1. Apply the concept of system design.
MEC701.2	MEC701.2. Select appropriate gears for power transmission on the basis of given load and speed
MEC701.3	MEC701.3. Design material handling systems such as hoisting mechanism of EOT crane,
MEC701.4	MEC701.4. Design belt conveyor systems
MEC701.5	MEC701.5. Design engine components such as cylinder, piston, connecting rod and crankshaft
MEC701.6	MEC701.6. Design pumps for the given applications
MEC702	**Logistics and Supply Chain Management**
MEC702.1	Students shall be able to understand the fundamentals of supply chain management and Logistics
MEC702.2	Students shall be able to Identify the drivers of supply chain performance and risks in supply chain management.

MEC702.3	Students shall be able to Apply various techniques of inventory management and rank the items using inventory management technique
MEC702.4	Students shall be able to learn tools and techniques used in logistics, transportation, warehousing and outsourcing decisions.
MEC702.5	Students shall be able to develop critical understanding towards digitization in supply chain management and sustainability
MEC702.6	Students shall be able to Apply various mathematical models/tools to design the supply chain network
MEDLO7031	**Automotive Power Systems**
MEDLO7031.1	Demonstrate the working of Fuel supply and ignition system of I.C. engines
MEDLO7031.2	Illustrate the working of lubrication, cooling and supercharging systems.
MEDLO7031.3	Comprehend the different technological advances in engines and alternate fuels
MEDLO7031.4	Identify and describe the history and different EV/HEV drivetrain topologies
MEDLO7031.5	Compare and evaluate various energy sources and energy storage components for EV and HEV applications
MEDLO7031.6	Comprehend EV and HEV working through Case studies.
MEDLO7032	**Renewable Energy Systems**
MEDLO7032.1	Describe the need for renewable energy and its potential for the development of a sustainable environment.
MEDLO7032.2	Identify and analyze various wind turbine energy harnessment techniques.
MEDLO7032.3	Identify and analyze various wind turbine energy harnessment techniques.
MEDLO7032.4	Design biogas plant for harnessing energy from organic waste.
MEDLO7032.5	Describe significance of hydrogen energy to fulfill present and future energy needs.
MEDLO7032.6	Describe the operating principle of geothermal energy and ocean energy and their role in sustainable development.
MEDLO7041	**Machinery Diagnostics**
MEDLO7041.1	Relate basic concepts of Machinery Diagnostic
MEDLO7041.2	Describe the working of vibration measuring instruments
MEDLO7041.3	Identify common faults in machinery using vibration spectrum
MEDLO7041.4	Interpret the vibration signals for monitoring and prognosis
ILO7013	**Management information System**
ILO 7013.1	Explain how information systems transform business
ILO 7013.2	Identify the impact information systems have on an organization
ILO 7013.3	Describe the IT infrastructure & its components with current trends
ILO 7013.4	Understand the principal tools & technologies for accessing information from databases to improve business performance & decision making

ILO 7013.5	Identify the types of systems used for enterprise-wide knowledge management & how they provide value for businesses
ILO7015	**Operations Research**
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
ILO7015.5	Apply Design of Experiments method for Optimization
ILO7017	**Disaster Management and Mitigation Measures**
ILO7017.1	Determine the impact of the disaster on human life
ILO7017.2	Analyse the salient features and mechanism of different types of Natural and Manmade Disasters
ILO7017.3	Identify the role played by Disaster Management, Policy and Administration in prevention of Disaster
ILO7017.4	Comprehend the relevance of Institutional Framework for Disaster Management in India
ILO7017.5	Identify the resources of Financing Relief Measures in the event of Disaster
ILO7017.6	Implement Preventive and Mitigation Measures to reduce the impact of Disaster.
MEL701	**Design of Mechanical Systems**
MEL701.1	Apply the concept of system design.
MEL701.2	Design of Gear box.
MEL701.3	Design of hoisting mechanism of EOT crane,
MEL701.4	Design belt conveyor systems
MEL701.5	Design engine components such as cylinder, piston, connecting rod and crankshaft
MEL701.6	Design pumps for the given applications
MEL702	**Maintenance Engineering Lab**
MEL702.1	Identify different tools used for maintenance.
MEL702.2	Apply different maintenance strategies.
MEL702.3	Demonstrate the process of servicing a machine.
MEL702.4	Identify common faults in Machinery using Vibration Spectrum.
MEL702.5	Interpret the Vibration Signals for Monitoring and Prognosis

MEL703	**Industrial Skills Lab**
MEL703.1	Skilfully prepare and edit documents and slides on MS Word and MS PowerPoint etc.
MEL703.2	Execute functions on MS Excel.
MEL703.3	Learn how to navigate tasks and execute functions in G-suite./ Msoffice
MEL703.4	Understand and practice metacognitive skillsof creativity and problem solving
MEL703.5	Hone team building and leadership skills.
MEP701	**Major Project-1**
MEP701.1	Students will be able to develop the understanding of the problem domain through extensive review of literature.
MEP701.2	Students will be able to identify and analyze the problem in detail to define its scope with problem specific data.
MEP701.3	Students will be able to identify various techniques to be implemented for the selected problem and related technical skills through feasibility analysis.
MEP701.4	Students will be able to design solutions for real-time problems that will positively impact society and environment.
MEP701.5	Students will be able to develop clarity of presentation based on communication, teamwork and leadership skills.
MEP701.6	Students will be able to inculcate professional and ethical behavior..
	SEMESTER -8
MEC801	**Operations Planning and Control**
MEC801.1	Illustrate operations functions and manage operations
MEC801.2	Apply various strategies to develop aggregate production plan based on the demand forecasting
MEC801.3	Apply various algorithms in scheduling and sequencing of manufacturing and service operations
MEC801.4	Develop Material Requirements Plans (MRP) to estimate the planned order releases
MEC801.5	Apply various techniques for facility layout planning and line balancing to optimize the resources
MEC801.6	Demonstrate the importance of implementation of JIT, Lean, Agile and Synchronous manufacturing in manufacturing and service organizations
MEDLO8061	**Product Design and Development**
MEDLO8061.1	Describe the process of product design & development.
MEDLO8061.2	Employ engineering, scientific, and mathematical principles to develop & execute a design project from a concept to a finished product.
MEDLO8061.3	Create 3D solid models of mechanical components using CAD software.
MEDLO8061.4	Demonstrate individual skills using selected manufacturing techniques such as rapid prototyping.

MEDLO8061.5	Fabricate an electromechanical assembly of a product from engineering drawings.
MEDLO8061.6	Work collaboratively in a team to complete a design project and effectively communicate the results of projects and other assignments both in a written and oral format.
MEDLO 8052	**Smart Materials**
MEDLO 8052.1	Classify and select different types of smart materials
MEDLO 8052.2	Comprehend Important Concepts and principles of Smart Materials
MEDLO 8052.3	Synthesis, sensing and actuation of Piezoelectric Materials, Magneto strictive Materials, Shape Memory Alloys, Electroactive Polymers
MEDLO 8052.4	Synthesis, sensing and actuation of Ferrofluids and Magneto rheological Fluids, Soft Matter, Carbon Nanotubes and Carbon nanostructures, Thermoelectric Materials
MEDLO 8052.5	Classify and select Smart Materials for Energy Applications: Materials used for energy storage
MEDLO 8052.6	Classify and select Composite Materials, Nano Composite Materials
ILO8021	**Project Management**
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
ILO8022	**Finance Management**
ILO8022.1	Learner will be able to Understand Indian finance system and corporate finance
ILO8022.2	Learner will be able to Take investment, finance as well as dividend decisions
MEL801	**Product Design and Development Lab**
MEL801.1	Identify the need for developing products
MEL801.2	Select suitable PD&D processes
MEL801.3	Apply the creativity & industrial design methods to design & develop the chosen product
MEL801.4	Work collaboratively in a team to complete a PD&D project.
MEL801.5	Effectively communicate the results of projects and other assignments both in a written and oral format
MEL802	**IOT Lab**

MEL802.1	Explain the Architecture , Communication Models and application Protocols of IoT
MEL802.2	Implement interfacing of various sensors with Microcontrollers
MEL802.3	Demonstrate the uploading and downloading of sensor Data on the Cloud.
MEL802.4	Apply IoT knowledge to key industries/domains that IoT is revolutionizing
MEP801	**Major Project-2**
MEP801.1	Students will be able to implement solutions for the selected problem by applying technical and professional skills.
MEP801.2	Students will be able to analyze impact of solutions in societal and environmental context for sustainable development.
MEP801.3	Students will be able to collaborate best practices along with effective use of modern tools.
MEP801.4	Students will be able to develop proficiency in oral and written communication with effective leadership and teamwork.
MEP801.5	Students will be able to nurture professional and ethical behavior.
MEP801.6	Students will be able to gain expertise that helps in building lifelong learning experience.

Fr. Conceicao Rodrigues College of Engineering
Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50
Department of Artificial Intelligence and Data Science

CO NUM	COURSE OUTCOME
	SEMESTER -3
	Engineering Mathematics III (CSC301)
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. (Apply)
CSC302.4	Ability to understand and apply concepts of graph theory in solving real world problems. (Apply)
CSC302.5	Demonstrate use of groups and codes in Encoding-Decoding (Analyze)
CSC302.6	Analyze a complex computing problem to find solution using principles of discrete mathematics (Analyze)
	Discrete Structures and Graph Theory (CSC302)
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. (Apply)
CSC302.4	Ability to understand and apply concepts of graph theory in solving real world problems. (Apply)
CSC302.5	Demonstrate use of groups and codes in Encoding-Decoding (Analyze)
CSC302.6	Analyze a complex computing problem to find solution using principles of discrete mathematics (Analyze)
	Data Structure (CSC303)
CSL301.1	Implement various linear data structures.
CSL301.2	Implement various non linear data structures.
CSL301.3	Implement appropriate searching techniques for a given problem.
CSL301.4	Choose appropriate data structure and apply it to solve problems in various domains
	Digital Logic & Computer Architecture (CSC304)
CSC304.1	To know different number systems and the basic structure of computer system.
CSC304.2	To apply the suitable algorithm for arithmetic operations
CSC304.3	To explain the basic concepts of digital components and processor organization
CSC304.4	To explain the generation of control signals for computer
CSC304.5	To demonstrate the memory organization in the computer system
CSC304.6	To describe the concepts of parallel processing and different Buses
	Computer Graphics (CSC305)
CSC305.1	Compute pixel positions for a given graphic primitive.
CSC305.2	Apply 2D &3D transformations on graphical objects.
CSC305.3	Apply clipping algorithms on 2D graphical objects.
CSC305.4	Explain viewing and modelling techniques in 2D and 3D space.
CSC305.5	Explain visible detection techniques applied to 3D objects.
	Data Structure Lab (CSL301)
CSL301.1	Implement various linear data structures.

CSL301.2	Implement various non linear data structures.
CSL301.3	Choose appropriate data structure and apply it to solve problems in various domains
CSL301.4	Implement appropriate searching techniques for a given problem.
	Digital Logic & Computer Architecture Lab (CSL302)
CSC302.1	Know different number systems and the basic structure of computer system.
CSC302.2	Apply the suitable algorithm for arithmetic operations
CSC302.3	Explain the basic concepts of digital components and processor organization
CSC302.4	Explain the generation of control signals for computer
CSC302.5	Demonstrate the memory organization in the computer system
CSC302.6	Describe the concepts of parallel processing and different Buses
	Computer Graphics Lab (CSL 303)
CSL303.1	Implement output and filled area primitive algorithms.
CSL303.2	Implement transformation and clipping algorithms on graphical objects.
CSL303.3	Implement curve and fractal generation methods.
CSL303.4	Develop a graphical application/animation based on the learned concept.
	Skill base Lab course: Object Oriented Programming with Java (CSL304)
CSL304.1	Apply fundamental programming constructs.
CSL304.2	Illustrate the concept of packages, classes and objects.
CSL304.3	Elaborate the concept of strings, arrays and vectors.
CSL304.4	Implement the concept of inheritance and interfaces.
CSL304.5	Implement the concept of exception handling and multithreading.
CSL304.6	Develop OOP based application.
	Mini Project – 1 A (CSM 301)
CSM 301.1	Identify problems based on societal /research needs
CSM301.2	Develop interpersonal skills to work as member of a group or leader.
CSM301.3	Draw the proper inferences from available results through theoretical/
CSM301.4	Analyze the impact of solutions in societal and environmental context for sustainable
CSM301.5	Demonstrate project management principles during project work.
	SEMESTER -4
	Engineering Mathematics IV (CSC401)
CSC401.1	Able to diagonalize the given matrix using eigen values and eigen vector.
CSC401.2	Evaluate complex integrals using Cauchy's theorem.
CSC401.3	Evaluate transform and the inverse transform.
CSC401.4	differences between means and variances, and analyse the independency of attributes.
CSC401.5	Able to optimize the given function using linear programming problem (LPP).
CSC401.6	Able to optimize the given function using non-linear programming problem (NLPP).
	Analysis of Algorithm (CSC402)
CSC402.1	Analyze the running time and space complexity of algorithms.
CSC402.2	Describe, apply and analyze the complexity of divide and conquer strategy.
CSC402.3	Describe, apply and analyze the complexity of greedy strategy.
CSC402.4	Describe, apply and analyze the complexity of dynamic programming strategy.
CSC402.5	Explain and apply backtracking, branch and bound.
CSC402.6	Explain and apply string matching techniques.
	Database Management System (CSC403)
CSC403.1	Recognize the need of database management system
CSC403.2	Design ER and EER diagram for real life applications

CSC403.3	Construct relational model and write relational algebra queries.
CSC403.4	Formulate SQL queries
CSC403.5	Apply the concept of normalization to relational database design.
CSC403.6	Describe the concepts of transaction, concurrency and recovery.
	Operating System (CSC404)
CSC404.1	Understand the objectives ,functions and structure of OS.
CSC404.2	Analyze the concept of process management and evaluate performance of process scheduling.
CSC404.3	Understand and apply concepts of synchronization and deadlocks.
CSC404.4	Evaluate performance of memory allocation and replacement policies.
CSC404.5	Understand the concepts of file management.
CSC404.6	Apply concepts of I/O management and analyze techniques of disk scheduling.
	Microprocessor (CSC405)
CSC405.1	Describe core concepts of 8086 microprocessors
CSC405.2	Apply the instructions of 8086 and write assembly language programs.
CSC405.3	Design 8086 based system using memory and peripheral chips.
CSC 405.4	Appraise the architecture of advanced processor.
	Analysis of Algorithm Lab (CSL401)
CSL402.1	Analyze the running time and space complexity of algorithms.
CSL402.2	Describe, apply and analyze the complexity of divide and conquer strategy.
CSL402.3	Describe, apply and analyze the complexity of greedy strategy.
CSL402.4	Describe, apply and analyze the complexity of dynamic programming strategy.
CSL402.5	Explain and apply backtracking, branch and bound.
CSL402.6	Explain and apply string matching techniques.
	Database Management System Lab(CSL402)
CSL402.1	Design ER/EER diagram and convert to relational model for real world application
CSL402.2	Apply DDL,DML,DCL and TCL ommands
CSL402.3	Write simple and complex queries
CSL402.4	Use PL/SQL constructs
CSL402.5	Demonstrate the concept of concurrent transaction execution and front end back end connectivity
	Operating System Lab(CSL403)
CSL403.1	Demonstrate basic operating system commands,shell scripts,system calls and API wrt Linux.
CSL403.2	Implement various process scheduling algorithms and evaluate their performance.
CSL403.3	Implement and analyse concepts of synchronization and deadlocks.
CSL403.4	Implement various memory management techniques and evaluate their performance.
CSL403.5	Implement and analyze concepts of virtual memory.
CSL403.6	Demonstrate and analyse concepts of file management and I/O management techniques.
	Microprocessor Lab (CSL404)
CSL404.1	Use appropriate instructions to program microprocessor to perform various task
CSL404.2	Develop the program in assembly/ mixed language for Intel 8086 processor
CSL404.3	Demonstrate the execution and debugging of assembly/ mixed language program
	Skill Base Lab Course: Python Programming (CSL405)
CSL405.1	Apply basic concepts in python to solve computing problems
CSL405.2	Perform file operations and text processing in python
CSL405.3	Develop programs for data structures using built in functions in python
CSL405.4	Develop basic applications in python
CSL405.5	Implement multithreading in python

CSL405.6	Develop basic programs using NumPy and Pandas

	Mini Project 1-B (CSM401)
CSM 401.1	Identify problems based on societal /research needs
CSM401.2	Develop interpersonal skills to work as member of a group or leader.
CSM401.3	Draw the proper inferences from available results through theoretical/
CSM401.4	Analyze the impact of solutions in societal and environmental context for sustainable
CSM401.5	Demonstrate project management principles during project work.
	SEMESTER - 5
	Computer Network (CSC501)
CSC501.1	To introduce concepts of computer networks and working of various layers of OSI.
CSC501.2	To explore the issues and challenges of protocols design while delving into TCP/IP protocol
CSC501.3	To assess the strengths and weaknesses of various routing algorithms
CSC501.4	To understand various transport layer and application layer protocols
CSC501.5	To design enterprise network for given user requirements in an application.
	Web Computing (CSC502)
CSC502.1	Select protocols or technologies required for various web applications
CSC502.2	Apply JavaScript to add functionality to web pages.
CSC502.3	Design front end application using React Components
CSC502.4	Construct web based Node.js applications using Express
CSC502.5	Design back-end applications using Node.js
CSC502.6	Construct React-Node based web real world application.

	Artificial Intelligence (CSC503)
CSC503.1	Identify the characteristics of the environment and differentiate between various agent architectures.
CSC503.2	Apply the most suitable search strategy to design problem solving agents
CSC503.3	Represent a natural language description of statements in logic and apply the inference rules to design
CSC503.4	Apply a probabilistic model for reasoning under uncertainty
CSC503.5	Describe various learning techniques.
	Data Warehousing & Mining (CSC504)
CSC504.1	Organize strategic data in an enterprise and build a data Warehouse.
CSC504.2	the importance of data mining.
CSC504.3	Organize and Prepare the data needed for data mining using pre preprocessing techniques
CSC504.4	large data sets
CSC504.5	Define and apply metrics to measure the performance of various data mining algorithms
CSC504.6	Understand Concepts related to Web mining

	Department Level Optional Course- 1 (Statistics for Artificial Intelligence & Data Science) CSDLO5011
CSDLO5011.1	Illustrate Exploratory Data Analysis
CSDLO5011.2	Describe data and sampling distributions
CSDLO5011.3	Solve Statistical Experiments and Significance Testing
CSDLO5011.4	Demonstrate summarizing data
CSDLO5011.5	Interpret the analysis of variance
CSDLO5011.6	Use Linear least squares
	Department Level Optional Course- 1 (Internet of Things) CSDLO5013
CSDLO5013.1	Describe the characteristics and conceptual framework of IoT.
CSDLO5013.2	Differentiate between the levels of the IoT architectures.

CSDLO5013.3	Analyze the IoT access technologies.
CSDLO5013.4	Ilustrate various edge to cloud protocols for IoT.
CSDLO5013.5	Apply IoT analytics and data visualization
CSDLO5013.6	Analyze and evaluate IoT applications**.**
	Web Computing and Network Lab (CSL501)
CSL501.1	Identify and apply the appropriate HTML tags to develop a webpage
CSL501.2	Identify and apply the appropriate CSS tags to format data on webpage
CSL501.3	Construct responsive websites using Bootstrap
CSL501.4	Use JavaScript to develop interactive web pages.
CSL501.5	Construct front end applications using React and back end using Node.js/express
CSL501.6	Use simulator for CISco packet tracer/GNS3
	Artificial Intelligence Lab (CSL502)
CSL502.1	Identify suitable agent architecture for given AI problem
CSL502.2	Implement simple programs using Prolog
CSL502.3	Implement various search techniques for problem solving agent
CSL502.4	Represent natural language description as statements in logic and apply inference rules to it
CSL502.5	Construct a Bayesian Belief Network for a given problem and draw probabilistic inference rules to it
CSL502.6	To describe the components of expert system
	Data Warehousing & Mining Lab (CSL503)
CSL503.1	Build a data warehouse
CSL503.2	Analyze data using OLAP operations so as to take strategic decisions.
CSL503.3	Demonstrate an understanding of the importance of data mining
CSL503.4	Organize and Prepare the data needed for data mining using pre preprocessing techniques
CSL503.5	Perform exploratory analysis of the data to be used for mining.
CSL503.6	large data sets.
	Business Communication and Ethics-II (CSL504)
CSL504.1	Plan and prepare effective business/ technical documents which will in turn provide a solid foundation for future managerial posts.
CSL504.2	Strategize personal and professional skills to build a professional image and meet the demands of the industry.
CSL504.3	Participate successfully in group discussions, meetings, and result-oriented agreeable solutions in group communication situations.
CSL504.4	Deliver persuasive and professional presentations to enhance professional skills.
CSL504.5	Develop creative thinking and interpersonal skills required for effective professional communication.
CSL503.6	Apply codes of ethical conduct, personal integrity, and norms of organizational behaviour.
	Mini Project : 2A (CSM501)
CSM 301.1	Identify problems based on societal /research needs
CSM301.2	Develop interpersonal skills to work as member of a group or leader.
CSM301.3	Draw the proper inferences from available results through theoretical/
CSM301.4	Analyze the impact of solutions in societal and environmental context for sustainable
CSM301.5	Demonstrate project management principles during project work.
	SEMESTER -6 **Data Analytics and Visualization (CSC601)**
CSC601.1	Comprenhend basics of data analytics and visualization
CSC601.2	Apply various regression models on a given data set and perform prediction
CSC601.3	Demonstarte advance understanding of time series concepts and analysis of data using various time series

CSC601.4	Analyze text data and gain insights
CSC601.5	Experiment with different analytics techniques and visualization using R
CSC601.6	Experiment with different analytics techniques and visualization using python
	Cryptography and System Security (CSC602)
CSC602.1	Identify information security goals and apply classical encryption techniques to secure information
CSC602.2	Apply different encryption and decryption techniques to solve problems related to confidentiality and
CSC602.3	Apply cryptographic checksums and evaluate the performance of different message digest algorithms for
CSC602.4	Apply different digital signature algorithms to achieve authentication to secure applications
CSC602.5	Apply computer security concepts to secure system assets like OS and Databases
CSC602.6	Apply the concepts in information security to web applications
	Software Engineering and Project Management (CSC603)
CSC603.1	Understand and use basic knowledge in software engineering
CSC603.2	Identify requirements, analyze and prepare models.
CSC603.3	Plan, schedule and track the progress of the projects
CSC603.4	Design & develop the software solutions for the growth of society
CSC603.5	Apply testing and assure quality in software solutions
CSC603.6	Projects. They can also organize different activities of project
	Machine Learning (CSC604)
CSC604.1	Comprehend basics of Machine Learning
CSC604.2	Build Mathematical foundation for machine learning
CSC604.3	Understand various Machine learning models
CSC604.4	Select suitable Machine learning models for a given problem
CSC604.5	Build Neural Network based models
CSC604.6	Apply Dimensionality Reduction techniques
	Department Level Optional Course -2 Distributed Computing (CSDLO6012)
CSDL6012.1	Demonstrate knowledge of the basic elements and concepts related to distributed systems & technologies (B2 – Comprehension)
CSDL6012.2	Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware. (B3 – Application)
CSDL6012.3	Analyze the various techniques used for clock synchronization, mutual exclusion and deadlock handling (B4 – Analysis)
CSDL6012.4	Describe the concepts of Resource and Process management (B2 – Comprehension)
CSDL6012.5	Assess the significance of Consistency and Replication Management models, and Fault Tolerance techniques (B4 – Analysis)
CSDL6012.6	Apply the knowledge of Distributed File System in building large-scale distributed applications. (B3 – Application)
	Department Level Optional Course -2 Image & Video processing (CSDLO6013)
CSDLO6013.1.	To gain fundamental knowledge of Image processing.
CSDLO6013.2.	To apply image enhancement techniques.
CSDLO6013.3.	To apply image segmentation and compression techniques.
CSDLO6013.4.	To gain an in-depth understanding of image transforms.
CSDLO6013.5.	To gain fundamental understanding of video processing.
	Data Analytics and Visualization Lab (CSL601)
CSL601.1	Explore various data analytics Libraries in R and Python.
CSL601.2	Implement various Regression techniques for prediction.

CSL601.3	Build various time series models on a given data set.
CSL601.4	Design Text Analytics Application on a given data set.
CSL601.5	Implement visualization techniques to given data sets using R
CSL601.6	Implement visualization techniques to given data sets using Python.
	Cryptography & System Security Lab (CSL602)
CSL602.1	Apply the knowledge of symmetric cryptography to implement simple ciphers.
CSL602.2	Apply the concepts of cryptography to implement block ciphers.
CSL602.3	Analyse and evaluate performance of hashing algorithms
CSL602.4	Explore the different network reconnaissance tools to gather information about networks
CSL602.5	Use tools like sniffers and port scanners and other related tools for analyzing packets in a network
CSL602.6	Apply different application security principles and practices
	Software Engineering and Project Management Lab (CSL603)
CSC603.1	Understand and use basic knowledge in software engineering
CSC603.2	Identify requirements, analyze and prepare models.
CSC603.3	Plan, schedule and track the progress of the projects
CSC603.4	Design & develop the software solutions for the growth of society
CSC603.5	Apply testing and assure quality in software solutions
CSC603.6	Projects. They can also organize different activities of project
	Machine Learning Lab (CSL604)
CSL604.1	Implement various Machine learning models
CSL604.2	Apply suitable Machine learning models for a given problem
CSL604.3	Implement Neural Network based models
CSL604.4	Apply Dimensionality Reduction techniques
	Skill base Lab Course: Cloud Computing (CSL605)
CSL605.1	Implement different types of virtualization techniques.
CSL605.2	Analyze various cloud computing service models and implement them to solve the given problems.
CSL605.3	Design and develop real world web applications and deploy them on commercial cloud(s).
CSL605.4	Explain major security issues in the cloud and mechanisms to address them.
CSL605.5	Explore various commercially available cloud services and recommend the appropriate one for the given
CSL605.6	Implement the concept of containerization
	Mini Project Lab: 2B (CSM601)
CSM 401.1	Identify problems based on societal /research needs
CSM401.2	Develop interpersonal skills to work as member of a group or leader.
CSM401.3	Draw the proper inferences from available results through theoretical/
CSM401.4	Analyze the impact of solutions in societal and environmental context for sustainable
CSM401.5	Demonstrate project management principles during project work.