JOGINPALLY B.R. ENGINEERING COLLEGE

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Approved by AICTE & Affiliated to JNTUH, Hyderabad

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Course Outcomes for all Programmes

PROGRAM OUTCOMES (POs)

(Common for S&H, EEE, ECE, CSE, IT , MEC , MBA , M.Tech-CSE ,M.Tech-PEED)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B.TECH I Year I Sem_R16
(Common for EEE, ECE, CSE, IT)

Code	Course Name	Course Outcomes
MA101BS	Mathematics - I	**At the end of this course, each student should be able to:** **CO1:** Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations. **CO2:** Find the Eigen values and Eigen vectors which come across under linear transformations. **CO3:** Find the extreme values of functions of two variables with/ without constraints. **CO4:** Identify whether the given first order DE is exact or not. **CO5:** Solve higher order DE's and apply them for solving some real world problems.
CH102BS	Engineering Chemistry	**At the end of this course, each student should be able to:** Students will gain the basic knowledge of electrochemical procedures related to corrosion and its control. They can understand the basic properties of water and its usage in domestic and industrial purposes. They learn the use of fundamental principles to make predictions about the general properties of materials. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.
PH103BS	Engineering Physics-I	**At the end of this course, each student should be able to:** **CO1:** Realize the importance of light phenomena in thin films and resolution. **CO2:** Learn principle, working of various laser systems and light propagation through

		optical fibers. **CO3:** Distinguish various crystal systems and understand atomic packing factor. **CO4:** Know the various defects in crystals.
EN104HS	Professional Communication in English	**At the end of this course, each student should be able to:** **CO1:** Use English Language effectively in spoken and written forms. **CO2:** Comprehend the given texts and respond appropriately. **CO3:** Communicate confidently in formal and informal contexts.
ME105ES	Engineering Mechanics	**At the end of this course, each student should be able to:** **CO1:** Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces. Solve problem of bodies subjected to friction. **CO2:** Find the location of centroid and calculate moment of inertia of a given section. **CO3:** Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory. **CO4:** Motion and rigid body motion. Solve problems using work energy equations for translation, fixed axis rotation and plane. **CO5:** Motion and solve problems of vibration.
EE106ES	Basic Electrical and Electronics Engineering	**At the end of this course, each student should be able to:** **CO1:** To analyze and solve problems of electrical circuits using network laws and theorems. **CO2:** To identify and characterize diodes and various types of transistors.

EN107HS	English Language Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Better understanding of nuances of English language through audio- visual experience and group activities. **CO2 :** Neutralization of accent for intelligibility. **CO3:** Speaking skills with clarity and confidence which in turn enhances their employability skills.
ME108ES	Engineering Workshop	**At the end of this course, each student should be able to:** **CO1:** Study and practice on machine tools and their operations. **CO2:** Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding. **CO3:** Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling. **CO4:** Apply basic electrical engineering knowledge for house wiring practice.

B.Tech-I YEAR - I Sem_MEC

Code	Course Name	Course Outcomes
MA101BS	Mathematics - I	**At the end of this course, each student should be able to:** **CO1:** Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations. **CO2:** Find the Eigen values and Eigen vectors which come across under linear transformations. **CO3:** Find the extreme values of functions of two variables with/ without constraints. **CO4:** Identify whether the given first order DE is exact or not.
MA102BS	Mathematics-II	**At the end of this course, each student should be able to:** **CO1:** Use Laplace transform techniques for solving DE's. **CO2:** Evaluate integrals using Beta and Gamma functions. **CO3:** Evaluate the multiple integrals and can apply these concepts to find areas, volumes, moment of inertia etc of regions on a plane or in space. **CO4:** Evaluate the line, surface and volume integrals and converting them from one to another.
PH103BS	Engineering Physics	**At the end of this course, each student should be able to:** **CO1:** Realize the importance of light phenomena in thin films and resolution. **CO2:** Learn principle, working of various laser systems and light propagation through optical fibers. **CO3:** Distinguish various crystal systems and understand atomic packing factor. **CO4:** Know the various defects in crystals.

CS104ES	Computer Programming in C	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic knowledge of computer hardware and software. **CO2:** Ability to write algorithms for solving problems. **CO3:** Ability to draw flowcharts for solving problems. **CO4:** Ability to code a given logic in C programming language. **CO5:** Gain knowledge in using C language for solving problems.
ME105ES	Engineering Mechanics	**At the end of this course, each student should be able to:** **CO1:** Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces. Solve problem of bodies subjected to friction. **CO2:** Find the location of centroid and calculate moment of inertia of a given section. **CO3:** Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear. **CO4:** Rotatory motion and rigid body motion. Solve problems using work energy equations for translation, fixed axis rotation and plane **CO5:** Motion and solve problems of vibration.
ME106ES	Engineering Graphics	**At the end of this course, each student should be able to:** **CO1:** Preparing working drawings to communicate the ideas and information. **CO2:** Read, understand and interpret engineering drawings.
PH107BS	Engineering Physics Lab	**At the end of this course, each student should be able to:** **CO1:** Develop skills to impart practical knowledge

		in real time solutions. **CO2:** Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations. **CO3:** Design new experiments/instruments with practical knowledge. **CO4:** Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems. **CO5:** Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CS108ES	Computer Programming in C Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to design and test programs to solve mathematical and scientific problems. **CO2:** Ability to write structured programs using control structures and functions.

B.TECH I Year II Sem_R16
(Common for EEE, ECE, CSE, IT)

Code	Course Name	Course Outcomes
PH201BS	Engineering Physics-II	**At the end of this course, each student should be able to:** **CO1:** Realize the importance of behavior of a particle quantum mechanically. **CO2:** Learn concentration estimation of charge carriers in semi conductors. **CO3:** Learn various magnetic dielectric properties and apply them in engineering applications. **CO4:** Know the basic principles and applications of super conductors.
MA202BS	Mathematics-II	**At the end of this course, each student should be able to:** **CO1:** Use Laplace transform techniques for solving DE's. **CO2:** Evaluate integrals using Beta and Gamma Functions. **CO3:** Evaluate the multiple integrals and can apply these concepts to find areas, volumes, moment of inertia etc of regions on a plane or in space. **CO4:** Evaluate the line, surface and volume integrals and converting them from one to another.
MA203BS	Mathematics-III	**At the end of this course, each student should be able to:** **CO1:** Differentiate among random variables involved in the probability models which are useful for all branches of engineering. **CO2:** Calculate mean, proportions and variances of sampling distributions and to make important decisions for few samples which are taken from a large data. **CO3:** Solve the tests of ANOVA for classified data **CO4:** Find the root of a given equation and solution of a system of equations and fit a curve for a given data.

		CO5: Find the numerical solutions for a given first order initial value problem.
CS204ES	Computer Programming in C	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic knowledge of computer hardware and software. **CO2:** Ability to write algorithms for solving problems. **CO3:** Ability to draw flowcharts for solving problems. **CO4:** Ability to code a given logic in C programming language. **CO5:** Gain knowledge in using C language for solving problems.
ME205ES	Engineering Graphics	**At the end of this course, each student should be able to:** **CO1:** Ability to prepare working drawings to communicate the ideas and information. **CO2:** Ability to read, understand and interpret engineering drawings.
CH206BS	Engineering Chemistry Lab	**At the end of this course, each student should be able to:** **CO1:** Determination of parameters like hardness and chloride content in water. **CO2:** Estimation of rate constant of a reaction from concentration – time relationships. **CO3:** Determination of physical properties like adsorption and viscosity. **CO4:** Calculation of Rf values of some organic molecules by TLC technique.
PH207BS	Engineering Physics Lab	**At the end of this course, each student should be able to:** **CO1:** Develop skills to impart practical knowledge in real time solution. **CO2:** Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.

		CO3: Design new instruments with practical knowledge. **CO4:** Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems. **CO5:** Understand measurement technology, usage of new instruments and real time applications in engineering studies.
CS208ES	Computer Programming in C Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to design and test programs to solve mathematical and scientific problems. **CO2:** Ability to write structured programs using control structures and functions.

B.Tech-I YEAR - II Sem_MEC

Code	Course Name	Course Outcomes
AP201BS	Applied Physics	**At the end of this course, each student should be able to:** **CO1:** Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations. **CO2:** Find the Eigen values and Eigen vectors which come across under linear transformations. **CO3:** Find the extreme values of functions of two variables with/ without constraints. **CO4:** Identify whether the given first order DE is exact or not. **CO5:** Solve higher order DE's and apply them for solving some real world problems.
CH202BS	Engineering Chemistry	**At the end of this course, each student should be able to:** **CO1:** Use Laplace transform techniques for solving DE's. **CO2:** Evaluate integrals using Beta and Gamma functions. **CO3:** Evaluate the multiple integrals and can apply these concepts to find areas, volumes, moment of inertia etc of regions on a plane or in space. **CO4:** Evaluate the line, surface and volume integrals and converting them from one to another.
MA203BS	Mathematics-III	**At the end of this course, each student should be able to:** **CO1:** Realize the importance of light phenomena in thin films and resolution. **CO2:** Learn principle, working of various laser systems and light propagation through optical fibers. **CO3:** Distinguish various crystal systems and

		understand atomic packing factor. **CO4:** Know the various defects in crystals.
EN204HS	Professional Communication in English	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic knowledge of computer hardware and software. **CO2:** Ability to write algorithms for solving problems. **CO3:** Ability to draw flowcharts for solving problems. **CO4:** Ability to code a given logic in C programming language. **CO5:** Gain knowledge in using C language for solving problems.
EE205ES	Basic Electrical & Electronics Engineering	**At the end of this course, each student should be able to:** **CO1:** Predict the behavior of any electrical and magnetic circuits. **CO2:** Formulate and solve complex AC, Dc circuits. **CO3:** Identify the type of electrical machine used for that particular application. **CO4:** Realize the requirement of transformers in transmission and distribution of electric power and other applications. **CO5:** Function on multi-disciplinary teams.
CH206BS	Engineering Chemistry Lab	**At the end of this course, each student should be able to:** **CO1:** Preparing working drawings to communicate the ideas and information. **CO2:** Read, understand and interpret engineering drawings.
EN207HS	English Language Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Better understanding of nuances of English language through audio- visual experience

		and group activities . **CO2:** Neutralization of accent for intelligibility. **CO3:** Speaking skills with clarity and confidence which in turn enhances their employability skills.
ME208ES	Engineering Workshop	**At the end of this course, each student should be able to:** **CO1:** Ability to design and test programs to solve mathematical and scientific problems. **CO2:** Ability to write structured programs using control structures and functions.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-I: The ability to analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO-II: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO-III: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

B.TECH II Year I Sem_R16_CSE

Code	Course Name	Course Outcomes
MA301BS	Mathematics – IV	**At the end of this course, each student should be able to:** **CO1:** Analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem. **CO2:** Find the Taylor's and Laurent's series expansion of complex functions. **CO3:** The bilinear transformation. **CO4:** Express any periodic function in term of sines and cosines. **CO5:** Express a non-periodic function as integral representation. **CO6:** Analyze one dimensional wave and heat equation.
CS302ES	Data Structures through C++	**At the end of this course, each student should be able to:** **CO1:** Ability to choose appropriate data structures to represent data items in real world problems. **CO2:** Ability to analyze the time and space complexities of algorithms. **CO3:** Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees. **CO4:** Able to analyze and implement various kinds of searching and sorting techniques.
CS303ES	Mathematical Foundations of Computer Science	**At the end of this course, each student should be able to:** **CO1:** Ability to apply mathematical logic to solve problems. **CO2:** Understand sets, relations, functions, and discrete structures.

		CO3: Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions. **CO4:** Able to formulate problems and solve recurrence relations. **CO5:** Able to model and solve real-world problems using graphs and trees.
CS304ES	Digital Logic Design	**At the end of this course, each student should be able to:** **CO1:** Able to understand number systems and codes. **CO2:** Able to solve Boolean expressions using Minimization methods. **CO3:** Able to design the sequential and combinational circuits. **CO4:** Able to apply state reduction methods to solve sequential circuits.
CS305ES	Object Oriented Programming through Java	**At the end of this course, each student should be able to:** **CO1:** Able to solve real world problems using OOP techniques. **CO2:** Able to understand the use of abstract classes. **CO3:** Able to solve problems using java collection framework and I/O classes. **CO4:** Able to develop multithreaded applications with synchronization. **CO5:** Able to develop applets for web applications. **CO6:** Able to design GUI based applications.
CS306ES	Data Structures through C++ Lab	**At the end of this course, each student should be able to:** **CO1:** Able to identify the appropriate data structures and algorithms for solving real world problems. **CO2:** Able to implement various kinds of searching and sorting techniques. **CO3:** Able to implement data structures such as stacks, queues, Search trees, and hash tables to

		solve various computing problems.
CS307ES	IT Workshop	**At the end of this course, each student should be able to:** **CO1:** Apply knowledge for computer assembling and software installation. **CO2:** Ability how to solve the trouble shooting problems. **CO3:** Apply the tools for preparation of PPT, Documentation and budget sheet etc.
CS308ES	Object Oriented Programming through Java Lab	**At the end of this course, each student should be able to:** **CO1:** Able to write programs for solving real world problems using java collection frame work. **CO2:** Able to write programs using abstract classes. **CO3:** Able to write multithreaded programs. **CO4:** Able to write GUI programs using swing controls in Java.
* MC300ES	Environmental Science and Technology	**At the end of this course, each student should be able to:** Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

B.TECH II Year II Sem_R16_CSE

Code	Course Name	Course Outcomes
CS401BS	Computer Organization	**At the end of this course, each student should be able to:** **CO1:** Able to understand the basic components and the design of CPU, ALU and Control Unit. **CO2:** Ability to understand memory hierarchy and its impact on computer cost/performance. **CO3:** Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design. **CO4:** Ability to understand the instruction set, instruction formats and addressing modes of 8086. **CO5:** Ability to write assembly language programs to solve problems.
CS402BS	Database Management Systems	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic elements of a relational database management system. **CO2:** Ability to identify the data models for relevant problems. **CO3:** Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data. **CO4:** Apply normalization for the development of application software.
CS403BS	Operating Systems	**At the end of this course, each student should be able to:** **CO1:** Apply optimization techniques for the improvement of system performance. **CO2:** Ability to design and solve synchronization problems. **CO3:** Learn about minimization of turnaround time, waiting time and response time and also

		maximization of throughput by keeping CPU as busy as possible. **CO4:** Ability to change access controls to protect files. **CO5:** Ability to compare the different operating systems.
CS404BS	Formal Languages and Automata Theory	**At the end of this course, each student should be able to:** **CO1:** Able to understand the concept of abstract machines and their power to recognize the languages. **CO2:** Able to employ finite state machines for modeling and solving computing problems. **CO3:** Able to design context free grammars for formal languages. **CO4:** Able to distinguish between decidability and undecidability. **CO5:** Able to gain proficiency with mathematical tools and formal methods.
CS405BS	Business Economics and Financial Analysis	**At the end of this course, each student should be able to:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analyzing the Financial Statements of a Company.
CS406BS	Computer Organization Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze the behavior of Logic Gates with the help of HDL/ VHDL. **CO2:** Implement sequential circuits and verify the results through simulation by VHDL. **CO3:** Design 8-bit ALU. **CO4:** Design 24X8 RAM. **CO5:** Design 24X8 STACK.

		CO6: Design 8-bit processor.
CS407BS	Database Management Systems Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to design and implement a database schema for given problem. **CO2:** Apply the normalization techniques for development of application software to realistic problems. **CO3:** Ability to formulate queries using SQL DML / DDL / DCL commands.
CS408BS	Operating Systems Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to develop application programs using system calls in Unix. **CO2:** Ability to implement interprocess communication between two processes. **CO3:** Ability to design and solve synchronization problems. **CO4:** Ability to simulate and implement operating system concepts such as scheduling, deadlock management , file management, and memory management.
* MC400HS	Gender Sensitization Lab	**At the end of this course, each student should be able to:** **CO1:** Students will have developed a better understanding of important issues related to gender in contemporary India. **CO2:** Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film. **CO3:** Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.

		CO4: Students will acquire insight into the gendered division of labour and its relation to politics and economics. **CO5:** Men and women students and professionals will be better equipped to work and live together as equals. **CO6:** Students will develop a sense of appreciation of women in all walks of life. **CO7:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

B.TECH III Year I Sem_R16_CSE

Code	Course Name	Course Outcomes
CS501PC	Design and Analysis of Algorithms	**At the end of this course, each student should be able to:** **CO1:** Ability to analyze the performance of algorithms. **CO2:** Ability to choose appropriate algorithm design techniques for solving problems. **CO3:** Ability to understand how the choice of data Structures and the algorithm design methods impact the performance of programs.
CS502PC	Data Communication and Computer Networks	**At the end of this course, each student should be able to:** **CO1:** Students should be understand and explore the basics of Computer Networks and Various Protocols. He / She will be in a position to understand the World Wide Web concepts. **CO2:** Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and adhoc networks.
CS503PC	Software Engineering	**At the end of this course, each student should be able to:** **CO1:** Ability to identify the minimum requirements for the development of application. **CO2:** Ability to develop, maintain, efficient, reliable and cost effective software solutions. **CO3:** Ability to critically thinking and evaluate assumptions and arguments.
SM504MS	Fundamentals of Management	**At the end of this course, each student should be able to:** **CO1:** The students understand the significance of Management in their Profession. **CO2:** The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.

		CO3: The students can explore the Management Practices in their domain area.
	Open Elective –I	
CS505PC	Design and Analysis of Algorithms Lab	**At the end of this course, each student should be able to:** Ability to write programs in java to solve problems using algorithm design techniques such as Divide and Conquer, Greedy, Dynamic programming, and Backtracking.
CS506PC	Computer Networks Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the encryption and decryption concepts in Linux environment. **CO2:** Ability to apply appropriate algorithm for the finding of shortest route. **CO3:** Ability to configure the routing table.
CS507PC	Software Engineering Lab	**At the end of this course, each student should be able to:** **CO1:** Build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting. **CO2:** Become acquainted with historical and modern software methodologies. **CO3:** Understand the phases of software projects and practice the activities of each phase. **CO4:** Practice clean coding. **CO5:** Take part in project management.
*MC500HS	Professional Ethics	**At the end of this course, each student should be able to:** The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

B.TECH III Year II Sem_R16_CSE

Code	Course Name	Course Outcomes
CS601PC	Compiler Design	**At the end of this course, each student should be able to:** **CO1:** Ability to design, develop, and implement a compiler for any language. **CO2:** Able to use lex and yacc tools for developing a scanner and a parser. **CO3:** Able to design and implement LL and LR parsers. **CO4:** Able to design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity. **CO5:** Ability to design algorithms to generate machine code.
CS602PC	Web Technologies	**At the end of this course, each student should be able to:** **CO1:** Gain knowledge of client side scripting, validation of forms and AJAX programming. **CO2:** Have Understanding of server-side scripting with PHP language. **CO3:** Have understanding of what is XML and how to parse and use XML Data with Java. **CO4:** To introduce Server side programming with Java Servlets and JSP.
CS603PC	Cryptography and Network Security	**At the end of this course, each student should be able to:** **CO1:** Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues. **CO2:** Ability to identify information system requirements for both of them such as client and server. **CO3:** Ability to understand the current legal issues

		towards information security.
	Open Elective-II	
CS611PE	**Professional Elective-I** Mobile Computing	**At the end of this course, each student should be able to:** **CO1:** Able to think and develop new mobile application. **CO2:** Able to take any new technical issue related to this new paradigm and come up with a solution(s). **CO3:** Able to develop new ad hoc network applications and/or algorithms/protocols. **CO4:** Able to understand & develop any existing or new protocol related to mobile environment.
CS612PE	**Professional Elective-I** Design Patterns	**At the end of this course, each student should be able to:** **CO1:** Create software designs that are scalable and easily maintainable. **CO2:** Understand the best use of Object Oriented concepts for creating truly OOP programs **CO3:** Use creational design patterns in software design for class instantiation. **CO4:** Use structural design patterns for better class and object composition. **CO5:** Use behavioral patterns for better organization and communication between the objects. **CO6:** Use refactoring to compose the methods for proper code packaging. **CO7:** Use refactoring to better organize the class responsibilities of current code.
CS613PE	**Professional Elective-I** Artificial Intelligence	**At the end of this course, each student should be able to:** **CO1:** Possess the ability to formulate an efficient problem space for a problem expressed in English. **CO2:** Possess the ability to select a search algorithm for a problem and characterize its time and space

		complexities. **CO3:** Possess the skill for representing knowledge using the appropriate technique. **CO4:** Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing.
CS614PE	**Professional Elective-I** Information Security Management (Security Analyst-I)	**At the end of this course, each student should be able to:** **CO1:** Understand the difference between threats and attacks. **CO2:** Understand the Security Issues and Measures. **CO3:** Know the KEY Elements and Logical Elements of Networks . **CO4:** Understand the Data Leakage, its Threats and Mitigation. **CO5:** Understand the Database Security. **CO6:** Understand the Policies, Guideline and Framework of Information Security. **CO7:** Understand the Roles and Responsibilities of ISM.
CS615PE	**Professional Elective-I** Introduction to Analytics (Associate Analyst-I)	**At the end of this course, each student should be able to:** **CO1:** Understand the impact of data analytics for business decisions and strategy Carry out data analysis/statistical analysis. **CO2:** To carry out standard data visualization and formal inference procedures. **CO3:** Design Data Architecture. **CO4:** Understand various Data Sources.
CS604PC	Cryptography and Network Security Lab	**At the end of this course, each student should be able to:** **CO1:** Use C language to develop simple XOR operation for encryption of data. **CO2:** Make use of C/Java to implement Symmetric cryptography.

		CO3: Choose C/Java to develop Asymmetric cryptography. Implement Diffie-Hellman Key exchange using HTML and Javascript. **CO4:** Develop java programs on MD-5 and SHA-1 Algorithms.
CS605PC	Web Technologies Lab	**At the end of this course, each student should be able to:** **CO1:** Use LAMP Stack for web applications. **CO2:** Use Tomcat Server for Servlets and JSPs. **CO3:** Write simple applications with Technologies like HTML, Javascript, AJAX, PHP,Servlets and JSPs. **CO4:** Connect to Database and get results. **CO5:** Parse XML files using Java(DOM and SAX parsers).
EN606HS	Advanced English Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire vocabulary and use it contextually. **CO2:** Listen and speak effectively. **CO3:** Develop proficiency in academic reading and Writing. **CO4:** Increase possibilities of job prospects. **CO5:** Communicate confidently in formal and informal Contexts.

B.TECH IV Year I Sem_R16_CSE

Code	Course Name	Course Outcomes
CS701PC	Data Mining	**At the end of this course, each student should be able to:** **CO1:** Ability to perform the preprocessing of data and apply mining techniques on it. **CO2:** Ability to identify the association rules, classification and clusters in large data sets. **CO3:** Ability to solve real world problems in business and scientific information using data mining. **CO4:** Ability to classify web pages, extracting knowledge from the web.
CS702PC	Principles of Programming Languages	**At the end of this course, each student should be able to:** **CO1:** Ability to express syntax and semantics in formal notation. **CO2:** Ability to apply suitable programming paradigm for the application. **CO3:** Ability to compare the features of various programming languages. **CO4:** Able to understand the programming paradigms of modern programming languages. **CO5:** Able to understand the concepts of ADT and OOP. **CO6:** Ability to program in different language paradigms and evaluate their relative benefits.
CS721PE	**Professional Elective – II** Python Programming	**At the end of this course, each student should be able to:** **CO1:** Examine Python syntax and semantics and be fluent in the use of Python flow control and functions. **CO2:** Demonstrate proficiency in handling Strings and File Systems. **CO3:** Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries

		and use Regular Expressions. **CO4:** Interpret the concepts of Object-Oriented Programming as used in Python. **CO5:** Implement exemplary applications related to Network Programming, Web Services and Databases in Python.
CS722PE	**Professional Elective – II** Mobile Application Development	**At the end of this course, each student should be able to:** **CO1:** Describe Android platform, Architecture and features. **CO2:** Design User Interface and develop activity for Android App. **CO3:** Use Intent , Broadcast receivers and Internet services in Android App. **CO4:** Design and implement Database Application and Content providers. **CO5:** Use multimedia, camera and Location based services in Android App. **CO6:** Discuss various security issues in Android Platform.
CS723PE	**Professional Elective – II** Web Scripting Languages	**At the end of this course, each student should be able to:** **CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. **CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. **CO3:** Acquire programming skills in scripting language.
CS724PE	**Professional Elective – II** Internet of Things	**At the end of this course, each student should be able to:** **CO1:** Interpret the impact and challenges posed by IoT networks leading to new architectural models.

		CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network. **CO3:** Appraise the role of IoT protocols for efficient network communication. **CO4:** Elaborate the need for Data Analytics and Security in IoT. **CO5:** Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
CS731PE	**Professional Elective - III** Graph Theory	**At the end of this course, each student should be able to:** **CO1:** Know some important classes of graph theoretic Problems. **CO2:** Be able to formulate and prove central theorems about trees, matching, connectivity, colouring and planar graphs. **CO3:** Be able to describe and apply some basic algorithms for graphs. **CO4:** Be able to use graph theory as a modeling tool.
CS732PE	**Professional Elective - III** Distributed Systems	**At the end of this course, each student should be able to:** **CO1:** Able to comprehend and design a new distributed system with the desired features. **CO2**: Able to start literature survey leading to further research in any subarea. **CO3:** Able to develop new distributed applications.
CS733PE	**Professional Elective - III** Machine Learning	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of computational intelligence like machine learning. **CO2:** Ability to get the skill to apply machine learning techniques to address the real time problems in different areas. **CO3:** Understand the Neural Networks and its usage in machine learning application.

CS734PE	**Professional Elective - III** Software Process and Project Management	**At the end of this course, each student should be able to:** **CO1:** Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation. **CO2:** Analyze the major and minor milestones, artifacts and metrics from management and technical perspective. **CO3:** Design and develop software product using conventional and modern principles of software project management.
CS741PE	**Professional Elective - IV** Computational Complexity	**At the end of this course, each student should be able to:** **CO1:** Ability to classify decision problems into appropriate complexity classes. **CO2:** Ability to specify what it means to reduce one problem to another, and construct reductions for simple examples. **CO3:** Ability to classify optimization problems into appropriate approximation complexity classes **CO4:** Ability to choose appropriate data structure for the given problem. **CO5:** Ability to choose and apply appropriate design method for the given problem.
CS742PE	**Professional Elective - IV** Cloud Computing	**At the end of this course, each student should be able to:** **CO1:** Ability to understand various service delivery models of a cloud computing architecture. **CO2:** Ability to understand the ways in which the cloud can be programmed and deployed. **CO3:** Understanding cloud service providers.
CS743PE	**Professional Elective - IV** Blockchain	**At the end of this course, each student should be able to:** Learn about research advances related to one of the

	Technology	most popular technological areas today.
CS744PE	**Professional Elective - IV** Social Network Analysis	**At the end of this course, each student should be able to:** **CO1:** Develop semantic web related applications. **CO2:** Represent knowledge using ontology. **CO3:** Predict human behaviour in social web and related communities. **CO4:** Visualize social networks.
CS703PC	Data Mining Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to add mining algorithms as a component to the exiting tools. **CO2:** Ability to apply mining techniques for realistic data.
CS751PC	**Professional Elective** -II Lab Python Programming Lab	**At the end of this course, each student should be able to:** **CO1:** Student should be able to understand the basic concepts scripting and the contributions of scripting language. **CO2:** Ability to explore python especially the object oriented concepts, and the built in objects of Python. **CO3:** Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations.
CS752PC	**Professional Elective** -II Lab Mobile Application Development Lab	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the android features and create , develop using android. **CO2:** Demonstrate and Understanding anatomy of an Android application. **CO3:** Apply the android geo location based services. **CO4:** Illustrate the android wifi features and advance android development.

		CO5: Demonstrate the linux security and implement ADL interface.
CS753PC	**Professional Elective** -II Lab Web Scripting Languages Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the differences between Scripting languages and programming languages. **CO2:** Able to gain some fluency programming in Ruby, Perl, TCL.
CS754PC	**Professional Elective** -II Lab Internet of Things Lab	**At the end of this course, each student should be able to:** **CO1:** Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts. **CO2:** Collaborate on research with industry partners to address significant and complex challenges surrounding IoT technologies and applications. **CO3:** This may be used as a platform for conducting consultancy work required by government/Private organizations in around Coimbatore. **CO4:** Enable faculty learning, research and hands-on experimentation to discover and demonstrate the promise of the Internet of Things. **CO5:** Provide students unique interdisciplinary learning and innovation experiences with IoT technologies.

CS705PC	Industry Oriented Mini Project	**At the end of this course, each student should be able to:** **CO1:** Formulate a real world problem and develop its requirements. **CO2:** Student will be exposed to industrial awareness. **CO3:** Self learning technologies, methods and/or techniques that contribute to the software solution of the project.
CS706PC	Seminar	**At the end of this course, each student should be able to:** **CO1:** Ability to work in actual working environment. **CO2:** Ability to utilize technical resources. **CO3:** Ability to write technical documents and give oral presentations related to the work completed.

B.TECH IV Year II Sem_R16_CSE

Code	Course Name	Course Outcomes
	Open Elective – III	
CS851PE	**Professional Elective – V** Information Theory & Coding	**At the end of this course, each student should be able to:** **CO1:** Learn measurement of information and errors. **CO2:** Obtain knowledge in designing various source codes and channel codes. **CO3:** Design encoders and decoders for block and cyclic codes. **CO4:** Understand the significance of codes in various applications.
CS852PE	**Professional Elective – V** Real-Time Systems	**At the end of this course, each student should be able to:** **CO1:** Be able to explain real-time concepts such as preemptive multitasking, task priorities. **CO2:** Priority inversions, mutual exclusion, context switching, and synchronization, interrupt. **CO3:** Latency and response time, and semaphores. **CO4:** Able describe how a real-time operating system kernel is implemented. **CO5:** Able explain how tasks are managed. **CO6:** Explain how the real-time operating system implements time management. **CO7:** Discuss how tasks can communicate using semaphores, mailboxes, and queues. **CO8:** Be able to implement a real-time system on an embedded processor. **CO9:** Be able to work with real time operating systems like RT Linux, Vx Works, MicroC /OSII, Tiny OS.
CS853PE	**Professional Elective – V** Data Analytics	**At the end of this course, each student should be able to:** **CO1:** After completion of this course students will

		be able to Understand the impact of data analytic for business decisions and strategy. **CO2:** Carry out data analysis/statistical analysis. **CO3:** To carry out standard data visualization and formal inference procedures. **CO4:** Design Data Architecture. **CO5:** Understand various Data Sources.
CS854PE	**Professional Elective – V** Modern Software Engineering	**At the end of this course, each student should be able to:** **CO1:** Basic knowledge and understanding of the analysis and design of complex systems. **CO2:** Ability to apply software engineering principles and techniques.
CS861PE	**Professional Elective -VI** Advanced Algorithms	**At the end of this course, each student should be able to:** **CO1:** Ability to analyze the performance of algorithms. **CO2:** Ability to choose appropriate data structures and algorithm design methods for a specified application. **CO3:** Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.
CS862PE	**Professional Elective -VI** Web Services and Service Oriented Architecture	**At the end of this course, each student should be able to:** CO1: Basic details of WSDL, UDDI, SOAP. CO2: Implement WS client and server with interoperable systems.
CS863PE	**Professional Elective -VI** Computer Forensics	**At the end of this course, each student should be able to:** **CO1:** Students will understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.

		CO2: It gives an opportunity to students to continue their zeal in research in computer forensics.
CS864PE	**Professional Elective -VI** Neural Networks and Deep Learning	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the concepts of Neural Networks. **CO2:** Ability to select the Learning Networks in modeling real world systems. **CO3:** Ability to use an efficient algorithm for Deep Models. **CO4:** Ability to apply optimization strategies for large scale applications.
CS801PC	Major Project	**At the end of this course, each student should be able to:** **CO1:** Ability to implement and execute well defined objective. **CO2:** Ability to work in team at component level and system level. **CO3:** Ability to troubleshoot.

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-I. To possess the knowledge of information technology, on social issues to find solution.

PSO-II To use recent techniques, skills and tools to solve complex engineering problems.

PSO-III To design, develop, implement and evaluate software components, process and systems to meet the industrial needs and contribute to society.

B.TECH II Year I Sem_R16_IT

Code	Course Name	Course Outcomes
MA301BS	Mathematics – IV	**At the end of this course, each student should be able to:** **CO1:** Analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem. **CO2:** Find the Taylor's and Laurent's series expansion of complex functions. **CO3:** The bilinear transformation. **CO4:** Express any periodic function in term of sines and cosines. **CO5:** Express a non-periodic function as integral representation. **CO6:** Analyze one dimensional wave and heat equation.
CS302ES	Data Structures through C++	**At the end of this course, each student should be able to:** **CO1:** Ability to choose appropriate data structures to represent data items in real world problems. **CO2:** Ability to analyze the time and space complexities of algorithms. **CO3:** Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees. **CO4:** Able to analyze and implement various kinds of searching and sorting techniques.
CS303ES	Mathematical Foundations of Computer Science	**At the end of this course, each student should be able to:** **CO1:** Ability to apply mathematical logic to solve problems. **CO2:** Understand sets, relations, functions, and discrete structures.

		CO3: Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions. **CO4:** Able to formulate problems and solve recurrence relations. **CO5:** Able to model and solve real-world problems using graphs and trees.
CS304ES	Digital Logic Design	**At the end of this course, each student should be able to:** **CO1:** Able to understand number systems and codes. **CO2:** Able to solve Boolean expressions using Minimization methods. **CO3:** Able to design the sequential and combinational circuits. **CO4:** Able to apply state reduction methods to solve sequential circuits.
CS305ES	Object Oriented Programming through Java	**At the end of this course, each student should be able to:** **CO1:** Able to solve real world problems using OOP techniques. **CO2:** Able to understand the use of abstract classes. **CO3:** Able to solve problems using java collection framework and I/O classes. **CO4:** Able to develop multithreaded applications with synchronization. **CO5:** Able to develop applets for web applications. **CO6:** Able to design GUI based applications.
CS306ES	Data Structures through C++ Lab	**At the end of this course, each student should be able to:** **CO1:** Able to identify the appropriate data structures and algorithms for solving real world problems. **CO2:** Able to implement various kinds of searching and sorting techniques. **CO3:** Able to implement data structures such as stacks, queues, Search trees, and hash tables to

		solve various computing problems.
CS307ES	IT Workshop	**At the end of this course, each student should be able to:** **CO1:** Apply knowledge for computer assembling and software installation. **CO2:** Ability how to solve the trouble shooting problems. **CO3:** Apply the tools for preparation of PPT, Documentation and budget sheet etc.
CS308ES	Object Oriented Programming through Java Lab	**At the end of this course, each student should be able to:** **CO1:** Able to write programs for solving real world problems using java collection frame work. **CO2:** Able to write programs using abstract classes. **CO3:** Able to write multithreaded programs. **CO4:** Able to write GUI programs using swing controls in Java.
* MC300ES	Environmental Science and Technology	**At the end of this course, each student should be able to:** Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

B.TECH II Year II Sem_R16_IT

Code	Course Name	Course Outcomes
CS401BS	Computer Organization	**At the end of this course, each student should be able to:** **CO1:** Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit. **CO2:** Ability to understand memory hierarchy and its impact on computer cost/performance. **CO3:** Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design. **CO4:** Ability to understand the instruction set, instruction formats and addressing modes of 8086. **CO5:** Ability to write assembly language programs to solve problems.
CS402BS	Database Management Systems	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic elements of a relational database management system. **CO2:** Ability to identify the data models for relevant problems. **CO3:** Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data. **CO4:** Apply normalization for the development of application software.
CS403BS	Operating Systems	**At the end of this course, each student should be able to:** **CO1:** Apply optimization techniques for the improvement of system performance. **CO2:** Ability to design and solve synchronization problems. **CO3:** Learn about minimization of turnaround time, waiting time and response time and also

		maximization of throughput by keeping CPU as busy as possible. **CO4:** Ability to change access controls to protect files. **CO5:** Ability to compare the different operating systems.
CS404BS	Formal Languages and Automata Theory	**At the end of this course, each student should be able to:** **CO1:** Able to understand the concept of abstract machines and their power to recognize the languages. **CO2:** Able to employ finite state machines for modeling and solving computing problems. **CO3:** Able to design context free grammars for formal languages. **CO4:** Able to distinguish between decidability and undecidability. **CO5:** Able to gain proficiency with mathematical tools and formal methods.
CS405BS	Business Economics and Financial Analysis	**At the end of this course, each student should be able to:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.
CS406BS	Computer Organization Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze the behavior of Logic Gates with the help of HDL/ VHDL. **CO2:** Implement sequential circuits and verify the results through simulation by VHDL. **CO3:** Design 8-bit ALU. **CO4:** Design 24X8 RAM. **CO5:** Design 24X8 STACK.

		CO6: Design 8-bit processor.
CS407BS	Database Management Systems Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to design and implement a database schema for given problem. **CO2:** Apply the normalization techniques for development of application software to realistic problems. **CO3:** Ability to formulate queries using SQL DML / DDL / DCL commands.
CS408BS	Operating Systems Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to develop application programs using system calls in Unix. **CO2:** Ability to implement interprocess communication between two processes. **CO3:** Ability to design and solve synchronization problems. **CO4:** Ability to simulate and implement operating system concepts such as scheduling, deadlock management , file management, and memory management.
* MC400HS	Gender Sensitization Lab	**At the end of this course, each student should be able to:** **CO1:** Students will have developed a better understanding of important issues related to gender in contemporary India. **CO2:** Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film. **CO3:** Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.

		CO4: Students will acquire insight into the gendered division of labour and its relation to politics and economics. **CO5:** Men and women students and professionals will be better equipped to work and live together as equals. **CO6:** Students will develop a sense of appreciation of women in all walks of life. **CO7:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

B.TECH III Year I Sem_R16_IT

Code	Course Name	Course Outcomes
CS501PC	Design and Analysis of Algorithms	**At the end of this course, each student should be able to:** **CO1:** Ability to analyze the performance of algorithms. **CO2:** Ability to choose appropriate algorithm design techniques for solving problems. **CO3:** Ability to understand how the choice of data Structures and the algorithm design methods impact the performance of programs.
CS502PC	Data Communication and Computer Networks	**At the end of this course, each student should be able to:** **CO1:** Students should be understand and explore the basics of Computer Networks and Various Protocols. He / She will be in a position to understand the World Wide Web concepts. **CO2:** Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and adhoc networks.
CS503PC	Software Engineering	**At the end of this course, each student should be able to:** **CO1:** Ability to identify the minimum requirements for the development of application. **CO2:** Ability to develop, maintain, efficient, reliable and cost effective software solutions. **CO3:** Ability to critically thinking and evaluate assumptions and arguments.
SM504MS	Fundamentals of Management	**At the end of this course, each student should be able to:** **CO1:** The students understand the significance of Management in their Profession. **CO2:** The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course.

		CO3: The students can explore the Management Practices in their domain area.
	Open Elective –I	
CS505PC	Design and Analysis of Algorithms Lab	**At the end of this course, each student should be able to:** Ability to write programs in java to solve problems using algorithm design techniques such as Divide and Conquer, Greedy, Dynamic programming, and Backtracking.
CS506PC	Computer Networks Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the encryption and decryption concepts in Linux environment. **CO2:** Ability to apply appropriate algorithm for the finding of shortest route. **CO3:** Ability to configure the routing table.
CS507PC	Software Engineering Lab	**At the end of this course, each student should be able to:** **CO1:** Build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting. **CO2:** Become acquainted with historical and modern software methodologies. **CO3:** Understand the phases of software projects and practice the activities of each phase **CO4:** Practice clean coding. **CO5:** Take part in project management.
*MC500HS	Professional Ethics	**At the end of this course, each student should be able to:** The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

B.TECH III Year II Sem_R16_IT

Code	Course Name	Course Outcomes
CS601PC	Compiler Design	**At the end of this course, each student should be able to:** **CO1:** Ability to design, develop, and implement a compiler for any language. **CO2:** Able to use lex and yacc tools for developing a scanner and a parser. **CO3:** Able to design and implement LL and LR parsers. **CO4:** Able to design algorithms to perform code optimization in order to improve the performance of a program in terms of space and time complexity. **CO5:** Ability to design algorithms to generate machine code.
CS602PC	Web Technologies	**At the end of this course, each student should be able to:** **CO1:** Gain knowledge of client side scripting, validation of forms and AJAX programming. **CO2:** Have Understanding of server-side scripting with PHP language. **CO3:** Have understanding of what is XML and how to parse and use XML Data with Java. **CO4:** To introduce Server side programming with Java Servlets and JSP.
CS603PC	Cryptography and Network Security	**At the end of this course, each student should be able to:** **CO1:** Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues. **CO2:** Ability to identify information system requirements for both of them such as client and server. **CO3:** Ability to understand the current legal issues

		towards information security.
	Open Elective-II	
CS611PE	**Professional Elective-I** Mobile Computing	**At the end of this course, each student should be able to:** **CO1:** Able to think and develop new mobile application. **CO2:** Able to take any new technical issue related to this new paradigm and come up with a solution(s). **CO3:** Able to develop new ad hoc network applications and/or algorithms/protocols. **CO4:** Able to understand & develop any existing or new protocol related to mobile environment.
CS612PE	**Professional Elective-I** Design Patterns	**At the end of this course, each student should be able to:** **CO1:** Create software designs that are scalable and easily maintainable. **CO2:** Understand the best use of Object Oriented concepts for creating truly OOP programs **CO3:** Use creational design patterns in software design for class instantiation. **CO4:** Use structural design patterns for better class and object composition. **CO5:** Use behavioral patterns for better organization and communication between the objects. **CO6:** Use refactoring to compose the methods for proper code packaging. **CO7:** Use refactoring to better organize the class responsibilities of current code.
CS613PE	**Professional Elective-I** Artificial Intelligence	**At the end of this course, each student should be able to:** **CO1:** Possess the ability to formulate an efficient problem space for a problem expressed in English. **CO2:** Possess the ability to select a search algorithm for a problem and characterize its time and space

		complexities. **CO3:** Possess the skill for representing knowledge using the appropriate technique. **CO4:** Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing.
CS614PE	**Professional Elective-I** Information Security Management (Security Analyst-I)	**At the end of this course, each student should be able to:** **CO1:** Understand the difference between threats and attacks. **CO2:** Understand the Security Issues and Measures. **CO3:** Know the KEY Elements and Logical Elements of Networks . **CO4:** Understand the Data Leakage, its Threats and Mitigation. **CO5:** Understand the Database Security. **CO6:** Understand the Policies, Guideline and Framework of Information Security. **CO7:** Understand the Roles and Responsibilities of ISM.
CS615PE	**Professional Elective-I** Introduction to Analytics (Associate Analyst-I)	**At the end of this course, each student should be able to:** **CO1:** Understand the impact of data analytics for business decisions and strategy Carry out data analysis/statistical analysis. **CO2:** To carry out standard data visualization and formal inference procedures. **CO3:** Design Data Architecture. **CO4:** Understand various Data Sources.
CS604PC	Cryptography and Network Security Lab	**At the end of this course, each student should be able to:** **CO1:** Use C language to develop simple XOR operation for encryption of data. **CO2:** Make use of C/Java to implement Symmetric cryptography.

		CO3: Choose C/Java to develop Asymmetric cryptography. Implement Diffie-Hellman Key exchange using HTML and Javascript. **CO4:** Develop java programs on MD-5 and SHA-1 Algorithms.
CS605PC	Web Technologies Lab	**At the end of this course, each student should be able to:** **CO1:** Use LAMP Stack for web applications. **CO2:** Use Tomcat Server for Servlets and JSPs. **CO3:** Write simple applications with Technologies like HTML, Javascript, AJAX, PHP,Servlets and JSPs. **CO4:** Connect to Database and get results. **CO5:** Parse XML files using Java(DOM and SAX parsers).
EN606HS	Advanced English Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire vocabulary and use it contextually. **CO2:** Listen and speak effectively. **CO3:** Develop proficiency in academic reading and Writing. **CO4:** Increase possibilities of job prospects. **CO5:** Communicate confidently in formal and informal Contexts.

B.TECH IV Year I Sem_R16_IT

Code	Course Name	Course Outcomes
CS701PC	Data Mining	**At the end of this course, each student should be able to:** **CO1:** Ability to perform the preprocessing of data and apply mining techniques on it. **CO2:** Ability to identify the association rules, classification and clusters in large data sets. **CO3:** Ability to solve real world problems in business and scientific information using data mining. **CO4:** Ability to classify web pages, extracting knowledge from the web.
IT702PC	Android Application Development	**At the end of this course, each student should be able to:** **CO1:** Ability to express syntax and semantics in formal notation. **CO2:** Ability to apply suitable programming paradigm for the application. **CO3:** Ability to compare the features of various programming languages. **CO4:** Able to understand the programming paradigms of modern programming languages. **CO5:** Able to understand the concepts of ADT and OOP. **CO6:** Ability to program in different language paradigms and evaluate their relative benefits.
CS721PE	**Professional Elective – II** Python Programming	**At the end of this course, each student should be able to:** **CO1:** Examine Python syntax and semantics and be fluent in the use of Python flow control and functions. **CO2:** Demonstrate proficiency in handling Strings and File Systems. **CO3:** Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries

		and use Regular Expressions. **CO4:** Interpret the concepts of Object-Oriented Programming as used in Python. **CO5:** Implement exemplary applications related to Network Programming, Web Services and Databases in Python.
IT722PE	**Professional Elective – II** Ethical Hacking	**At the end of this course, each student should be able to:** **CO1:** Gain the knowledge of the use and availability of tools to support an ethical hack. **CO2:** Gain the knowledge of interpreting the results of a controlled attack. **CO3:** Understand the role of politics, inherent and imposed limitations and metrics for planning of a test. **CO4:** Comprehend the dangers associated with penetration testing.
CS723PE	**Professional Elective – II** Web Scripting Languages	**At the end of this course, each student should be able to:** **CO1:** Comprehend the differences between typical scripting languages and typical system and application programming languages. **CO2:** Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem. **CO3:** Acquire programming skills in scripting language.
CS724PE	**Professional Elective – II** Internet of Things	**At the end of this course, each student should be able to:** **CO1:** Interpret the impact and challenges posed by IoT networks leading to new architectural models. **CO2:** Compare and contrast the deployment of smart objects and the technologies to connect them to network.

		CO3: Appraise the role of IoT protocols for efficient network communication. **CO4:** Elaborate the need for Data Analytics and Security in IoT. **CO5:** Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
IT731PE	**Professional Elective - III** Web and Database Security	**At the end of this course, each student should be able to:** **CO1:** Understand the Web architecture and applications. **CO2:** Understand client side and service side programming. **CO3:** Understand how common mistakes can be bypassed and exploit the application. **CO4:** Identify common application vulnerabilities.
IT732PE	**Professional Elective - III** Embedded Systems	**At the end of this course, each student should be able to:** **CO1:** Expected to understand the selection procedure of processors in the embedded domain. **CO2**: Design procedure of embedded firm ware. **CO3:** Expected to visualize the role of realtime operating systems in embedded systems. CO4: Expected to evaluate the correlation between task synchronization and latency issues.
IT733PE	**Professional Elective - III** Artificial Intelligence	**At the end of this course, each student should be able to:** **CO1:** Ability to formulate an efficient problem space for a problem expressed in natural language. **CO2:** Select a search algorithm for a problem and estimate its time and space complexities. **CO3:** Possess the skill for representing knowledge using the appropriate technique for a given problem. **CO4:** Possess the ability to apply AI techniques to solve problems of game playing, and machine

		learning.
CS734PE	**Professional Elective - III** Software Process and Project Management	**At the end of this course, each student should be able to:** **CO1:** Gain knowledge of software economics, phases in the life cycle of software development, project organization, project control and process instrumentation. **CO2:** Analyze the major and minor milestones, artifacts and metrics from management and technical perspective. **CO3:** Design and develop software product using conventional and modern principles of software project management.
IT741PE	**Professional Elective - IV** Information Retrieval System	**At the end of this course, each student should be able to:** **CO1:** Ability to apply IR principles to locate relevant information large collections of data. **CO2:** Ability to design different document clustering algorithms. **CO3:** Implement retrieval systems for web search tasks. **CO4:** Design an Information Retrieval System for web search tasks.
CS742PE	**Professional Elective - IV** Cloud Computing	**At the end of this course, each student should be able to:** **CO1:** Ability to understand various service delivery models of a cloud computing architecture. **CO2:** Ability to understand the ways in which the cloud can be programmed and deployed. **CO3:** Understanding cloud service providers.
CS743PE	**Professional Elective - IV** Blockchain Technology	**At the end of this course, each student should be able to:** Learn about research advances related to one of the most popular technological areas today.

CS744PE	**Professional Elective - IV** Social Network Analysis	**At the end of this course, each student should be able to:** **CO1:** Develop semantic web related applications. **CO2:** Represent knowledge using ontology. **CO3:** Predict human behaviour in social web and related communities. **CO4:** Visualize social networks.
IT703PC	Android Application Development Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to add mining algorithms as a component to the exiting tools. **CO2:** Ability to apply mining techniques for realistic data.
CS751PC	**Professional Elective** -II Lab Python Programming Lab	**At the end of this course, each student should be able to:** **CO1:** Student should be able to understand the basic concepts scripting and the contributions of scripting language. **CO2:** Ability to explore python especially the object oriented concepts, and the built in objects of Python. **CO3:** Ability to create practical and contemporary applications such as TCP/IP network programming, Web applications, discrete event simulations.
IT752PC	**Professional Elective** -II Lab Ethical Hacking Lab	**At the end of this course, each student should be able to:** **CO1:** Gain the knowledge of the use and availability of tools to support an ethical hack. **CO2:** Gain the knowledge of interpreting the results of a controlled attack.
CS753PC	**Professional Elective** -II Lab Web Scripting Languages Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the differences between Scripting languages and programming languages. **CO2:** Able to gain some fluency programming in Ruby, Perl, TCL.

CS754PC	**Professional Elective** -II Lab Internet of Things Lab	**At the end of this course, each student should be able to:** **CO1:** Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts. **CO2:** Collaborate on research with industry partners to address significant and complex challenges surrounding IoT technologies and applications. **CO3:** This may be used as a platform for conducting consultancy work required by government/Private organizations in around Coimbatore. **CO4:** Enable faculty learning, research and hands-on experimentation to discover and demonstrate the promise of the Internet of Things. **CO5:** Provide students unique interdisciplinary learning and innovation experiences with IoT technologies.
IT705PC	Industry Oriented Mini Project	**At the end of this course, each student should be able to:** **CO1:** Formulate a real world problem and develop its requirements. **CO2:** Student will be exposed to industrial awareness. **CO3:** Self learning technologies, methods and/or techniques that contribute to the software solution of the project.
IT706PC	Seminar	**At the end of this course, each student should be able to:** **CO1:** Ability to work in actual working environment. **CO2:** Ability to utilize technical resources. **CO3:** Ability to write technical documents and give oral presentations related to the work completed.

B.Tech-IV YEAR - II Sem_IT

Code	Course Name	Course Outcomes
	Open Elective – III	
IT851PE	**Professional Elective – V** Steganography and Watermarking	**At the end of this course, each student should be able to:** **CO1:** Know the History and importance of watermarking and steganography. **CO2:** Analyze Applications and properties of watermarking and steganography. **CO3:** Demonstrate Models and algorithms of watermarking. **CO4:** Possess the passion for acquiring knowledge and skill in preserving authentication of Information. **CO5:** Identify theoretic foundations of steganography and steganalysis.
CS852PE	**Professional Elective – V** Real-Time Systems	**At the end of this course, each student should be able to:** **CO1:** Be able to explain real-time concepts such as preemptive multitasking, task priorities. **CO2:** Priority inversions, mutual exclusion, context switching, and synchronization, interrupt. **CO3:** Latency and response time, and semaphores. **CO4:** Able describe how a real-time operating system kernel is implemented. **CO5:** Able explain how tasks are managed. **CO6:** Explain how the real-time operating system implements time management. **CO7:** Discuss how tasks can communicate using semaphores, mailboxes, and queues. **CO8:** Be able to implement a real-time system on an embedded processor. **CO9:** Be able to work with real time operating systems like RT Linux, Vx Works, MicroC /OSII.

CS853PE	**Professional Elective – V** Data Analytics	**At the end of this course, each student should be able to:** **CO1:** After completion of this course students will be able to Understand the impact of data analytic for business decisions and strategy. **CO2:** Carry out data analysis/statistical analysis. **CO3:** To carry out standard data visualization and formal inference procedures. **CO4:** Design Data Architecture. **CO5:** Understand various Data Sources.
CS854PE	**Professional Elective – V** Modern Software Engineering	**At the end of this course, each student should be able to:** **CO1:** Basic knowledge and understanding of the analysis and design of complex systems. **CO2:** Ability to apply **software engineering** principles and techniques.
IT861PE	**Professional Elective -VI** Intrusion Detection Systems	**At the end of this course, each student should be able to:** **CO1:** Possess a fundamental knowledge of Cyber Security. **CO2:** Understand what vulnerability is and how to address most common vulnerabilities. **CO3:** Know basic and fundamental risk management principles as it relates to Cyber Security and Mobile Computing. **CO4:** Have the knowledge needed to practice safer computing and safeguard your information using Digital Forensics. **CO5:** Understand basic technical controls in use today, such as firewalls and Intrusion Detection systems. **CO6:** Understand legal perspectives of Cyber Crimes and Cyber Security.

IT862PE	**Professional Elective -VI** AdHoc & SensorNetworks	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks. **CO2:** Ability to solve the issues in real-time application development based on ASN. **CO3:** Ability to conduct further research in the domain of ASN.
IT863PE	**Professional Elective -VI** Human Computer Intraction	**At the end of this course, each student should be able to:** **CO1:** Ability to apply HCI and principles to interaction design. **CO2:** Ability to design certain tools for blind or PH people.
CS864PE	**Professional Elective -VI** Neural Networks and Deep Learning	**At the end of this course, each student should be able to:** **CO1:** Ability to understand the concepts of Neural Networks. **CO2:** Ability to select the Learning Networks in modeling real world systems. **CO3:** Ability to use an efficient algorithm for Deep Models. **CO4:** Ability to apply optimization strategies for large scale applications.
IT801PC	Major Project	**At the end of this course, each student should be able to:** **CO1:** Ability to implement and execute well defined objective. **CO2:** Ability to work in team at component level and system level. **CO3:** Ability to troubleshoot.

DEPARTMENT OF ELECTRONICS &COMMUNCATIONS ENGINEEING

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO I. Professional Skills An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

PSO II. Problem-Solving Skills An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO III. Successful career and Entrepreneurship An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

B.Tech-II YEAR - I Sem_ECE

Code	Course Name	Course Outcomes
MA301BS	Mathematics – IV	**At the end of this course, each student should be able to:** **CO1:** Analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem. **CO2:** Find the Taylor's and Laurent's series expansion of complex functions. **CO3:** The bilinear transformation. **CO4:** Express any periodic function in term of sines and cosines. **CO5:** Express a non-periodic function as integral representation. **CO6:** Analyze one dimensional wave and heat equation.
EC302ES	Analog Electronics	**At the end of this course, each student should be able to:** **CO1:** Design and analyze small signal amplifier circuits applying the biasing techniques learnt earlier. **CO2:** Cascade different amplifier configurations to obtain the required overall specifications like Gain, Bandwidth, Input and Output interfacing Impedances. **CO3:** Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications. **CO4:** Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations.
EC303ES	Electrical Technology	**At the end of this course, each student should be able to:** **CO1:** To analyze the performance of dc generators and motors.

		CO2: To analyze the performance of transformers. **CO3:** To learn the in-depth knowledge on three phase induction motors. **CO4:** To analyze the performance of special motors and electrical instruments in real time applications.
EC304ES	Signals and Stochastic Process	**At the end of this course, each student should be able to:** **CO1:** Represent any arbitrary analog or Digital time domain signal in frequency domain. **CO2:** Understand the importance of sampling, sampling theorem and its effects. **CO3:** Understand the characteristics of linear time invariant systems. **CO4:** Determine the conditions for distortion less transmission through a system. **CO5:** Understand the concepts of Random Process and its Characteristics. **CO6:** Understand the response of linear time Invariant system for a Random Processes.
EC305ES	Network Analysis	**At the end of this course, each student should be able to:** **CO1:** Gains the knowledge on Basic network elements. **CO2:** Learns and analyze the RLC circuits' behavior in detail. **CO3:** Analyze the performance of periodic waveforms. **CO4:** Learns and gain the knowledge in characteristics of two port network parameters(Z,Y,ABCD,h&g). **CO5:** To analyze the filter design concepts in real world applications.
EC306ES	Electronic Devices and Circuits Lab	**At the end of this course, each student should be able to:** **CO1:** After Completion of the course the student is able to Apply various devices to real time problems.

		CO2: Compute frequency response of various Amplifiers.
EC307ES	Basic Simulation Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze various types of signals and sequences. Apply convolution and correlation operations on different signals. **CO2:** Determine the response of an LTI system to given signals. **CO3:** Plot the spectrum of a given signal using MATLAB. **CO4:** Verify the Sampling theorem. **CO5:** Synthesize Laplace transform and able to locate poles and zeros of a system. **CO6:** Compute various statistical properties of a random noise and verify whether it is stationary.
EC308ES	Basic Electrical Engineering Lab	**At the end of this course, each student should be able to:** **CO1:** Verify the theoretical characteristics of diodes, transistors, OP-amps and digital electronic components experimentally . **CO2:** Implement and analyze various circuits viz. Rectifiers, Voltage Regulators, Amplifier circuits, Op-Amp based linear & non-linear circuits . **CO3:** Design Op-amp based circuits and Combinational and Sequential logic circuits.
* MC300ES	Environmental Science and Technology	**At the end of this course, each student should be able to:** Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

B.Tech-II YEAR - II Sem_ECE

Code	Course Name	Course Outcomes
EC401ES	Switching Theory and Logic Design	**At the end of this course, each student should be able to:** **CO1:** Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray and BCD. **CO2:** Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions. **CO3:** Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits. **CO4:** Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.
EC402ES	Pulse and Digital Circuits.	**At the end of this course, each student should be able to:** **CO1:** Understand the applications of diode as integrator, differentiator, clippers, clampler circuits. **CO2:** Learn various switching devices such as diode, transistor, SCR. Difference between logic gates and sampling gates. **CO3:** Design multivibrators for various applications, synchronization techniques and sweep circuits. **CO4:** Realizing logic gates using diodes and transistors. **CO5:** Understanding of time and frequency domain aspects. **CO6:** Importance of clock pulse and its generating techniques.

SM405MS	Business Economics and Financial Anaysis.	**At the end of this course, each student should be able to:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of Aa company.
EE404ES	Control Systems	**At the end of this course, each student should be able to:** **CO1:** Improve the system performance by selecting a suitable controller and/or a compensator for a specific application. **CO2:** Apply various time domain and frequency domain techniques to assess the system performance. **CO3:** Apply various control strategies to different applications (example: Power systems, electrical drives etc…). **CO4:** Test system Controllability and Observability using state space representation and applications of state space representation to various systems.
EC405ES	Analog Communications	**At the end of this course, each student should be able to:** **CO1:** Able to analyze and design various modulation and demodulation analog systems. **CO2:** Understand the characteristics of noise present in analog systems. **CO3:** Study of signal to Noise Ration (SNR) performance, of various Analog Communication systems. **CO4:** Analyze and design the various Pulse Modulation Systems. **CO5:** Understand the concepts of Multiplexing: Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM).

EC406ES	Analog Communications Lab	**At the end of this course, each student should be able to:** **CO1:** Comprehend the fundamentals in explain the functionality of modulation and demodulation environment . **CO2:** Analyze the concepts, write and simulate the concepts of AM and AMDemodulation process in Communication. **CO3:** Know the origin and simulation of FM and FM-Demodulation process in communication . **CO4:** Acquaint with AM and FM basic functionalities **CO5:** Discriminate the AM and FM functionalities . **CO6:** Interpret with various angle modulation and demodulation systems . **CO7:** Create the writing and simulation environments in PWM, PPM, Mixer and ring modulation.
EC407ES	Pulse and Digital Circuits Lab	**At the end of this course, each student should be able to:** **CO1:** Design various linear & non-linear circuits and analyze their response. **CO2:** Design and generate various types of non-sinusoidal waveforms using multivibrators. **CO3:** Design current and voltage sweep circuits based on given specifications. • Design various digital logic circuits.
EC408ES	Analog Electronics Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze and select analog devices using circuit specifications based on circuit requirements. **CO2:** Conduct experiments on different types of multivibrators. **CO3:** Design Digital to Analog Converters (DAC). **CO4:** Design pulse stretcher and square wave generating circuits. **CO5:** Design oscillators and function generator

		circuits. **CO6:** Identify the positive and negative feedback circuits. **CO7:** Discriminate the design of simple circuits like summers, subtractors and multivibrators using op-amp.
*MC400HS	Gender Sensitization Lab	**At the end of this course, each student should be able to:** **CO1:** Students will have developed a better understanding of important issues related to gender in contemporary India. **CO2:** Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film. **CO3:** Students will attain a finer grasp of how gender discrimination works in our society and how to counter it. **CO4:** Students will acquire insight into the gendered division of labour and its relation to politics and economics. **CO5:** Men and women students and professionals will be better equipped to work and live together as equals. **CO6:** Students will develop a sense of appreciation of women in all walks of life. **CO7:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

B.Tech-III YEAR - I Sem_ECE

Code	Course Name	Course Outcomes
EC501PC	Electromagnetic Theory And Transmission Lines	**At the end of this course, each student should be able to:** **CO1:** Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems. **CO2:** Analyze the Wave Equations for good conductors and good dielectrics, and evaluate the UPW Characteristics for several practical media of interest. **CO3:** Establish the proof and estimate the polarization features, reflection and transmission coefficients for UPW propagation, distinguish between Brewster and Critical Angles, and acquire knowledge of their applications. **CO4:** Determine the Transmission Line parameters for different lines, characterize the distortions and estimate the characteristics for different lines. **CO5:** Analyze the RF Line features and configure them as SC, OC Lines, QWTs and HWTs, and design the same for effective impedance transformation. **CO6:** Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.
EC502PC	Linear And Digital Ic Applications	**At the end of this course, each student should be able to:** **CO1:** A thorough understanding of operational amplifiers with linear integrated circuits. **CO2:** Understanding of the different families of digital integrated circuits and their characteristics. **CO3:** Also students will be able to design circuits using operational amplifiers for various applications.

EC503PC	Digital Communications	**At the end of this course, each student should be able to:** **CO1:** Understand basic components of Digital Communication Systems. **CO2:** Design optimum receiver for Digital Modulation techniques. **CO3:** Analyze the error performance of Digital Modulation Techniques. **CO4:** Understand the redundancy present in Digital Communication by using various source coding techniques. **CO5:** Know about different error detecting and error correction codes like block codes, cyclic codes and convolution codes.
SM504MS	Fundamentals Of Management	**At the end of this course, each student should be able to:** The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.
	Open Elective – I	
EC505PC	Linear IC Applications Lab	**At the end of this course, each student should be able to:** **CO1:** Understand the basics of Op-Amp and to Design, Analyze Amplifiers, Active filters and Hysteresis voltage of Schmitt trigger using 741 IC. **CO2:** Design the Multivibrator circuits using IC555 and determine the frequency of oscillation and time delay. **CO3:** Understand the functionality of IC723 and determine the load and line regulations. **CO4:** Understand the characteristics of PLL & design the various applications of PLL.

EC506PC	Digital Ic Applications Lab	**At the end of this course, each student should be able to:** **CO1:** Have extended knowledge of digital circuits and systems . **CO2:** Understand different IC numbers for different circuits. **CO3:** Able to design circuits using digital ICs **CO4:** Have thorough understanding of combinational and sequential circuits for various applications.
EC507PC	Digital Communications Lab	**At the end of this course, each student should be able to:** **CO1:** Develop any real application using digital modulation techniques. **CO2:** Develop time division multiplexing concepts in real applications. **CO3:** Measures the bandwidth of various modulation techniques and observes the output waveforms. **CO4:** Demonstrate a good background in analyzing the block diagram of communication systems. **CO5:** Use appropriate design skills to illustrate design skills to illustrate electronic components & method to implement different communication circuits & systems . **CO6:** Emphasize on sampling modeling, techniques, signal constellations. **CO7:** Study the spectral characteristics of PAM and QAM.
*MC500HS	Professional Ethics	**At the end of this course, each student should be able to:** The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

B.Tech-III YEAR - II Sem_ECE

Code	Course Name	Course Outcomes
	Open Elective-II	
EC611PE	**Professional Elective – I** Computer organization and operating system	**At the end of this course, each student should be able to:** **CO1:** Basic structure of a digital computer **CO2:** Arithmetic operations of binary number system **CO3:** The organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit. **CO4:** Operating system functions, types, system calls. **CO5:** Memory management techniques and dead lock avoidance operating systems' file system implementation and its interface.
EC612PE	**Professional Elective – I** Digital Image Processing	**At the end of this course, each student should be able to:** **CO1:** Exploration of the limitations of the computational methods on digital images. **CO2:** Expected to implement the spatial and frequency domain image transforms on enhancement and restoration of images. **CO3:** Elaborate understanding on image enhancement techniques. **CO4:** Expected to define the need for compression and evaluate the basic compression algorithms.
EC613PE	**Professional Elective – I** Spread Spectrum Communications	**At the end of this course, each student should be able to:** **CO1:** Generate various types of Spread spectrum sequences and can simulate CDMA system (Both Transmitter & Receiver). **CO2:** Analyze the performance of Spread spectrum systems in Jamming environment and systems with Forward Error Correction. **CO3:** Can provide detection and cancellation schemes for Multiusers in CDMA cellular radio.

EC614PE	**Professional Elective – I** Digital System Design	**At the end of this course, each student should be able to:** **CO1:** To understands the minimization of Finite state machine. **CO2:** To exposes the design approaches using ROM's, PAL's and PLA's. **CO3:** To provide in depth understanding of Fault models. **CO4:** To understands test pattern generation techniques for fault detection. **CO5:** To design fault diagnosis in sequential circuits.
EC601PC	Antennas And Wave Propagation	**At the end of this course, each student should be able to:** **CO1:** Explain the mechanism of radiation, distinguish between different antenna characteristic parameters, establish their mathematical relations, estimate them for different practical cases. **CO2:** Distinguish between short dipoles, half-wave dipoles, quarter-wave monopoles and small loops, configure their current distributions, derive their far fields and radiation characteristics and sketch their patterns. **CO3:** Analyze a microstrip rectangular patch antenna and a parabolic reflector antenna, identify the requirements and relevant feed structure, carry out the design and establish their patterns. **CO4:** Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory. **CO5:** Carry out the Linear Array Analysis, estimate the array factor and characteristics and sketch the pattern for 2-element array, N-element BSA, EFA, modified EFA, Binomial Arrays. **CO6:** Classify the different wave propagation mechanisms, identify their frequency ranges, determine the characteristic features of ground wave, ionospheric

		wave,space wave, duct and tropospheric propagations, and estimate the parameters involved.
EC602PC	Microprocessors And Microcontrollers	**At the end of this course, each student should be able to:** **CO1:** Understands the internal architecture and organization of 8086, 8051 and ARM Processors / controllers. **CO2:** Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.
EC603PC	Digital Signal Processing	**At the end of this course, each student should be able to:** **CO1:** Perform time, frequency, and Z -transform analysis on signals and systems. **CO2:** Understand the inter-relationship between DFT and various transforms. **CO3:** Understand the significance of various filter structures and effects of round off errors. **CO4:** Design a digital filter for a given specification. **CO5:** Understand the fast computation of DFT and appreciate the FFT processing. **CO6:** Understand the tradeoffs between normal and multi rate DSP techniques and finite length word effects.
EC604PC	Digital Signal Processing Lab	**At the end of this course, each student should be able to:** **CO1:** Apply knowledge of digital filter design for various applications. **CO2:** Analyze various signals in transform domain. **CO3:** Apply MultiMate concepts in different areas **CO4:** Perform real time experiments on processors such as audio and speech processing. **CO5:** Work with MATLAB functions. **CO6:** Enable students to analyze and design different signals & filters using MATLAB . **CO7:** Provide the basic knowledge of trainer kit TMS320C6713 DSP Processors.

EN605HS	Microprocessors and Microcontrollers Lab	**At the end of this course, each student should be able to:** **CO1:** Understand and apply the fundamentals of assembly level programming of microprocessors and microcontrollers. **CO2:** Work with standard microprocessor real time interfaces including PPI, serial ports, digital - to - analog converters and analog - to - digital converters. **CO3:** Troubleshoot interactions between software and hardware. **CO4:** Analyze abstract problems and apply a combination of hardware and software to address the problem.
EN606HS	Advanced English Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire vocabulary and use it contextually. **CO2:** Listen and speak effectively. **CO3:** Develop proficiency in academic reading and writing. **CO4:** Increase possibilities of job prospects. **CO5:** Communicate confidently in formal and informal contexts.

B.Tech-IV YEAR - I Sem_ECE

Code	Course Name	Course Outcomes
EC701PC	Microwave Engineering	**At the end of this course, each student should be able to:** **CO1:** To analyze completely the rectangular waveguides, their mode characteristics, and design waveguides for solving practical microwave transmission line problems. **CO2:** To distinguish between the different types of waveguide and ferrite components, explain their functioning and select proper components for engineering applications. **CO3:** To distinguish between the methods of power generation at microwave frequencies, derive the performance characteristics of 2-Cavity and Relfex Klystrons, Magnetrons, TWTs and estimate their efficiency levels, and solve related numerical problems. **CO4:** To realize the need for solid state microwave sources, understand the concepts of TEDs, RWH Theory and explain the salient features of Gunn Diodes and ATT Devices. **CO5:** To establish the properties of Scattering Matrix, formulate the S-Matrix for various microwave junctions, and understand the utility of S-parameters in microwave component design. **CO6:** To set up a microwave bench, establish the measurement procedure and conduct the experiments in microwave lab for measurement of various microwave parameters.
EC721PE	**Professional Elective – II** Computer Networks	**At the end of this course, each student should be able to:** **CO1:** Students should understand and explore the

		basics of Computer Networks and Various Protocols. He/ She will be in a position to understand the World Wide Web concepts. **CO2:** Students will be in a position to administrate a network and flow of information further he/she can understand easily the concepts of network security, Mobile and ad hoc networks.
EC722PE	**Professional Elective – II** FPGA Programming	**At the end of this course, each student should be able to:** **CO1:** Understand design styles. **CO2:** Implement memories, multipliers, shifters, ALU using PLD. **CO3:** Synthesize Verilog code for special purpose processor using Vertex, Spartan FPGAs. **CO4 :** Implement parameterized library cell design.
EC723PE	**Professional Elective – II** Coding Theory and Techniques	**At the end of this course, each student should be able to:** **CO1:** Learn measurement of information and errors. **CO2:** Obtain knowledge in designing various source codes and channel codes. **CO3:** Design encoders and decoders for block and cyclic codes. **CO4:** Understand the significance of codes in various applications.
EC724PE	**Professional Elective – II** Soft Computing Techniques	**At the end of this course, each student should be able to:** **CO1:** Identify and employ suitable soft computing techniques in classification and optimization problems. **CO2:** Design hybrid systems to suit a given real – life problem.
EC731PE	**Professional Elective – III** Wireless Communications and	**At the end of this course, each student should be able to:** **CO1:** Understand cellular system design concepts. **CO2:** Analyze various multiple access schemes used in

	Networks	wireless communication. **CO3:** Demonstrate wireless Local and Wide area networks and their specifications. **CO4:** Familiar with some of the existing and emerging wireless standards. **CO5:** Understand the concept of orthogonal frequency division multiplexing.
EC732PE	**Professional Elective – III** Internet of Things	**At the end of this course, each student should be able to:** **CO1:** Interpret the impact and challenges posed by IoT networks leading to new architectural models. **CO2:** Compare and contrast the deployment of smart objects and the technologies to connect them to network. **CO3:** Appraise the role of IoT protocols for efficient network communication. **CO4:** Elaborate the need for Data Analytics and Security in IoT. **CO5:** Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
EC733PE	**Professional Elective – III** Radar Systems	**At the end of this course, each student should be able to:** **CO1:** Derive the complete radar range equation. **CO2:** Understand the need and functioning of CW, FM-CW and MTI radars. **CO3:** Known various Tracking methods. **CO4:** Derive the matched filter response characteristics for radar receivers.
EC734PE	**Professional Elective – III** Embedded Sytem Design	**At the end of this course, each student should be able to:** **CO1:** Expected to understand the selection procedure of Processors in the embedded domain. **CO2:** Design Procedure for Embedded Firmware.

		CO3: Expected to visualize the role of Real time Operating Systems in Embedded Systems. **CO4:** Expected to evaluate the Correlation between task synchronization and latency issues.
EC741PE	**Professional Elective – IV** Optimization Techniques	**At the end of this course, each student should be able to:** **CO1:** Explain the need of optimization of engineering Systems. **CO2:** Understand optimization of electrical and electronics engineering problems. **CO3:** Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem. **CO4:** Apply unconstrained optimization and constrained non-linear programming and dynamic programming. **CO5:** Formulate optimization problems.
EC742PE	**Professional Elective – IV** Object Oriented Programming	**At the end of this course, each student should be able to:** **CO1:** Able to solve real world problems using OOP techniques. **CO2:** Able to understand the use of abstract classes. **CO3:** Able to solve problems using java collection framework and I/o classes. **CO4:** Able to develop multithreaded applications with synchronization. **CO5:** Able to develop applets for web applications. **CO6:** Able to design GUI based applications.
EC743PE	**Professional Elective – IV** Electronic Measurements and Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement. **CO2:** Measure various physical parameters by appropriately selecting the transducers.

		CO3: Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
EC744PE	**Professional Elective – IV** Artificial Intelligence	**At the end of this course, each student should be able to:** **CO1:** Ability to formulate an efficient problem space for a problem expressed in natural language. **CO2:** Select a search algorithm for a problem and estimate its time and space complexities. **CO3:** Possess the skill for representing knowledge using the appropriate technique for a given problem. **CO4:** Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.
EC702PC	VLSI Design	**At the end of this course, each student should be able to:** **CO1:** Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors. **CO2:** Choose an appropriate inverter depending on specifications required for a circuit. **CO3:** Draw the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit. **CO4:** Design different types of logic gates using CMOS inverter and analyze their transfer characteristics. **CO5:** Provide design concepts required to design building blocks of data path using gates. **CO6:** Design simple memories using MOS transistors and can understand design of large memories. **CO7:** Design simple logic circuit using PLA, PAL, FPGA and CPLD.

		CO8: Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system
EC703PC	VLSI and E-CAD Lab	**At the end of this course, each student should be able to:** **CO1:** To learn the HDL programming language. **CO2:** To learn the simulation of basic gates using the basic programming language. **CO3:** To learn the simulation of combinational circuits using programming language. **CO4:** To learn the simulation of sequential circuits using programming language. **CO5:** To learn the synthesis and layouts of analog and digital CMOS circuits. **CO6:** To develop an ability to simulate and synthesize various digital circuits.
EC704PC	Microwave Engineering Lab	**At the end of this course, each student should be able to:** **CO1:** Design test bench for measurement of various microwave parameters. **CO2:** Analyze various characteristics of microwave junctions and design of microwave communication links. **CO3:** Integrating a wide range of Microwave components into one design oriented frame work . **CO4:** Design and solve real world problems . **CO5:** Use a microwave test bench in analyzing various types of microwave measurements. **CO6:** Measure the various parameters in microwave engineering. **CO7:** Design & analyze the micro wave integrated circuits.

EC705PC	Industry Oriented Mini Project	**At the end of this course, each student should be able to:** **CO1:** Formulate a real world problem and develop its Requirements. **CO2:** Student will be exposed to industrial awareness. **CO3:** Self learning technologies, methods and/or techniques that contribute to the software solution of the project.
EC706PC	Seminar	**At the end of this course, each student should be able to:** **CO1:** Ability to work in actual working environment. **CO2:** Ability to utilize technical resources. **CO3:** Ability to write technical documents and give oral presentations related to the work completed.

B.Tech-IV YEAR - II Sem_ECE

Code	Course Name	Course Outcomes
	Open Elective – III	
EC851PE	**Professional Elective –V** Network Security and Cryptography	**At the end of this course, each student should be able to:** **CO1:** Describe network security fundamental concepts and principles. **CO2:** Encrypt and decrypt messages using block ciphers and network security technology and protocols. **CO3:** Analyze key agreement algorithms to identify their weaknesses. **CO4:** Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities.
EC853PE	**Professional Elective –V** Optical Communications	**At the end of this course, each student should be able to:** **CO1:** Understand and analyze the constructional parameters of optical fibres. **CO2:** Be able to design an optical system. **CO3:** Estimate the losses due to attenuation, absorption, scattering and bending. **CO4:** Compare various optical detectors and choose suitable one for different applications.
EC854PE	**Professional Elective –V** Machine Learning	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of computational intelligence like machine learning. **CO2:** Ability to get the skill to apply machine learning techniques to address the real time problems in different areas. **CO3:** Understand the Neural Networks and its usage in machine learning application.

EC861PE	**Professional Elective –VI** Actuators and Robot Systems	**At the end of this course, each student should be able to:** At the end of the course unit students will be able to: Undertake kinematics analysis of robot manipulators. Understand the importance of robot dynamics. Have an understanding of the functionality and limitations of robot actuators and sensors.
EC862PE	**Professional Elective –VI** Analog CMOS IC Design	**At the end of this course, each student should be able to:** **CO1:** Design basic building blocks of CMOS analog ICs. **CO2:** Carry out the design of single and two stage operational amplifiers and voltage references. **CO3:** Determine the device dimensions of each MOSFETs involved. **CO4:** Design various amplifiers like differential, current and operational amplifiers.
EC863PE	**Professional Elective –VI** Global Positioning System	**At the end of this course, each student should be able to:** **CO1:** Identify GPS components and their functions **CO2:** Select GPS survey method . **CO3:** Interpret the navigational message and signals received by the GPS satellite . **CO4:** Identify error sources in GPS observations, and apply the corrections for accurate positioning **CO5:** Map the geospatial features.
EC864PE	**Professional Elective –VI** Computer Vision	**At the end of this course, each student should be able to:** **CO1:** Implement fundamental image processing techniques required for computer vision. **CO2:** Perform shape analysis. **CO3:** Implement boundary tracking techniques. **CO4:** Apply chain codes and other region descriptors. **CO5:** Apply Hough Transform for line, circle, and ellipse detections. **CO6:** Apply 3D vision techniques.

		CO7: Implement motion related techniques. **CO8:** Develop applications using computer vision techniques.
EC801PC	Major Project	**At the end of this course, each student should be able to:** **CO1:** Ability to implement and execute well defined objective. **CO2:** Ability to work in team at component level and system level. **CO3:** Ability to troubleshoot.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO I: Apply the knowledge of Mathematics, Science and Electrical Engineering fundamentals to solve complex problems in electrical machines, control systems, power systems and electronics.

PSO II: Ability to understand the recent technological developments in Electrical & Electronics Engineering and develop products/software to cater the societal & Industrial needs.

PSO III: Analyse and Design suitable controllers and power converters for the given system.

PSO IV: Introduce and improvise the ability to apply project management techniques to electrical and electronics systems.

B.Tech-II YEAR - I Sem_EEE

Code	Course Name	Course Outcomes
MA301BS	Mathamatics – IV	**At the end of this course, each student should be able to:** **CO1:** Analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem. **CO2:** Find the Taylor's and Laurent's series expansion of complex functions. **CO3:** The bilinear transformation. **CO4:** Express any periodic function in term of sines and cosines. **CO5:** Express a non-periodic function as integral representation. **CO6:** Analyze one dimensional wave and heat equation.
EE302ES	Electromagnetic Fields	**At the end of this course, each student should be able to:** **CO1:** Apply vector calculus to static electric – magnetic fields. **CO2:** Compute the force, fields & Energy for different charge & current configurations & evaluate apacitance and inductance. **CO3:** Analyze Maxwell's equation in different forms (Differential and integral) in Electrostatic, Magnetic time varying fields.
EE303ES	Electrical Machines-I	**At the end of this course, each student should be able to:** **CO1:** Identify different parts of a DC machine & understand its operation. **CO2:** Carry out different testing methods to predetermine the efficiency of DC machines. **CO3:** Understand different excitation and starting methods of DC machines.

		CO4: Control the voltage and speed of a DC machines.
EE304ES	Network Theory	**At the end of this course, each student should be able to:** **CO1:** Analyze the Electrical Circuits with the concept of Network topology. **CO2:** Apply the concepts of Magnetic circuit & Analyze Magnetic circuits. **CO3:** Determine self and mutually induced EMF's for Magnetically coupled coils. **CO4:** Understand the importance of three phase circuits and Analyze the three phase circuits with Star & Delta connected balanced and unbalanced loads. **CO5:** Analyze the transient behavior of electrical networks for various excitations. **CO6:** Obtain the various network parameters for the given two port networks. **CO7:** Represent the transfer function for the given Network. **CO8:** Determine the parameters for the design of various filters.
EE305ES	Electronic Circuits	**At the end of this course, each student should be able to:** **CO1:** Apply the knowledge of BJT to design practical amplifier circuits. **CO2:** Design electronic sub systems such as feedback amplifiers, oscillators and power amplifiers to meet the required specifications. **CO3:** Design linear and non linear wave shaping circuits with different inputs. **CO4:** Analyze multi vibrators using transistors.
EE306ES	Electrical Machines Lab - I	**At the end of this course, each student should be able to:** **CO1:** Start and control the Different DC Machines. **CO2:** Assess the performance of different machines

		using different testing methods. **CO3:** Identify different conditions required to be satisfied for self - excitation of DC Generators. **CO4:** Separate iron losses of DC machines into different components.
EC306ES	Electronic Devices & Circuits Lab	**At the end of this course, each student should be able to:** **CO1:** After Completion of the course the student is able to Apply various devices to real time problems. **CO2:** Compute frequency response of various Amplifiers.
EE307ES	Networks Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze complex DC and AC linear circuits. **CO2:** Apply concepts of electrical circuits across Engineering. **CO3:** Evaluate response in a given network by using theorems.
*MC300ES	Environmental Science and Technology	**At the end of this course, each student should be able to:** Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

B.Tech-II YEAR - II Sem_EEE

Code	Course Name	Course Outcomes
EC401ES	Switching Theory & Logic Design	**At the end of this course, each student should be able to:** **CO1:** Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray and BCD. **CO2:** Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions. **CO3:** Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits. **CO4:** Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.
EE402ES	Power Systems - I	**At the end of this course, each student should be able to:** **CO1:** Draw the layout of hydro power plant, thermal power station, Nuclear power plant and gas power plant and explain its operation. **CO2:** Describe A.C. and D.C. distribution systems and its voltage drop calculations. **CO3:** Illustrate various economic aspects of the power plant erection, operation and different tariff methods. **CO4:** Understand power factor improvement methods and determine economical power factor.

EE403ES	Electrical Machines – II	**At the end of this course, each student should be able to:** **CO1:** Identify different parts of transformers and induction motors and specify their functions. **CO2:** Understand the operation of transformers and induction motors. **CO3:** Carry out different testing methods and assess the performance of transformers and induction motors. **CO4:** Start and control the induction motor.
EE404ES	Control Systems	**At the end of this course, each student should be able to:** **CO1:** Improve the system performance by selecting a suitable controller and/or a compensator for a specific application. **CO2:** Apply various time domain and frequency domain techniques to assess the system performance. **CO3:** Apply various control strategies to different applications (example: Power systems, electrical drives etc…). **CO4:** Test system Controllability and Observability using state space representation and applications of state space representation to various systems.
SM405ES	Business Economics and Financial Analysis	**At the end of this course, each student should be able to:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

EE406ES	Control Systems Lab	**At the end of this course, each student should be able to:** **CO1:** How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application. **CO2:** Apply various time domain and frequency domain techniques to assess the system performance. **CO3:** Apply various control strategies to different applications(example: Power systems, electrical drives etc). **CO4:** Test system controllability and observability using state space representation and applications of state space representation to various systems.
EE407ES	Electrical Machines Lab - II	**At the end of this course, each student should be able to:** **CO1:** Assess the performance of different machines using different testing methods. **CO2:** To convert the Phase from three phase to two phase and vice versa. **CO3:** Compensate the changes in terminal voltages of synchronous generator after estimating the change by different methods. **CO4:** Control the active and reactive power flows in synchronous machines. **CO5:** Start different machines and control the speed and power factor.
EE408ES	Electronic Circuits Lab	**At the end of this course, each student should be able to:** **CO1:** Apply the concepts of amplifiers in the design of Public Addressing System. **CO2:** Generate Sinusoidal wave forms. **CO3:** Design stable system using feedback concepts. **CO4:** Design multi vibrator using transistor.

***MC400HS**	Gender Sensitization Lab	**At the end of this course, each student should be able to:** **CO1:** Students will have developed a better understanding of important issues related to gender in contemporary India. **CO2:** Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film. **CO3:** Students will attain a finer grasp of how gender discrimination works in our society and how to counter it. **CO4:** Students will acquire insight into the gendered division of labour and its relation to politics and economics. **CO5:** Men and women students and professionals will be better equipped to work and live together as equals. **CO6:** Students will develop a sense of appreciation of women in all walks of life. **CO7:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

B.Tech-III YEAR - I Sem_EEE

Code	Course Name	Course Outcomes
EE501PC	Electrical Measurements & Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Understand different types of measuring instruments, their construction, operation and characteristics. **CO2:** Identify the instruments suitable for typical Measurements. **CO3:** Apply the knowledge about transducers and instrument transformers to use them effectively. Apply the knowledge about transducers and instrument transformers to use them effectively.
EE502PC	Power Systems - II	**At the end of this course, each student should be able to:** **CO1:** Able to compute inductance and capacitance for different configurations of transmission lines. **CO2:** Able to analyze the performance of transmission Lines. **CO3:** Can understand transient's phenomenon of transmission lines. **CO4:** Able to calculate sag and tension calculations. **CO5:** Will be able to understand overhead line insulators and underground cables.
EI503PC	Microprocessors and Microcontrollers	**At the end of this course, each student should be able to:** **CO1:** Understands the internal architecture and organization of 8086, 8051 and ARM processors / controllers. **CO2:** Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor/ micro controller based systems.

SM504MS	Fundamentals of Management	**At the end of this course, each student should be able to:** The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.
	Open Elective-I	
EE506PC	Basic Electrical simulation Lab	**At the end of this course, each student should be able to:** **CO1:** Apply signal generation in different systems. **CO2:** Analyze networks by various techniques . **CO3:** Analyze circuit responses . **CO4:** Analyze bridge rectifiers.
EE505PC	Electrical Measurements & Instrumentation Lab	**At the end of this course, each student should be able to:** **CO1:** To choose instruments. **CO2:** Test any instrument. **CO3:** Find the accuracy of any instrument by performing Experiment. **CO4:** Calibrate PMMC instrument using D.C Potentiometer.
*MC500HS	Professional Ethics	**At the end of this course, each student should be able to:** The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.
EI507PC	Microprocessors and Microcontrollers Lab	**At the end of this course, each student should be able to:** **CO1:** Understands the internal architecture, organization and assembly language programming of processors.

		CO2: Understands the internal architecture, organization and assembly language programming of 8051 / controllers Understands the interfacing techniques to 8086 and 8051 based systems. **CO3:** Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

B.Tech-III YEAR - II Sem_EEE

Code	Course Name	Course Outcomes
EE601PC	Power Systems Analysis	**At the end of this course, each student should be able to:** **CO1:** Develop the Ybus and Zbus matrices. **CO2:** Analyze load flow for various requirements of the power system. **CO3:** Analyze short circuit studies for the protection of power system . **CO4:** Estimate stability and instability in power Systems.
EE602PC	Power Electronics	**At the end of this course, each student should be able to:** **CO1:** Choose the appropriate converter for various Applications. **CO2:** Design the power converters suitable for particular applications. **CO3:** Develop the novel control methodologies for better performance.
EE603PC	Switch Gear and Protection	**At the end of this course, each student should be able to:** **CO1:** Understand the types of Circuit breakers and choice of Relays for appropriate protection of power system equipment. **CO2:** Understand various types of Protective devices in Electrical Power Systems. **CO3:** Interpret the existing transmission voltage levels and various means to protect the system against over voltages. **CO4:** Understand the importance of Neutral Grounding, Effects of Ungrounded Neutral grounding on system performance, Methods and Practices.

	OPEN Elective –II	
EM611PE	**Professional Elective – I** Computer Organization	**At the end of this course, each student should be able to:** **CO1:** Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit. **CO2:** Ability to understand memory hierarchy and its impact on computer cost/performance. **CO3:** Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design. **CO4:** Ability to understand the instruction set, instruction formats and addressing modes of 8086. **CO5:** Ability to write assembly language programs to solve problems.
EM612PE	**Professional Elective – I** Linear Systems Analysis	**At the end of this course, each student should be able to:** **CO1:** Use mathematical modeling tools to represent linear systems. **CO2:** Use mathematical modeling tools to analyze linear systems.
EM613PE	**Professional Elective – I** Linear and Digital IC Applications	**At the end of this course, each student should be able to:** **CO1:** A thorough understanding of operational amplifiers with linear integrated circuits. **CO2:** Understanding of the different families of digital integrated circuits and their characteristics. **CO3:** Also students will be able to design circuits using operational amplifiers for various applications.
EE614PE	**Professional Elective – I** Electrical and Electronics Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Design and implement systems utilizing analog / digital control devices. **CO2:** Apply the concepts of automatic control, including measurement, feedback, and feed

		forward regulation for the operation of continuous and discrete systems. **CO3:** Solve technical problems and be proficient in the analysis, design, test, and implementation of instrumentation and control systems. **CO4:** Apply the concepts of heat transfer to the design of process control systems. **CO5:** Able to utilize modern and effective management skills for performing investigation, analysis, and synthesis in the implementation of automatic control systems.
EE604PC	Power System Lab	**At the end of this course, each student should be able to:** **CO1:** Perform various load flow techniques. **CO2:** Understand Different protection methods. **CO3:** Analyze the experimental data and draw the conclusions.
EE605PC	Power electronics Lab	**At the end of this course, each student should be able to:** **CO1:** Understand the operating principles of various power electronic converters. **CO2:** Use power electronic simulation packages& hardware to develop the power converters. **CO3:** Analyze and choose the appropriate converters for various applications After completion of this course, the student is able to **CO4:** Understand the operating principles of various power electronic converters. **CO5:** Use power electronic simulation packages& hardware to develop the power converters. **CO6:** Analyze and choose the appropriate converters for various applications
EN606HS	Advanced English Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire vocabulary and use it contextually **CO2:** Listen and speak effectively. **CO3:** Develop proficiency in academic reading and Writing. **CO4:** Increase possibilities of job prospects. **CO5:** Communicate confidently in formal and informal Contexts.

B.Tech-IV YEAR - I Sem_EEE

Code	Course Name	Course Outcomes
EE701PC	Power Semiconductor Drives	**At the end of this course, each student should be able to:** **CO1:** Indentify the drawbacks of speed control of motor by conventional methods. **CO2:** Differentiate Phase controlled and chopper controlled DC drives speed-torque. **CO3:** Characteristics merits and demerits. **CO4:** Understand Ac motor drive speed–torque characteristics using different control strategies its merits and demerits. **CO5:** Describe Slip power recovery schemes.
EE702PC	Power System Operation and control	**At the end of this course, each student should be able to:** **CO1:** Analyze the optimal scheduling of power plants. **CO2:** Analyze the steady state behavior of the power system for voltage and frequency. **CO3:** Fluctuations. **CO4:** Describe reactive power control of a power system. **CO5:** Design suitable controller to dampen the frequency and voltage steady state oscillations.
EE721PE	**Professional Elective – II** Digital Signal Processing	**At the end of this course, each student should be able to:** **CO1:** Perform time, frequency, and Z -transform analysis on signals and systems. **CO2:** Understand the inter-relationship between DFT and various transforms. **CO3:** Understand the significance of various filter structures and effects of round off errors. **CO4:** Design a digital filter for a given specification.

		CO5: Understand the fast computation of DFT and appreciate the FFT processing. **CO6:** Understand the tradeoffs between normal and multi rate DSP techniques and finite length word effects.
EE722PE	**Professional Elective – II** HVDC Transmission	**At the end of this course, each student should be able to:** **CO1:** Compare EHV AC and HVDC system and to describe various types of DC links. **CO2:** Analyze Graetz circuit for rectifier and inverter mode of operation . **CO3:** Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems . **CO4:** Describe various protection methods for HVDC systems and classify Harmonics and design different types of filters.
EE723PE	**Professional Elective – II** Switch Mode Power Supplies	**At the end of this course, each student should be able to:** After completion of this course the students are able to understand the concepts and principle of operation of various types of switched mode power supply systems for both D.C. and A.C. outputs.
EE724PE	**Professional Elective – II** Reliability Engineering	**At the end of this course, each student should be able to:** **CO1:** Model various systems applying reliability Networks. **CO2:** Evaluate the reliability of simple and complex Systems. **CO3:** Estimate the limiting state probabilities of repairable systems.

		CO4: Apply various mathematical models for evaluating reliability of irreparable systems.
EE731PE	**Professional Elective - III** Digital Control Systems	**At the end of this course, each student should be able to:** **CO1:** Carry map S-plane and Z-plane, do state-space Analysis. **CO2:** Carry stability analysis in S-domain and Z-Domains. **CO3:** Carry stability analysis through bilinear transformation and R-H criteria, **CO4:** Design of discrete-time control systems, design of lag, lead, lead-lag compensators,design of PID controllers and design of state feedback controllers and observers. **CO5:** Apply the above concepts to real-world electrical and electronics problems and applications.
EE732PE	**Professional Elective - III** Power Quality	**At the end of this course, each student should be able to:** **CO1:** Know the severity of power quality problems in distribution system. **CO2:** Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage) . **CO3:** Concept of improving the power quality to sensitive load by various mitigating custom power devices.
EE733PE	**Professional Elective - III** Modern Power Electronics	**At the end of this course, each student should be able to:** **CO1:** To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT,GTO etc. **CO2:** To understand application of aforesaid Power Electronics devices in Choppers, Inverters and Converters etc. **CO3:** To understand control of Electrical Motors through DC-DC converters, AC Converters etc.

		CO4: To understand the use of Inductors and Capacitors in Choppers, Inverters and Converters.
EE734PE	**Professional Elective - III** Optimization Techniques	**At the end of this course, each student should be able to:** **CO1:** Explain the need of optimization of engineering Systems. **CO2:** Understand optimization of electrical and electronics engineering problems. **CO3:** Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem. **CO4:** Apply unconstrained optimization and constrained non-linear programming and dynamic programming. **CO5:** Formulate optimization problems.
EE741PE	**Professional Elective - IV** Programmable Logic Controllers	**At the end of this course, each student should be able to:** **CO1:** Understand the purpose, functions, and operations of a PLC. **CO2:** Identify the basic components of the PLC and how they function. **CO3:** View a directory of processor files using PLC software. **CO4:** Ability to gain knowledge on Programmable Logic Controllers. **CO5:** Will understand different types of Devices to which PLC input and output modules are Connected. **CO6:** To provide the knowledge about understand various types of PLC registers. **CO7:** Able to create ladder diagrams from process control descriptions. **CO8:** Ability to apply PLC timers and counters for the control of industrial processes.

		CO9: Able to use different types PLC functions, Data Handling Function.
EE742PE	**Professional Elective - IV** EHV AC Transmission Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the basic concepts of EHV AC transmission. **CO2:** Get the Knowledge on EHV transmission line inductance and capacitance. **CO3:** Understand the voltage gradients of conductor **CO4:** Identify corona effects on transmission lines **CO5:** Calculate electrostatic fields of EHVAC lines and its effects. **CO6:** Analyze travelling waves **CO7:** Distinguish various compensators for voltage control.
EE743PE	**Professional Elective - IV** Flexible A.C. Transmission Systems	**At the end of this course, each student should be able to:** **CO1:** Choose proper controller for the specific application based on system requirements . **CO2:** Understand various systems thoroughly and their requirements. **CO3:** Understand the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping . **CO4:** Understand the Power and control circuits of Series Controllers GCSC, TSSC and TCSC.
EE744PE	**Professional Elective - IV** Special Machines	**At the end of this course, each student should be able to:** **CO1:** To select different special machines as part of control system components. **CO2:** To use special machines as transducers for converting physical signals into electrical signals.

		CO3: To use micro-processors for controlling different machines. **CO4:** To understand the operation of different special machines.
EE703PC	Electrical Systems Simulation Lab	**At the end of this course, each student should be able to:** **CO1:** Design and Analyze electrical systems in time and frequency domain. **CO2:** Analyze various transmission lines and perform fault analysis. **CO3:** Model Load frequency control of Power Systems. **CO4:** Design various Power Electronic Converters and Drives.
EE704PC	Electrical Workshop	**At the end of this course, each student should be able to:** **CO1:** Get practical knowledge related to electrical. **CO2:** Fabricate basic electrical circuit elements / Networks. **CO3:** Trouble shoot the electrical circuits . **CO4:** Design filter circuit for application. **CO5:** Get hardware skills such as soldering, winding etc. **CO6:** Get debugging skills.
EE705PC	Industry Oriented Mini Project	**At the end of this course, each student should be able to:** **CO1:** Formulate a real world problem and develop its requirements. **CO2:** Student will be exposed to industrial awareness. **CO3:** Self learning technologies, methods and/or techniques that contribute to the software solution of the project.
EE706PC	Seminar	**At the end of this course, each student should be able to:** **CO1:** Ability to work in actual working environment. **CO2:** Ability to utilize technical resources. **CO3:** Ability to write technical documents and give oral presentations related to the work completed.

B.Tech-IV YEAR - II Sem_EEE

Code	Course Name	Course Outcomes
	Open Elective – III	
EE851PE	**Professional Elective – V** Artificial Neural Networks and Fuzzy Systems	**At the end of this course, each student should be able to:** **CO1:** To understand artificial neural network models and their training algorithms. **CO2:** To understand the concept of fuzzy logic system components, fuzzification and defuzzification. **CO3:** Apply the above concepts to real-world problems and applications.
EE852PE	**Professional Elective – V** Electrical Distribution Systems	**At the end of this course, each student should be able to:** **CO1:** Distinguish between transmission, and distribution line and design the feeders. **CO2:** Power loss and voltage drop of the feeders. **CO3:** Design protection of distribution systems. **CO4:** Understand the importance of voltage control and power factor improvement.
EE853PE	**Professional Elective – V** Wind, Solar and Hybrid Energy Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the energy scenario and the consequent growths of the power generate renewable energy sources. **CO2:** Understand the basic physics of wind and solar power generation. **CO3:** Understand the power electronic interfaces for wind and solar generation. **CO4:** Understand the issues related to the grid-integration of solar and wind energy systems.

EE854PE	**Professional Elective – V** High Voltage Engineering	**At the end of this course, each student should be able to:** **CO1:** Acquire knowledge on, basics of high voltage engineering **CO2:** Understand break-down phenomenon in different types of dielectrics. **CO3:** Understand generation and measurement of high voltages and currents. **CO4:** Understand the phenomenon of over-voltages, concept of insulation co-ordination. **CO5:** Know testing of various materials and electrical apparatus used in high voltage engineering.
EE861PE	**Professional Elective -VI** VLSI Design	**At the end of this course, each student should be able to:** **CO1:** Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors. **CO2:** Choose an appropriate inverter depending on specifications required for a circuit. **CO3:** Draw the layout of any logic circuit which helps to understand and estimate parasitic of any logic circuit. **CO4:** Design different types of logic gates using CMOS inverter and analyze their transfer characteristics. **CO5:** Provide design concepts required to design building blocks of data path using gates. **CO6:** Design simple memories using MOS transistors and can understand design of large memories. **CO7:** Design simple logic circuit using PLA, PAL, FPGA and CPLD. **CO8:** Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

EE862PE	**Professional Elective -VI** Smart Electric Grid	**At the end of this course, each student should be able to:** **CO1:** Recite the structure of an electricity market in either regulated or deregulated market conditions. **CO2:** Understand the advantages of DC distribution and developing technologies in distribution **CO3:** Discriminate the trade-off between economics and reliability of an electric power system, differentiate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets **CO4:** Analyze the development of smart and intelligent domestic systems
EE863PE	**Professional Elective -VI** Utilization of Electric Power	**At the end of this course, each student should be able to:** **CO1:** Acquire knowledge on, electric drives characteristics and their applicability in industry based on the nature of different types of loads and their characteristics **CO2:** Understands the concepts and methods of electric heating, welding, illumination and electric traction **CO3:** Apply the above concepts to real-world electrical and electronics problems and applications.
EE864PE	Professional Elective -VI Electric and Hybrid Vehicles	**At the end of this course, each student should be able to:** **CO1:** Recite the structure of an electricity market in either regulated or deregulated market conditions. **CO2:** Understand the advantages of DC distribution and developing technologies in distribution. **CO3:** Discriminate the trade-off between

		economics and reliability of an electric power system, differentiate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets. **CO4:** Analyze the development of smart and intelligent domestic systems.
EE801PC	Major Project	**At the end of this course, each student should be able to:** **CO1:** Ability to implement and execute well defined Objective. **CO2:** Ability to work in team at component level and system level. **CO3:** Ability to troubleshoot.

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-I: Mechanical Engineering graduates would be able to Work in power plants and manufacturing industry in the sphere of operation and maintenance.

PSO-II: Mechanical Engineering graduates would be able to apply creative thinking to design mechanical equipment and processes including development of domain specific software tools.

B.Tech-II YEAR - I Sem_ME

Code	Course Name	Course Outcomes
MA301BS	Mathematics - IV	**At the end of this course, each student should be able to:** **CO1:** Analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem. **CO2:** Find the Taylor's and Laurent's series expansion of complex functions. **CO3:** The bilinear transformation **CO4:** Express any periodic function in term of sines and cosines. **CO5:** Express a non-periodic function as integral Representation. **CO6:** Analyze one dimensional wave and heat Equation.
ME304ES	Thermodynamics	**At the end of this course, each student should be able to:** **CO1:** Understand and differentiate between different thermodynamic systems and processes. **CO2:** Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis. **CO3:** Understand and analyze the Thermodynamic cycles and evaluate performance parameters.
ME302ES	Kinematics of Machinery	**At the end of this course, each student should be able to:** The main purpose is to give an idea about the relative motions obtained in all the above type of components used in mechanical Engineering.
ME305ES	Metallurgy and Material Science	**At the end of this course, each student should be able to:** **CO1:** Identify the properties of metals with respect to

		crystal structure and grain size . **CO2:** Interpret the phase diagrams of materials . **CO3:** Classify and Distinguish different types of cast irons, steels and non ferrous alloys . **CO4:** Describe the concept of heat treatment of steels & strengthening mechanisms . **CO5:** Explain the powder metallurgy process, types and manufacturing of composite materials.
ME303ES	Mechanics of Solids	**At the end of this course, each student should be able to:** **CO1:** Analyze the behavior of the solid bodies subjected to various types of loading. **CO2:** Apply knowledge of materials and structural elements to the analysis of simple structures. **CO3:** Undertake problem identification, formulation and solution using a range of analytical methods. **CO4:** Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams. **CO5:** Expectation and capacity to undertake lifelong learning.
ME306ES	Fuels and Lubricants Lab	**At the end of this course, each student should be able to:** **CO1:** Illustrate the viscosity of liquid lubricants. **CO2:** Understand the calorific values of solid and gaseous fuels. **CO3:** Analyse the flash and fire points of liquid fuels. **CO4:** Observe the carbon residue for fuels. **CO5:** Compare the depth penetration for different lubricants.
ME307ES	Mechanics of Solids Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze the behavior of the solid bodies subjected to various types of loading.

		CO2: Apply knowledge of materials and structural elements to the analysis of simple structures. **CO3:** Undertake problem identification, formulation and solution using a range of analytical methods **CO4:** Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams. **CO5:** Expectation and capacity to undertake lifelong learning.
ME308ES	Metallurgy and Material Science Lab	**At the end of this course, each student should be able to:** The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application. Upon graduation, students would have acquired and developed the necessary background and skills for successful careers in the materials-related industries. Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree.
***MC300HS**	Gender Sensitization Lab	**At the end of this course, each student should be able to:** **CO1:** Students will have developed a better understanding of important issues related to gender in contemporary India. **CO2:** Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film. **CO3:** Students will attain a finer grasp of how gender

		discrimination works in our society and how to counter it. **CO4:** Students will acquire insight into the gendered division of labour and its relation to politics and economics. **CO5:** Men and women students and professionals will be better equipped to work and live together as equals. **CO6:** Students will develop a sense of appreciation of women in all walks of life. **CO7:** Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

B.Tech-II YEAR - II Sem_ME

Code	Course Name	Course Outcomes
MA403ES	Dynamics of Machinery	**At the end of this course, each student should be able to:** The study of KOM& DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.
ME401ES	Fluid Mechanics and Hydraulic Machines	**At the end of this course, each student should be able to:** **CO1:** Able to explain the effect of fluid properties on a flow system. **CO2:** Able to identify type of fluid flow patterns and describe continuity equation. **CO3:** To analyze a variety of practical fluid flow and measuring devices and utilize fluid Mechanics principles in design. **CO4:** To select and analyze an appropriate turbine with reference to given situation in power plants. **CO5:** To estimate performance parameters of a given Centrifugal and Reciprocating pump. **CO6:** Able to demonstrate boundary layer concepts.
ME404ES	Machine Drawings	**At the end of this course, each student should be able to:** **CO1:** Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components. **CO2:** Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

		CO3: Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned. **CO4:** Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features. **CO5:** Title boxes, their size, location and details - common abbreviations and their liberal usage. **CO6:** Types of Drawings – working drawings for machine parts.
ME405ES	Manufacturing Process	**At the end of this course, each student should be able to:** Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds. Design core, core print and gating system in metal casting processes Understand arc, gas, solid state and resistance welding processes. Develop process-maps for metal forming processes using plasticity principles. Identify the effect of process variables to manufacture defect free products.
ME405MS	Business Economics and Financial Analysis	**At the end of this course, each student should be able to:** The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a company.
ME406ES	Kinematics and Dynamics Lab	**At the end of this course, each student should be able to:** **CO1:** Understand types of motion. **CO2:** Analyze forces and torques of components in linkages. **CO3:** Understand static and dynamic balance. **CO4:** Understand forward and inverse Kinematics of open-loop mechanism.

ME407ES	Fluid Mechanics and Hydraulic Machines Lab	**At the end of this course, each student should be able to:** **CO1:** Able to explain the effect of fluid properties on a flow system. **CO2:** Able to identify type of fluid flow patterns and describe continuity equation. **CO3:** To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design. **CO4:** To select and analyze an appropriate turbine with reference to given situation in power plants. **CO5:** To estimate performance parameters of a given Centrifugal and Reciprocating pump. **CO6:** Able to demonstrate boundary layer concepts
ME408ES	Manufacturing Process Lab	**At the end of this course, each student should be able to:** Understanding the properties of moulding sands and pattern making. Fabricate joints using gas welding and arc welding. Evaluate the quality of welded joints. Basic idea of press working tools and performs moulding studies on plastics.
***MC400ES**	Environmental Science and Technology	**At the end of this course, each student should be able to:** Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development.

B.Tech-III YEAR - I Sem_ME

Code	Course Name	Course Outcomes
ME501PC	Design of Machine Members - I	**At the end of this course, each student should be able to:** **CO1:** The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure. **CO2:** Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading. **CO3:** Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.
ME502PC	Thermal Engineering-I	**At the end of this course, each student should be able to:** At the end of the course, the student should be able to evaluate the performance of IC engines and compressors under the given operating conditions. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance
ME503PC	Metrology and Machine Tools	**At the end of this course, each student should be able to:** **CO1:** Identify techniques to minimize the errors in measurement. **CO2:** Identify methods and devices for measurement of length, angle, gear & thread parameters, surface roughness and geometric features of parts. **CO3:** Understand working of lathe, shaper, planer,

		drilling, milling and grinding machines. **CO4:** Comprehend speed and feed mechanisms of machine tools. **CO5:** Estimate machining times for machining operations on machine tools.
SM504MS	Fundamentals of Management	**At the end of this course, each student should be able to:** The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.
	Open Elective – I	
ME505PC	Thermal Engineering Lab	**At the end of this course, each student should be able to:** **CO1:** Ability to analyze the performance and operating characteristics of an IC engine using rope brake and electrical dynamometer. **CO2:** Draw the heat balance sheet for an IC engine. **CO3:** Able to analyze the performance of reciprocating air compressor. **CO4:** Know the principle of working of steam boilers and their accessories and mountings. **CO5:** Calculate &compare the performance characteristics and IC engine load variations with Air fuel ratio.
ME506PC	Machine Tools Lab	**At the end of this course, each student should be able to:** **CO1:** To undertake machining operation such as step turning, taper turning and thread cutting on lathe machine. **CO2:** To drill holes using drilling machine and cut internal threads by tapping. **CO3:** To cut slots and key ways usingslotter and

		milling machine. **CO4:** To prepare a cutting tool with required tool geometry using a tool and cutter grinder. **CO5:** To perform finishing operation on flat surfaces using surface grinding machine and Cylindrical grinding attachment.
ME507PC	Engineering Metrology Lab	**At the end of this course, each student should be able to:** **CO1:** To measure angle using Sine Bar/ Bevel Protractor . **CO2:** To demonstrate measurements using Tool maker microscope . **CO3:** To demonstrate measurements of surface flatness using spirit level & Optical flats. **CO4:** To measure Screw thread parameters using 2-wire or 3-wire method. **CO5:** To measure gear tooth profile using gear tooth vernier.
*MC500HS	Professional Ethics	**At the end of this course, each student should be able to:** **CO1:** The students will understand the importance of Values and Ethics in their personal lives and professional careers. **CO2:** The students will learn the rights and responsibilities as an employee, team member and a global citizen.

B.Tech-III YEAR - II Sem_ME

Code	Course Name	Course Outcomes
ME601PC	Thermal Engineering –II	**At the end of this course, each student should be able to:** **CO1:** Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants. **CO2 :** Apply the laws of Thermodynamics to analyze thermodynamic cycles. **CO3:** Differentiate between vapour power cycles and gas power cycles. **CO4:** Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants. **CO5:** Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components.
ME602PC	Design of Machine Members-II	**At the end of this course, each student should be able to:** **CO1:** Knowledge about journal bearing design using different empirical relations. **CO2:** Estimation of life of rolling element bearings and their selection for given service conditions. **CO3:** Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry.
ME603PC	Heat Transfer	**At the end of this course, each student should be able to:** **CO1:** Understand the basic modes of heat transfer. **CO2:** Compute one dimensional steady state heat transfer with and without heat generation. **CO3:** Understand and analyze heat transfer through

		extended surfaces. **CO4:** Understand one dimensional transient conduction heat transfer. **CO5:** Understand concepts of continuity, momentum and energy equations. **CO6:** Interpret and analyze forced and free convective heat transfer. **CO7:** Understand the principles of boiling, condensation and radiation heat transfer. **CO8:** Design of heat exchangers using LMTD and NTU methods.
	Open Elective – II	
ME611PE	**Professional Elective – I** Finite Element Methods	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer. Formulate and solve problems in one dimensional structures including trusses, beams and frames. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems. Implement and solve the finite element formulations using MATLAB.
ME612PE	**Professional Elective – I** Refrigeration and Air Conditioning	**At the end of this course, each student should be able to:** At the end of the course, the student should be able to Differentiate between different types of refrigeration systems with respect to application as well as conventional and unconventional refrigeration systems. Thermodynamically analyse refrigeration and air conditioning systems and evaluate performance parameters. Apply the principles of Psychometrics to design the air conditioning loads for the industrial applications.

ME613PE	**Professional Elective – I** Machine Tool Design	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Understand basic motions involved in a machine tool. Design machine tool structures. Design and analyze systems for specified speeds and feeds. Select subsystems for achieving high accuracy in machining. Understand control strategies for machine tool operations. Apply appropriate quality tests for quality assurance.
ME614PE	**Professional Elective – I** IC Engines and Gas Turbines	**At the end of this course, each student should be able to:** **CO1:** Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of IC engines along with its working principles. **CO2:** Describe the combustion phenomenon in SI and CI engines. **CO3:** Evaluate the performance of IC engines and the importance of alternate fuels. **CO4:** Classify the essential components of gas turbine along with its performance Improving methods. **CO5:** Illustrate the working principle of different types of Jet propulsive engines and Rockets.
ME604PC	Heat Transfer Lab	**At the end of this course, each student should be able to:** **CO1:** Perform steady state conduction experiments to estimate thermal conductivity of different materials. **CO2:** Perform transient heat conduction experiment **CO3:** Estimate heat transfer coefficients in forced convection, free convection , condensation and correlate with theoretical values. **CO4:** Obtain variation of temperature along the length of the pin fin under forced and free convection.

		CO5: Perform radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann's constant and compare with theoretical value.
ME605PC	CADD and MATLAB	**At the end of this course, each student should be able to:** **CO1:** Students should be able to apply computer methods for solving a wide range of engineering problems. **CO2:** Students should be able to use computer engineering software to solve and present problem solutions in a technical format. **CO3:** Students should be able to utilize computer skills to enhance learning and performance in other engineering and science courses. **CO4:** And finally, students should be able to demonstrate professionalism in interactions with Colleagues, faculty, and staff.
EN606HS	Advanced English Communication Skills Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire vocabulary and use it contextually. **CO2:** Listen and speak effectively. **CO3:** Develop proficiency in academic reading and writing. **CO4:** Increase possibilities of job prospects. **CO5:** Communicate confidently in formal and informal contexts Acquire vocabulary and use it contextually. **CO6:** Listen and speak effectively. **CO7:** Develop proficiency in academic reading and writing. **CO8:** Increase possibilities of job prospects. **CO9:** Communicate confidently in formal and informal contexts.

B.Tech IV YEAR – I SEM _ ME

Code	Course Name	Course Outcomes
ME701PC	CAD/CAM	**At the end of this course, each student should be able to:** Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces .Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.
ME702PC	Instrumentation and Control System	**At the end of this course, each student should be able to:** To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments. Analysis of errors so as to determine correction factors for each an instrument. To understand static and dynamic characteristics of instrument and should be able to determine loading response time. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.
ME721PE	**Professional Elective – II** Composite materials	**At the end of this course, each student should be able to:** The student will apply the concepts learnt during the course to design, and apply a composite material for a specific application.
ME722PE	**Professional Elective – II** Industrial Management	**At the end of this course, each student should be able to:** **CO1:** Choose, prepare, interpret and use cost Estimates.

		as a basis for the different situations in an industrial company. **CO2:** Interpret financial statements and other Financial reports of industrial companies, including the income statement, the balance sheet, the cash flow statement and key measures. **CO3:** Explain how strategic planning, management, management control, entrepreneurship, organization, production and learning works in an industrial company. **CO4:** Explain how the industrial company markets and price it's products. **CO5:** Explain how the company deal with it's environment.
ME723PE	**Professional Elective – II** Power Plant Engineering	**At the end of this course, each student should be able to:** **CO1:** Understand the concept of Rankine cycle. **CO2:** Understand working of boilers including water tube,fire tube and high pressure boilers and determine efficiencies. **CO3:** Analyze the flow of steam through nozzles. **CO4:** Evaluate the performance of condensers and steam turbines. **CO5:** Evaluate the performance of gas turbines.
ME724PE	**Professional Elective – II** Operations Research	**At the end of this course, each student should be able to:** Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization Technology.
ME731PE	**Professional Elective – III** Engineering Tribology	**At the end of this course, each student should be able to:** **CO1:** Understanding friction characteristics in journal bearings.

		CO2: Knowledge about different theories of lubrication to reduce friction and wear.
ME732PE	**Professional Elective – III** Computational Fluid Dynamics	**At the end of this course, each student should be able to:** **Outcome 1:** Provide the student with a significant level of experience in the use of modern CFD software for the analysis of complex fluid-flow systems. 1.1 The student will demonstrate the ability to use modern CFD software tools to build flow geometries, generate an adequate mesh for an accurate solution, select appropriate solvers to obtain a flow solution, and visualize the resulting flow field. 1.2 The student will demonstrate the ability to analyze a flow field to determine various quantities of interest, such as flow rates, heat fluxes, pressure drops, losses, etc., using flow visualization and analysis tools. **Outcome 2:** Improve the student's understanding of the basic principles of fluid mechanics. 2.1 The student will demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow. 2.2 The student will demonstrate an ability to describe various flow features in terms of appropriate fluid mechanical principles and force balances. **Outcome 3:** Improve the student's research and communication skills using a self-directed, detailed study of a complex fluid-flow problem and to communicate the results in written form. 3.1 The student will demonstrate the ability to simplify a real fluid-flow system into a simplified model problem, to select the proper governing equations for the physics involved in the system, to solve for the flow, to investigate the fluid-flow behavior, and to understand the results.

		3.2 The student will demonstrate the ability to communicate the results of this detailed fluid-flow study in a written format.
ME733PE	**Professional Elective – III** Robotics	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.
ME734PE	**Professional Elective – III** CNC Technology	**At the end of this course, each student should be able to:** At the end course, one should be able to select tooling method, control mechanism and do part programming for a given product.
ME741PE	**Professional Elective – IV** Mechanical Vibrations	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Understand the causes and effects of vibration in mechanical systems. Develop schematic models for physical systems and formulate governing equations of motion. Understand the role of damping, stiffness and inertia in mechanical systems Analyze rotating and reciprocating systems and compute critical speeds. Analyze and design machine supporting structures, vibration isolators and absorbers.
ME742PE	**Professional Elective – IV** Turbo Machines	**At the end of this course, each student should be able to:** **CO1:** Ability to design and calculate different parameters for turbo machines. **CO2:** Prerequisite to CFD and Industrial fluid power Courses.

		CO3: Ability to formulate design criteria. **CO4:** Ability to understand thermodynamics and kinematics behind turbo machines.
ME743PE	**Professional Elective – IV** MEMS	**At the end of this course, each student should be able to:** **CO1:** Students will be able to understand working principles of currently available micro sensors, actuators, and motors, valves, pumps, and fluidics used in Microsystems. **CO2:** Students will be able to apply scaling laws that are used extensively in the conceptual design of micro devices and systems. Students will be able to differentiate between the positive and negative consequences of scaling down certain physical quantities that are pertinent to Microsystems. **CO3:** Students will be able to use materials for common micro components and devices. **CO4:** Students will be able to choose a micromachining technique, such as bulk micromachining and surface micromachining for a specific MEMS fabrication process. **CO5:** Students will be able to understand the basic principles and applications of microfabrication processes, such as photolithography, ion implantation, diffusion, oxidation, CVD, PVD, and etching. **CO6:** Students will be able to consider recent advancements in the field of MEMS and devices. **CO7:** Students will be able communicate their results and findings orally via formal presentations and in writing through reports.

ME744PE	**Professional Elective – IV** Additive Manufacturing Technology	**At the end of this course, each student should be able to:** **CO1:** Describe various CAD issues for 3D printing and rapid prototyping and related operations for STL model manipulation. **CO2:** Formulate and solve typical problems on reverse engineering for surface reconstruction from physical prototype models through digitizing and spline-based surface fitting. **CO3:** Formulate and solve typical problems on reverse engineering for surface reconstruction from digitized mesh models through topological modelling and subdivision surface fitting. **CO4:** Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems. **CO5:** Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts.
ME703PC	CAD/CAM Lab	**At the end of this course, each student should be able to:** To be able to understand and handle design problems in a systematic manner. To be able to apply CAD in real life applications. To be understand the basic principles of different types of analysis.
ME704PC	Instrumentation and Control Systems Lab	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to Characterize and calibrate measuring devices. Identify and analyze errors in measurement. Analyze measured data using regression analysis. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

ME705PC	Industry Oriented Mini Project	**At the end of this course, each student should be able to:** **CO1:** Formulate a real world problem and develop its Requirements. **CO2:** Student will be exposed to industrial awareness. **CO3:** Self learning technologies, methods and/or techniques that contribute to the software solution of the project.
ME706PC	Seminar	**At the end of this course, each student should be able to:** **CO1:** Ability to work in actual working environment. **CO2:** Ability to utilize technical resources **CO3:** Ability to write technical documents and give oral presentations related to the work completed.

B.Tech IV YEAR –II SEM_ME

Code	Course Name	Course Outcomes
	Open Elective – III	
ME851PE	**Professional Elective – V** Automation in Manufacturing	**At the end of this course, each student should be able to:** **CO1:** Illustrate the basic concepts of automation in machine tools. **CO2:** Analyze various automated flow lines, Explain assembly systems and line balancing methods. **CO3:** Describe the importance of automated material handling and storage systems. **CO4:** Interpret the importance of adaptive control systems, automated inspection systems.
ME852PE	**Professional Elective – V** Fluid Power System	**At the end of this course, each student should be able to:** **CO1:** Understand the Properties of fluids, Fluids for hydraulic systems. **CO2:** Governing laws. distribution of fluid power, Design and analysis of typical hydraulic circuits. **CO3:** Know accessories used in fluid power system, Filtration systems andmaintenance of system.
ME853PE	**Professional Elective – V** Renewable Energy Sources	**At the end of this course, each student should be able to:** **CO1:** Understanding of renewable energy sources. **CO2:** Knowledge of working principle of various energy systems. **CO3:** Capability to carry out basic design of renewable energy systems.
ME854PE	**Professional Elective – V** Production Planning and Control	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against

		traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.
ME861PE	**Professional Elective – VI** Automobile Engineering	**At the end of this course, each student should be able to:** **CO1:** Gain the knowledge on automobile and its types and basic knowledge about engine and its Lubrication to the practical problems. **CO2:** Analyze the Type of cooling and new technology processes of cooling and ignition systems and its trouble shooting of simple problems on fuel, ignition, cooling, lubrication and electrical systems . **CO3:** Develop an ability to analyze of suspension system and braking systems. **CO4:** Analyze new technical challenges and design of Power steering systems and new technical advancements in the automotive industry and braking systems. **CO5:** Gain the knowledge about the Alternative fuels used in automobile, performance and Emissions of automobile and its control of international standards.
ME862PE	**Professional Elective – VI** Advanced Mechanics of Solids	**At the end of this course, each student should be able to:** **CO1:** Determined the point of location of applied load to avoid twisting in thin sections used in aerospace applications. **CO2:** Understand the concept of distinguish between neutral and centroidal axes in curved beams. **CO3:** Understanding the analogy models developed

		for analyzing the non circular bars subjected to torsion, and also analyzing the stresses developed between rolling bodies and stress in three dimensional bodies.
ME863PE	**Professional Elective – VI** Unconventional Machining Processes	**At the end of this course, each student should be able to:** **CO1:** Understand the basic techniques of machining processes modeling. **CO2:** Understand the mechanical aspects of orthogonal cutting mechanics. **CO3:** Understand the thermal aspects of orthogonal cutting mechanics. **CO4:** Ability to extend, through modeling techniques, the single point, multiple point and abrasive machining processes. **CO5:** Estimate the material removal rate and cutting force, in an industrially useful manner, for practical machining processes.
ME864PE	**Professional Elective – VI** Advanced Materials Technology	**At the end of this course, each student should be able to:** **CO1:** To select appropriate advanced materials processes for a given product or component recognizing material, size, precision, and surface quality requirements. **CO2:** To conduct theoretical and experimental analysis for advanced materials removal and laser processing technologies.
ME801PC	Major Project	**At the end of this course, each student should be able to:** **CO1:** Ability to implement and execute well defined Objective. **CO2:** Ability to work in team at component level and system level. **CO3:** Ability to troubleshoot.

Open Elective –I

(Common for EEE, ECE, CSE, IT,ME)

Code	Course Name	Course Outcomes
AE511OE	**Open Elective –I** Introduction to Space Technology	**At the end of this course, each student should be able to:** **CO1:** Distinguish the types of aerospace propulsion. **CO2:** Determine the attitude of the satellites. **CO3:** Support the space mission operations.
CE511OE	**Open Elective –I** Disaster Management	**At the end of this course, each student should be able to:** **CO1:** Understanding Disasters, man-made Hazards and Vulnerabilities. **CO2:** Understanding disaster management mechanism. **CO3:** Understanding capacity building concepts and planning of disaster managements.
CE512OE	**Open Elective –I** Intellectual Property Rights	**At the end of this course, each student should be able to:** **CO1:** IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents . **CO2:** Student get an insight on Copyrights, Patents and Software patents which are instrumental for further Advancements. **CO3:** Student get an insight Laws related in India . **CO4:** Student able to learn on Trademarks. **CO5:** Student get an insight on Trade secrets. **CO6:** Student get an insight on Cyber law.
BM511OE	Open Elective –I Reliability Engineering	**At the end of this course, each student should be able to:** **CO1:** Model various systems applying reliability networks **CO2:** Evaluate the reliability of simple and complex Systems. **CO3:** Estimate the limiting state probabilities of repairable systems.

		CO4: Apply various mathematical models for evaluating reliability of irrepairable systems.
CS511OE	Open Elective –I Operating Systems	**At the end of this course, each student should be able to:** **CO1:** Apply optimization techniques for the improvement of system performance. **CO2:** Ability to design and solve synchronization problems. **CO3:** Learn about minimization of turnaround time, waiting time and response time and also maximization of throughput by keeping CPU as busy as possible. **CO4:** Ability to change access controls to protect files. **CO5:** Ability to compare the different operating systems.
CS512OE	Open Elective –I Database Management Systems	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the basic elements of a relational database management system. **CO2:** Ability to identify the data models for relevant problems. **CO3:** Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data. **CO4:** Apply normalization for the development of application software.
EC511OE	Open Elective –I Principles of Electronic Communications	**At the end of this course, each student should be able to:** **CO1:** Work on various types of modulations. **CO2:** Should be able to use these communication modules in implementation. **CO3:** Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.
EM511OE	Open Elective –I Scripting Languages	**At the end of this course, each student should be able to:** **CO1:** Ability to create and run scripts using PERL / TCl /

		Python in IC design flow. **CO2:** Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow.
EE511OE	Open Elective –I Non Conventional Power Generation	**At the end of this course, each student should be able to:** **CO1:** Analyze solar thermal and photovoltaic systems and related technologies for energy conversion. **CO2:** Understand Wind energy conversion and devices available for it. **CO3:** Understand Biomass conversion technologies, Geo thermal resources and energy conversion principles and technologies. **CO4:** Realize Power from oceans (thermal, wave, tidal) and conversion devices. **CO5:** Understand fundamentals of fuel cells and commercial batteries.
EE512OE	Open Elective –I Electrical Engineering Materials	**At the end of this course, each student should be able to:** **CO1:** Understand various types of dielectric materials, their properties in various conditions. **CO2:** Evaluate magnetic materials and their behavior. **CO3:** Evaluate semiconductor materials and technologies. **CO4:** Acquire Knowledge on Materials used in electrical engineering and applications.
EE513OE	Open Elective –I Nanotechnology	**At the end of this course, each student should be able to:** The present syllabus of "Introduction to Nano Technology" will giveinsight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.
EI511OE	Open Elective –I Electronic Measurements and Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement. **CO2:** Measure various physical parameters by

		appropriately selecting the transducers. **CO3:** Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
ME511OE	Open Elective –I Optimization Techniques	**At the end of this course, each student should be able to:** **CO1:** Explain the need of optimization of engineering systems. **CO2:** Understand optimization of electrical and electronics engineering problems. **CO3:** Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem. **CO4:** Apply unconstrained optimization and constrained non-linear programming and dynamic programming. **CO5:** Formulate optimization problems.
ME512OE	Open Elective –I Computer Graphics	**At the end of this course, each student should be able to:** **CO1:** Students can animate scenes entertainment. **CO2:** Will be able work in computer aided design for content presentation. **CO3:** Better analogy data with pictorial representation.
ME513OE	Open Elective –I Introduction to Mechatronics	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.
ME514OE	Open Elective –I Fundamentals of Mechanical Engineering	**At the end of this course, each student should be able to:** **CO1:** To understand the fundamentals of mechanical systems. **CO2:** To understand and appreciate significance of mechanical engineering in different Fields of engineering

NT511OE	Open Elective –I Fabrication Processes	**At the end of this course, each student should be able to:** For given product, one should be able identify the manufacturing process.
NT512OE	Open Elective –I Non destructive Testing Methods	**At the end of this course, each student should be able to:** **CO1:** Identify the requirements of testing criteria as per material composition. **CO2:** Understand the theory of non destructive testing methods is used. **CO3:** Determine the type of requirement of non destructive test. **CO4:** Distinguish between the various NDT test as Ultrasonic and Eddy current methods. **CO5:** Understand the properties of radiation used in engineering. **CO6:** Describe the various types of non destructive test used to determine the surface cracks.
NT513OE	Open Elective –I Fundamentals of Engineering Materials	**At the end of this course, each student should be able to:** **CO1:** Identify the basic crystalline structure of steal. **CO2:** Understand the concept of TTT. **CO3:** Describe the various heat treatment methods to obtain the desired properties. **CO4:** Describe the composition of carbon contents in steel. **CO5:** Analyze the different forms of iron obtained during heating of steel. **CO6:** Understand the properties of non-ferrous alloys. **CO7:** Understand requirement.
MT511OE	Open Elective –I Analog and Digital I.C. Applications	**At the end of this course, each student should be able to:** **CO1:** Derive the gain equation of Op-amp and able to explain the working of the Op-amp . **CO2:** Design 1st order low pass and high pass butter worth filters .

		CO3: Design and analyze ADC's and DAC's . **CO4:** Recall the concepts of Digital circuits and Design digital circuits with digital IC's CO5: Compare memories.
MT512OE	Open Elective –I Intellectual Property Rights	**At the end of this course, each student should be able to:** **CO1:** IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents . **CO2:** Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements. **CO3:** Student get an insight Laws related in India . **CO4:** Student able to learn on Trademarks . **CO5:** Student get an insight on Trade secrets . **CO6:** Student get an insight on Cyber law.
MT513OE	Open Elective –I Computer Organization	**At the end of this course, each student should be able to:** **CO1:** Able to understand the basic components and the design of CPU, ALU and Contr**ol** Unit. **CO2:** Ability to understand memory hierarchy and its impact on computer cost/performance. **CO3:** Ability to understand the advantage of instruction level parallelism and pipelining for high performance Processor design. **CO4:** Ability to understand the instruction set, instruction formats and addressing modes of 8086. **CO5:** Ability to write assembly language programs to solve problems.
MM511OE	Open Elective –I Materials Characterization Techniques	**At the end of this course, each student should be able to:** At the end of the course the student will be able to characterize, identify, and apply the material to the concerned application.

MN511OE	Open Elective –I Introduction to Mining Technology	**At the end of this course, each student should be able to:** **CO1:** Basic terminology of mining and mechanics of blasting . **CO2:** Various phases of underground and open cast mining **CO3:** Various operations involved in drifting and shaft sinking . **CO4:** Various types of explosive and their use in mines.
PE511OE	Open Elective –I Materials Science and Engineering	**At the end of this course, each student should be able to:** **CO1:** Equipped with knowledge to prepare material selection diagram, evaluation of equipment life and prediction of life of the equipment. **CO2:** Acquiring the abilities to carryout reliability studies. **CO3:** Ready to carryout equipment failure analysis and propose the remedial measures.
PE512OE	Open Elective –I Renewable Energy Sources	**At the end of this course, each student should be able to:** **CO1:** Understanding of renewable energy sources. **CO2:** Knowledge of working principle of various energy systems. **CO3:** Capability to carry out basic design of renewable energy systems.
PE513OE	Open Elective –I Environmental Engineering	**At the end of this course, each student should be able to:** **CO1:** Analyze characteristics of water and wastewater. **CO2:** Estimate the quantity of drinking water and domestic wastewater generated. **CO3:** Design components of water supply systems Design sewerage system.

Open Elective-II

(Common for EEE, ECE, CSE, IT,ME)

Code	Course Name	Course Outcomes
AE621OE	**Open Elective-II** Introduction to Aerospace Engineering	**At the end of this course, each student should be able to:** **CO1:** Understand the nature of aerospace technologies. **CO2:** Identify the different types of Aircraft components and their functions. **CO3:** Assess the forces and moments due to flow over the aircraft components. **CO4:** Apply the principles of aerodynamics to different parts of an aeroplane. **CO5:** Evaluate the performance of propulsion system. **CO6:**Apply the knowledge of gravitational law, Kepler's law and Newton's law to the space vehicle.
MT621OE	**Open Elective-II** : Data Structures	**At the end of this course, each student should be able to:** **CO1:** Learn how to use data structure concepts for realistic problems. **CO2:** Ability to identify appropriate data structure for solving computing problems in respective language. **CO3:** Ability to solve problems independently and think critically.
MT622OE	**Open Elective-II** : Artificial Neural Networks	**At the end of this course, each student should be able to:** **CO1:** Create different neural networks of various architectures both feed forward and feed backward. **CO2:** Perform the training of neural networks using various learning rules. **CO3:** Perform the testing of neural networks and do the perform analysis of these networks for various

		pattern recognition applications.
BM621OE	**Open Elective-II** : Medical Electronics	**At the end of this course, each student should be able to:** **CO1:** Analyze and evaluate the effect of different diagnostic and therapeutic methods, their risk potential, physical principles, opportunities and possibilities for different medical procedures. **CO2:** To have a basic understanding of medical terminology, relevant for biomedical instrumentation. **CO3:** To understand and describe the physical and medical principles used as a basis for biomedical instrumentation. **CO4:** Understand the elements of risk for different instrumentation methods and basic electrical safety. **CO5:** Understand the position of biomedical instrumentation in modern hospital care.
CE621OE	**Open Elective-II** : Remote Sensing and GIS	**At the end of this course, each student should be able to:** **CO1:** Retrieve the information content of remotely sensed data. **CO2:** Analyze the energy interactions in the atmosphere and earth surface features **CO3:** Interpret the images for preparation of thematic maps. **CO4:** Apply problem specific remote sensing data for engineering applications **CO5:** Analyze spatial and attribute data for solving spatial problems **CO6:** Create GIS and cartographic outputs for presentation
CE622OE	**Open Elective-II** : Geo-Informatics	**At the end of this course, each student should be able to:** **CO1:** The characteristics of Aerial photographic images

		, Remote sensing satellites and Applications of remote sensing. **CO2:** The GIS and its Data models. **CO3:** The Global Navigation Satellite System.
CE623OE	**Open Elective-II** : Intellectual Property Rights	**At the end of this course, each student should be able to:** **CO1:** IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents . **CO2:** Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements. **CO3:** Student get an insight Laws related in India . **CO4:** Student able to learn on Trademarks . **CO5:** Student get an insight on Trade secrets . **CO6:** Student get an insight on Cyber law.
CN621OE	**Open Elective-II** : Environmental Impact Assessment	**At the end of this course, each student should be able to:** **CO1:** Identify the environmental attributes to be considered for the EIA study. **CO2:** Formulate objectives of the EIA studies. **CO3:** Identify the suitable methodology and prepare Rapid EIA. **CO4:** Indentify and incorporate mitigation measures.
CS621OE	**Open Elective-II** : Java Programming	**At the end of this course, each student should be able to:** **CO1:** Understanding of OOP concepts and basics of java programming (Console and GUI based). **CO2:** The skills to apply OOP and Java programming in problem solving. **CO3:** Should have the ability to extend his/her knowledge of Java programming further on his / her own.
CS622OE	**Open Elective-II** : Software Testing Methodologies	**At the end of this course, each student should be able to:** **CO1:** Ability to apply the process of testing and various methodologies in testing for developed software.

		CO2: Ability to write test cases for given software to test it before delivery to the customer.
CS623OE	**Open Elective-II** : Cyber Security	**At the end of this course, each student should be able to:** The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
EC621OE	**Open Elective-II** : Principles of Computer Communications and Networks	**At the end of this course, each student should be able to:** **CO1:** The student can get the knowledge of networking of computers, data transmission between computers. **CO2:** Will have the exposure about the various communication concepts. **CO3:** Will get awareness about the structure and equipment of computer network structures.
EM621OE	**Open Elective-II** : Soft Computing Techniques	**At the end of this course, each student should be able to:** **CO1:** Identify and employ suitable soft computing techniques in classification and optimization problems. **CO2:** Design hybrid systems to suit a given real – life problem.
EE621OE	**Open Elective-II** : Design Estimation and Costing of Electrical Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the design considerations of electrical installations. **CO2:** Design electrical installation for buildings and small industries. **CO3:** Identify and design the various types of light sources for different applications.
EE622OE	**Open Elective-II** : Energy Storage Systems	**At the end of this course, each student should be able to:** **CO1:** Analyze the characteristics of energy from

		various sources and need for storage **CO2:** Classify various types of energy storage and various devices used for the purpose **CO3:** Identify various real time applications.
EE623OE	**Open Elective-II** : Introduction to Mechatronics	**At the end of this course, each student should be able to:** The student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.
EI621OE	**Open Elective-II** : Industrial Electronics	**At the end of this course, each student should be able to:** **CO1:** Describe how electronic input and output circuits are used to control automated manufacturing and/or process systems. **CO2:** Identify basic elements used for input, output, timing, and control **CO3:** Define how programmable electronic systems use input data to alter output responses. **CO4:** Troubleshoot a representative system. **CO5:** Demonstrate how system operation can be altered with software programming.
ME621OE	**Open Elective-II** : World Class Manufacturing	**At the end of this course, each student should be able to:** Students should be able to compare the existing industry with WCM companies.
ME622OE	**Open Elective-II** : Fundamentals of Robotics	**At the end of this course, each student should be able to:** **CO1:** Understand the basic components of robots. **CO2:** Differentiate types of robots and robot grippers. **CO3:** Model forward and inverse kinematics of robot manipulators. **CO4:** Analyze forces in links and joints of a robot.

		CO5: Programme a robot to perform tasks in industrial applications. **CO6:** Design intelligent robots using sensors.
ME623OE	**Open Elective-II** : Fabrication Processes	**At the end of this course, each student should be able to:** For given product, one should be able identify the manufacturing process.
NT621OE	**Open Elective-II** : Introduction to Material Handling	**At the end of this course, each student should be able to:** **CO1:** Demonstrate ability to successfully complete Fork Lift Certification to safely and effectively operate in the manufacturing environment. **CO2:** Demonstrate proficiency in supply chain operations, utilizing appropriate methods to plan and implement processes necessary for the purchase and conveyance of goods in a timely and cost-effective manner **CO3:** It explains about the different types of material handling, advantages and disadvantages. It also suggests the selection procedure for the material handling along with its specifications. **CO4:** Need for Material handling also explained with different techniques like Automated Material handling Design Program, Computerized material handling Planning will be dealt. **CO5:** The Material handling is explained with models, selection procedure of material handling is depending on different function oriented systems. This also related with plant layout by which the minimization of the handling charges will come down. **CO6:** The ergonomics related to material handling equipment about design and miscellaneous equipments.

NT622OE	**Open Elective-II** : Non Conventional Energy Sources	**At the end of this course, each student should be able to:** **CO1:** Introduction to Renewable Energy Sources, Principles of Solar Radiation, Different Methods of Solar Energy Storage and its Applications, Concepts of Solar Ponds, Solar Distillation and Photo Voltaic Energy Conversion. Introduction to Flat Plate and Concentrating Collectors , Classification of Concentrating Collectors. **CO2:** Introduction to Wind Energy, Horizontal and Vertical Access Wind Mills, BioConversion **CO3:** Types of Bio-Gas Digesters and Utilization for Cooking Geothermal Energy Resources **CO4:** Types of Wells and Methods of Harnessing the Energy, Ocean Energy and Setting of OTEC Plants. **CO5:** Tidal and Wave Energy and Mini Hydel Power Plant,Need and Principles of Direct Energy Conversion. **CO6:** Concepts of Thermo-Electric Generators and MHD Generators.
NT623OE	**Open Elective-II** : Robotics	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.
MM621OE	**Open Elective-II** : Science and Technology of Nano Materials	**At the end of this course, each student should be able to:** The student will be able to design a component / material that would provide us a 'better tomorrow' via nanotechnology.

MM622OE	**Open Elective-II** : Metallurgy of Non Metallurgists	**At the end of this course, each student should be able to:** **CO1:** To use and apply metallurgy in his own branch of engineering. **CO2:**The student will be able to justify the various testing methods adopted for metals.
MN621OE	**Open Elective-II** : Coal Gasification, Coal Bed Methane and Shale Gas	**At the end of this course, each student should be able to:** Student can get specialized in the underground coal gasification concepts, application and future scope in various geomining conditions.
PE621OE	**Open Elective-II** : Energy Management and Conservation	**At the end of this course, each student should be able to:** Students would have a good knowledge about conventional energy sources and their audit. Ability to apply the fundamentals of energy conservation and management.
PE622OE	**Open Elective-II** : Optimization Techniques	**At the end of this course, each student should be able to:** **CO1:** Explain the need of optimization of engineering systems. **CO2:** Understand optimization of electrical and electronics engineering problems. **CO3:** Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem. **CO4:** Apply unconstrained optimization and constrained non-linear programming and dynamic programming. **CO5:** Formulate optimization problems.
PE623OE	**Open Elective-II** : Entrepreneurship and Small Business Enterprises	**At the end of this course, each student should be able to:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

Open Elective – III

(Common for EEE, ECE, CSE, IT,ME)

Code	Course Name	Course Outcomes
AE831OE	**Open Elective – III** Air Transportation Systems	**At the end of this course, each student should be able to:** **CO1:** Explain the air transport systems. **CO2:** Describe the aircraft characteristics, airlines and airport operation. **CO3:** Apply the Air Navigation System & Environmental Systems.
AE832OE	**Open Elective – III** Rockets and Missiles	**At the end of this course, each student should be able to:** **CO1:** Design a preliminary chemical rocket engine **CO2:** Compute various types of aerodynamic forces acting on the rocket and missile during the flight. **CO3:** Determine the various equations of motion used in rocket and missile technology **CO4:** Illustrate staging of rockets and its performance estimation. **CO5:** Judge the materials for rocket and missile components.
AM831OE	**Open Elective – III** Introduction to Mechatronics	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.
AM832OE	**Open Elective – III** Microprocessors and Microcontrollers	**At the end of this course, each student should be able to:** **CO1:** Understands the internal architecture and organization of 8086, 8051 and ARM processors / controllers.

		CO2: Understands the interfacing techniques to 8086 and 8051 and can develop assembly language programming to design microprocessor / micro controller based systems.
BM831OE	**Open Elective – III** Telemetry and Telecontrol	**At the end of this course, each student should be able to:** Upon completion of this course students will appreciate the application of different telemetry systems and control to any process.
BM832OE	**Open Elective – III** Electromagnetic Interference and Compatibility	**At the end of this course, each student should be able to:** **CO1:** Gain basic knowledge of problems associated with EMI and EMC from electronic circuits and systems. **CO2:** Analyze various sources of EMI and various possibilities to provide EMC. **CO3:** Understand and analyze possible EMI revention techniques such as grounding, shielding, filtering, and use of proper coupling mechanisms to improve compatibility of electronic circuits and systems in a given electromagnetic environment.
CE831OE	**Open Elective – III** Environmental Impact Assessment	**At the end of this course, each student should be able to:** **CO1:** Identify the environmental attributes to be considered for the EIA study. **CO2:** Formulate objectives of the EIA studies. **CO3:** Identify the suitable methodology and prepare Rapid EIA. **CO4:** Indentify and incorporate mitigation measures.
CE832OE	**Open Elective – III** Optimization Techniques in Engineering	**At the end of this course, each student should be able to:** **CO1:** Formulate optimization problem. **CO2:** Solve the problem by using a appropriate optimization techniques.

CE833OE	**Open Elective – III** Entrepreneurship and Small Business Enterprises	**At the end of this course, each student should be able to:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.
CN831OE	**Open Elective – III** Remote Sensing and GIS	**At the end of this course, each student should be able to:** **CO1:** Retrieve the information content of remotely sensed data. **CO2:** Analyze the energy interactions in the atmosphere and earth surface features. **CO3:** Interpret the images for preparation of thematic maps. **CO4:** Apply problem specific remote sensing data for engineering applications. **CO5:** Analyze spatial and attribute data for solving spatial problems. **CO6:** Create GIS and cartographic outputs for presentation.
CS831OE	**Open Elective – III** Linux Programming	**At the end of this course, each student should be able to:** **CO1:**Work confidently in Linux environment. **CO2:** Work with shell script to automate different tasks as Linux administration.
CS832OE	**Open Elective – III** R Programming	**At the end of this course, each student should be able to:** **CO1:** Be able to use and program in the Programming language R. **CO2:** Be able to use R to solve statistical problems. **CO3:** Be able to implement and describe Monte Carlo the technology. **CO4:** Be able to minimize and maximize functions using R.

CS833OE	**Open Elective – III** PHP Programming	**At the end of this course, each student should be able to:** **CO1:** Be able to develop a form containing several fields and be able to process the data provided on the form by a user in a PHP-based script. **CO2:** Understand basic PHP syntax for variable use and standard language constructs, such as conditionals and loops. **CO3:** Understand the syntax and use of PHP object-oriented classes. **CO4:** Understand the syntax and functions available to deal with file processing for files on the server as well as processing web URLs. **CO5:** Understand the paradigm for dealing with form-based data, both from the syntax of HTML forms, and how they are accessed inside a PHP-based script.
EC831OE	**Open Elective – III** Electronic Measuring Instruments	**At the end of this course, each student should be able to:** **CO1:** Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement. **CO2:** Measure various physical parameters by appropriately selecting the transducers. **CO3:** Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
EM831OE	**Open Elective – III** Data Analytics	**At the end of this course, each student should be able to:** **CO1:** Understand the impact of data analytics for business decisions and strategy. **CO2:** Carry out data analysis/statistical analysis **CO3:** To carry out standard data visualization and formal inference procedures. **CO4:** Design Data Architecture **CO5:** Understand various Data Sources.

EE831OE	**Open Elective – III** Entrepreneur Resource Planning	**At the end of this course, each student should be able to:** ERP System Implementation options, and functional modules of ERP. **CO1:** Introduction to ERP- Foundation for Understanding ERP systems-Business benefits of ERP-The challenges of implementing ERP system-ERP modules and Historical Development. Case: Response top RFP for ban ERP system (Mary Sumner). **CO2:** ERP system options & Selection methods-Measurement of project Inpact- information Technology Selection-ERP proposal evaluation-Project Evaluation Technique.(David L. olson). Case: Atlantic Manufacturing (Mary Sumner). **CO3:** ERP system Installation Options- IS/IT Management results-Risk Identification analysis-System Projects- Demonstration of the system-Failure method-system Architecture & ERP (David L. Olson) Case: Data Solutions & Technology Knowledge (Mary Sumner). **CO4:** ERP - sales and Marketing- Management control process in sales and marketing – ERP customer relationship management - ERP systems- Accounting & Finance control processes. Financial modules in ERP systems. Case: Atlantic manufacturing (Mary Sumner). **CO5:** ERP – Production and Material Management-Control process on production and manufacturing - Production module in ERP-supply chain Management & e-market place-e-business & ERP-e supply chain & ERP- Future directions for ERP. Case: HR in Atlantic manufacturing. (Mary Sumner).

EE832OE	**Open Elective – III** Management Information Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the usage of MIS in organizations and the constituents of the MIS. **CO2:** Understand the classifications of MIS, understanding of functional MIS and the different functionalities of these MIS. This would be followed by case study on Knowledge management. **CO3:** Assess the requirement and stage in which the organization is placed. Nolan model is expected to aid such decisions. **CO4:** Learn the functions and issues at each stage of system development. Further different ways in which systems can be developed are also learnt.
EE833OE	**Open Elective – III** Organizational Behaviour	**At the end of this course, each student should be able to:** **CO1:** Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour. **CO2:** Assess the potential effects of organizational level factors (such as structure, culture and change) on organizational behaviour. **CO3:** Critically evaluate the potential effects of important developments in the external environment (such as globalization and advances in technology) on organizational behaviour. **CO4:** Analyse organizational behavioural issues in the context of organizational behaviour theories, models and concepts.
EI831OE	**Open Elective – III** Sensors and Transducers,	**At the end of this course, each student should be able to:** Upon completion of this course the student shall be able to understand the working of basic sensors and transducers used in any industries.

EI832OE	**Open Elective – III** PC Based Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Understands measurement and analyzing techniques of digital computer power and performance . **CO2:** Understands the various types of interfacing systems and components. **CO3:** Develops the knowledge of real-time systems and case studies in instrumentation . **CO4:** Capability to analyze PC based data . **CO5:** Capable to develop instrumentation systems on various processes of industrial measurements.
ME831OE	**Open Elective – III** Total Quality Management	**At the end of this course, each student should be able to:** **CO1:** Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems. **CO2:** Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality. **CO3:** Critically appraise the organisational, communication and teamwork requirements for effective quality management . **CO4:** Critically analyse the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans.
ME832OE	**Open Elective – III** Industrial Safety, Health, and Environmental Engineering	**At the end of this course, each student should be able to:** **CO1:** To list out important legislations related to Health , Safety and Environment **CO2:** To list out requirements mentioned in factories act for the prevention of accidents. To understand the health and welfare provisions given in factories act.

		CO3: To understand the statutory requirements for an Industry on registration, license and its renewal. **CO4:** To prepare onsite and offsite emergency plan.
ME833OE	**Open Elective – III** Basics of Thermodynamics	**At the end of this course, each student should be able to:** **CO1:** Understand and differentiate between different thermodynamic systems and processes. **CO2:** Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes. **CO3:** Understand and analyze the Thermodynamic Cycles.
ME834OE	**Open Elective – III** Reliability Engineering	**At the end of this course, each student should be able to:** **CO1:** Model various systems applying reliability networks. **CO2:** Evaluate the reliability of simple and complex systems. **CO3:** Estimate the limiting state probabilities of repairable systems. **CO4:** Apply various mathematical models for evaluating reliability of irrepairable systems.
NT831OE	**Open Elective – III** Concepts of Nano Science And Technology	**At the end of this course, each student should be able to:** The intended course covers the whole spectrum of nanomaterials ranging from introduction, classification, synthesis, properties, and characterization tools of nanophase materials to application including some new developments in various aspects.
NT832OE	**Open Elective – III** Synthesis of Nanomaterials	**At the end of this course, each student should be able to:** To provide abundant knowledge on various synthesis methods of nanomaterials.

NT833OE	**Open Elective – III** Characterization of Nanomaterials	**At the end of this course, each student should be able to:** **CO1:** The student will develop a fundamental knowledge of nanomaterials. . **CO2:** The student will demonstrate an understanding of the properties of materials with strong dependence on size. **CO3:** The student will demonstrate an understanding of approaches to nanomaterials characterization.
MT831OE	**Open Elective – III** Renewable Energy Sources	**At the end of this course, each student should be able to:** **CO1:** Understanding of renewable energy sources. **CO2:** Knowledge of working principle of various energy systems. **CO3:** Capability to carry out basic design of renewable energy systems.
MT832OE	**Open Elective – III** Production Planning and Control	**At the end of this course, each student should be able to:** At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.
MT833OE	**Open Elective – III** Entrepreneurship and Small Business Enterprises	**At the end of this course, each student should be able to:** It enables students to learn the basics of Entrepreneurship and entrepreneurial development which will help them to provide vision for their own Start-up.

MM831OE	**Open Elective – III** Design and Selection of Engineering Materials	**At the end of this course, each student should be able to:** Understand the Relationship between materials selection, processing and applications.
MN831OE	**Open Elective – III** Solid Fuel Technology	**At the end of this course, each student should be able to:** Students can understand the fundamentals of Processes of formation of coal, properties and evaluation and coal preparation and washability characteristics of coal.
MN832OE	**Open Elective – III** Health & Safety in Mines	**At the end of this course, each student should be able to:** **CO1:** Gain insights of safety management system and risk management in Indian mining industries. **CO2:** Formulate safety audits and control in mining industries. **CO3:** Produce risk analysis using statistical methods and analysis of mine accidents.
PE831OE	**Open Elective – III** Disaster Management	**At the end of this course, each student should be able to:** **CO1:** Understanding Disasters, man-made Hazards and Vulnerabilities. **CO2:** Understanding disaster management mechanism. **CO3:** Understanding capacity building concepts and planning of disaster managements.
PE832OE	**Open Elective – III** Fundamentals of Liquefied Natural Gas	**At the end of this course, each student should be able to:** **CO1**: Have good knowledge on LNG process. **CO2:** Classify different liquefaction techniques. **CO3:** Understand different units in LNG processing and transportation. **CO4:** Have knowledge associated with safety aspects of LNG.

PE833OE	**Open Elective – III** Health, Safety and Environment in Petroleum Industry	**At the end of this course, each student should be able to:** **CO1:** The student can have the knowledge of various Acts related to safety, Health and environment in petroleum industry. **CO2:** The student can have the knowledge of various drilling fluids handling and safe disposal such toxic products. **CO3:** Knowledge of disaster management to fight any crisis. **CO4:** Knowledge of Hazard studies and occupational health hazards in the industry.

DEPARTMENT OF MASTER OF BUSINESS ADMINISTRATION

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Identify the key issues facing a business or business subdivisions, utilize qualitative and quantitative methods to explore and solve critical business problems (Problems solvers).

PSO-2: Incorporate diversity and multicultural perspectives while making business decisions (Decision makers).

PSO-3: The ability to employ modern System application Programs, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies(Risk takers).

MBA. I YEAR I SEMESTER _R17

Code	Course Name	Course Outcomes
17MBA01	Management & Organizational Behavior	**At the end of this course, each student should be able to:** **CO1:** Be able to understand evolution of Management and contribution of Management thinkers. **CO2:** To find out the relevance of environmental scanning, planning and how to take decisions **CO3:** Application of functions of organizing and controlling in the organization. **CO4:** To teach students the complex behavioral dynamics of individuals and groups in organizations. **CO5:** Distinguish the various theories of leadership and motivation, comparing and contrasting them, showing similarities, and differences.
17MBA02	Business Economics	**At the end of this course, each student should be able to:** **CO1:** To understand Economic Principles in Business **C02:** To Forecast Demand and Supply **CO3:** To find out Production and Cost Estimates **CO4:** To analyze Market Structure and Pricing Practices
17MBA03	Financial Accounting and Analysis	**At the end of this course, each student should be able to:** **CO1:** An ability to learn importance of accounting, accountancy and an account **CO2:** An ability to prepare journal and posting of ledger and preparing Trial balance. **CO3:** An ability to identify the value of inventory and goodwill. **CO4:** An ability to learn changes in working capital and funds from operations. **CO5:** An ability to use the techniques and skills and methods of ratio analysis to find the financial position of company.

17MBA04	Business Statistics	**At the end of this course, each student should be able to:** **CO1:** Understand how to calculate and apply measures of location and measures of dispersion-grouped and ungrouped data cases. **CO2:** How to apply discrete and continuous series in various business problems. **CO3:** Perform test of hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. **CO4:** Learn non- parametric test such as chi-square test for Independence as well as goodness of fit. **CO5:** Understand both the meaning and applicability of a dummy variable and the assumptions which underline a regression model.
17MBA05	Business Law & Ethics	**At the end of this course, each student should be able to:** **CO1:** Understand the legal contracts and the parties involved in it and related course judgments of Cases. **CO2:** An able to understand the formalities involved in incorporating companies. **CO3:** Study about the negotiable act, its instruments and Parties. **CO4:** Importance of ethics in business. **CO5:** Cyber crime and legal aspects.
17MBA06	Business Research Methodology (Elective I)	**At the end of this course, each student should be able to:** **CO1:** An ability to learn the concepts of types of research, research process, measurement of variables and ethics in research. **CO2:** An ability to understand research problem, research design and data collection methods and tools. **CO3:** An ability to understand the concepts of univariate

		and bi variate techniques for data analysis. **CO4:** Ability to utilize multivariate techniques for data analysis. **CO5:** An ability to report research work and presentation of results.
17MBA07	Business Communication Lab	**At the end of this course, each student should be able to:** **CO1:** Understand the importance of communication in business, Business messages, and case study . **CO2:** To develop writing skills and presentation. And presentation of letter writing and Memos. **CO3:** Writing business letters and proposals, general warning action and danger, format in instructions. **CO4:** Application of business communication in the self development process, corporate reports, and business proposals. **CO5:** Use effectively business vocabulary language communication, and able to learn resume formats of all types. **CO6:** Able to communicate confidently in formal and informal contexts. And able to learn online recruitment process.

MBA. I YEAR II SEMESTER _R17

Code	Course Name	Course Outcomes
17MBA08	Human Resource Management	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of human resources and their effective management in organizations. **CO2:** Learn about the process of Recruitment and Selection. **CO3:** To understand the concepts of Learning and Development of employees. **CO4:** Ascertain Performance Appraisal methods and learn compensation related concepts that include pay rates, retirement and insurance. **CO5:** Understand Grievance handling process.
17MBA09	Marketing Management	**At the end of this course, each student should be able to:** **CO1:** Understand concepts of marketing management. **CO2:** Comprehend to analyze markets and design customer driven strategies. **CO3:** Understand about to communicate the decisions towards business development with superior customer value. **CO4:** Understand Distribution Decisions, Promotion & Communication Strategies. **CO5:** Recognize Pricing Decisions & Personal Communication.
17MBA10	Financial Management	**At the end of this course, each student should be able to:** **CO1:** Understand Goals of financial function. **CO2:** Understand Investment criteria and decision process . **CO3:** Know Capital structure and Dividend Decisions. **CO4:** Understand **Working Capital Management.** **CO5:** Know Asset Liability Management.

17MBA11	Quantitative Analysis for Business Decisions	**At the end of this course, each student should be able to:** **CO1:** The Course covers origin and application of OR, Linear Programming, Decision Theory and queuing theory. **CO2:** The concept of quantitative analysis and business decisions helps the student in taking decisions for business. **CO3:** Understand statistical inference in relation to international business decision-making . **CO4:** Understand the importance and application of t-test, paired t- test and chi-square test in order to evaluate and interpret solution.
17MBA12	Entrepreneurship	**At the end of this course, each student should be able to:** **CO1:** Understand the mindset of the entrepreneurs. **CO2:** Understand entrepreneurial personality. **CO3:** Identify ventures for launching. **CO4:** Develop an idea on the legal framework of Entrepreneurship. **CO5:** Understand strategic perspectives in entrepreneurship.
17MBA13A	Total Quality Management	**At the end of this course, each student should be able to:** **CO1:** To know the Total quality approach and connect it to global competitiveness. **CO2:** To Understand the role of ethics and social responsibility in quality management. **CO3:** To Know the Principles and Practices of TQM . **CO4:** To Apply tools and techniques of Quality in achieving customer satisfaction and retention. **CO5:** To Apply continual improvement methods and Benchmarking.

17MBA14	Summer Internship	**At the end of this course, each student should be able to:** **CO1:** Understand Management functions and Organizational structure. **CO2:** Understand organizational dynamics in terms of organizational behaviour, culture, climate. **CO3:** Understand about Functional domain knowledge **CO4:** Understand Processes and systems. **CO5:** Understand External and internal environment impact on the organization.

MBA III SEMESTER _R17

Code	Course Name	Course Outcomes
17MBA15	Production & Operations Management	**At the end of this course, each student should be able to:** **CO1:** To understand the concept of operations management. **CO2:** To be able to do product, process design and analysis. **CO3:** To identify the plant location and layout. **CO4:** To be able to do scheduling. **CO5:** To manage the materials.
17MBA16	Management Information Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of MIS. **CO2:** Understand the business applications of Information Systems. **CO3:** Understand the information system planning. **CO4:** Understand the information system development and implementation. **CO5:** Understand Cyber-crime and information security.
17MBA17	Data Analytics	**At the end of this course, each student should be able to:** **CO1:** To understand the importance of increasing volume, variety and velocity of data in organization . **CO2:** To apply data analytical tools for decision making. **CO3:** To understand the Importance of Analytics and analytical tools . **CO4:** To Apply Analytical tools to solve business problems. **CO5:** To Analyze the economic and marketing environment's impact on business operations .

17MBA18M1	Digital Marketing	**At the end of this course, each student should be able to:** **CO1:** To understand the applications of digital marketing in the globalized market. **CO2:** To learn about channels of digital marketing **CO3:** Able to prepare digital marketing plan. **CO4:** Carry out search engine marketing. **CO5:** Understand the process of online advertising.
17MBA18F1	Security Analysis and Portfolio Management	**At the end of this course, each student should be able to:** **CO1:** Know Indian Investment Environment **CO2:** Understand Portfolio Analysis **CO3:** Understand Bond valuation and management **CO4:** Know Equity valuation of Cash market and derivatives **CO5:** Understand Performance evaluation of Portfolios.
17MBA18H1	Performance Management Systems	**At the end of this course, each student should be able to:** **CO1:** Understand Significance of Performance Management. **CO2:** Comprehend Communication of Performance Management. **CO3:** Understand Performance Management and Development of Employees. **CO4:** Comprehend Reward System. **CO5:** Understand other performance related concepts.
17MBA19M2	Advertising and Sales Management	**At the end of this course, each student should be able to:** **CO1:** To Know the importance of Advertising ,Sales management and difference between selling and marketing. **CO2:** An ability to learn the Sales planning and budgeting. **CO3:** To Understand sales force management and recruitment & selection of the sales force. **CO4:** An ability to learn distribution management and

		distribution channels. **CO5:** Ability to learn Lease managing channel information system and ethical issues of sales .
17MBA19F2	Financial Institutions, Markets & Services	**At the end of this course, each student should be able to:** **CO1:** Understand Introduction to Indian Financial system. **CO2:** Understand Banking and Non-Banking Institutions. **CO3:** Know about Financial and Securities markets. **CO4:** Understand Fund and Fee based services. **CO5:** Recognize Fee-based / Advisory services, Investment Banking, Credit rating.
17MBA19H2	Learning and Development	**At the end of this course, each student should be able to:** **CO1:** To Understand the importance of Learning performance . **CO2:** Learn about the process and methods of Training and Development. **CO3:** To understand the concepts of Training Need Analysis. **CO4:** To learn the Training Methods.
17MBA20M3	Consumer Behavior	**At the end of this course, each student should be able to:** **CO1:** Understand consumer behavior. **CO2:** Know environmental influences on consumer Behavior. **CO3:** Know perception and attitude of consumers. **CO4:** Understand consumer decision making. **CO5:** Know marketing ethics towards consumers.
17MBA20F3	Strategic Management Accounting	**At the end of this course, each student should be able to:** **CO1:** Understand Fundamentals of Management Accounting and Cost Accounting . **CO2:** Understand the detailed cost concepts, cost structure and elements of costs of manufacturing. **CO3:** Understand the Marginal costing.

		CO4: Understand the concepts of Budget and Budgetary controls **CO5:** Understand the elements involved in decision making, planning and control.
17MBA20H3	Management of Industrial Relations	**At the end of this course, each student should be able to:** **CO1:** To understands the industrial relations, its importance in HR and Nature and scope of Industrial Relations. **CO2:** To understand the role of Trade Unions, Settlement of disputes, Collective Bargaining, Wage Policy Managing employee relations at work for healthy work environment. **CO3:** To know the types and levels of Tripartism. **CO4:** To understand the aspects of Labor Legislation. **CO5:** To know various Labor Laws like Factories Act, Wage and Bonus Act and Dispute Preventive and Corrective Mechanisms

MBA IV SEMESTER _R17

Code	Course Name	Course Outcomes
17MBA21	Strategic Management	**At the end of this course, each student should be able to:** **CO1:** Understand Strategic management concepts b **CO2:** Comprehend Tools and Techniques for Strategic Analysis. **CO3:** Understand Strategy Implementation **CO4:** Understand Strategies for competing in globalised Markets. **CO5:** Comprehend Strategy Evaluation and Control.
17MBA22M4	Customer Relationship Management	**At the end of this course, each student should be able to:** **CO1:** Understand need of CRM **CO2:** Understand building customer relations **CO3:** Know CRM process **CO4:** Comprehend CRM structures **CO5:** Understand Planning and Implementation of CRM.
17MBA22F4	International Financial Management	**At the end of this course, each student should be able to:** **CO1:** Understand international financial management and its challenges and changes. **CO2:** Understand about the Indian monetary system. **CO3:** Understand foreign exchange market and exchange Rates. **CO4:** Understand the Asset and liability Management.
17MBA22H4	International Human Resource Management	**At the end of this course, each student should be able to:** **CO1:** To understand the growing significance of international Human Relations management in the context of Global workforce. **CO2:** To Know the Cultural aspects of IHRM **CO3:** To understand role of IHRM in Successful MNC **CO4:** To understand Global human Resource Planning **CO5:** To understand Training, development and performance management of Global employees

17MBA23M5	International Marketing	**At the end of this course, each student should be able to:** **CO1:**To understand the formulation of Global Marketing Strategies and its Implementation. **CO2:** To understand the Global Marketing Management, **CO3:** To develop skills in researching and analyzing trends in global markets and in modern marketing practice **CO4:** To know the Global Market Opportunities **CO5:** To understand Developing and Implementing Global Marketing Strategies.
17MBA23F5	Strategic Investment and Financing Decisions	**At the end of this course, each student should be able to:** **CO1:** Understand Investment Decisions in Risk and uncertainty. **CO2:** Understand Strategic investment decisions and Capital Budgeting Techniques. **CO3:** Know about Investment Appraisal Techniques. **CO4:** Understand Hiring , Leasing Financing Decisions. **CO5:** Comprehend Mergers and Acquisitions.
17MBA23H5	Leadership and Change Management	**At the end of this course, each student should be able to:** **CO1:** Understand Skills approach to Leadership, and Leadership, Role and function of a Leader. **CO2:** Learn about the application of Contingency theory and Path- Goal theory and styles of leadership **CO3:** Understand Organizational change concepts Transformational leadership and the characteristic features of Servant Leadership. **CO4:** Able to identify important Perspectives of Management of Change and Culture in various organizations. **CO5:** Understand the concept of Strategies for Managing change

17MBA24M6	Marketing of Services	**At the end of this course, each student should be able to:** **CO1:** To understand the marketing management of services based companies. **CO2:** To list out the characteristics of services. **CO3:** To understand the consumer behavior in services. **CO4:** To align the service design and standards. **CO5:** To do service delivery and managing service delivery promise.
17MBA24F6	Risk Management	**At the end of this course, each student should be able to:** **CO1:** Understand Concepts of Risk Management **CO2:** Understand Risk Management Measurement **CO3:** Understand Risk Management using Forward and Futures. **CO4:** Know Risk Management using Options **CO5:** Comprehend Risk Management using Swaps
17MBA24H6	Talent and Knowledge Management	**At the end of this course, each student should be able to:** **CO1:** Understand Talent Management concepts and process. **CO2:** Comprehend Succession and Career planning approaches. **CO3:** Understand Knowledge management aspects. **CO4:**Comprehend Knowledge Management assessments. **CO5:** Understand Knowledge Management solutions.

MASTERS IN TECHNOLOGY (M.Tech)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-I: The ability to analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO-II: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO-III: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

M. TECH. I YEAR I SEMESTER _R17

Code	Course Name	Course Outcomes
PC - 1	Advanced Algorithms	**At the end of this course, each student should be able to:** **CO1:** Analyze the complexity/performance of different algorithms. **CO2:** Determine the appropriate data structure for solving a particular set of problems. **CO3:** Categorize the different problems in various classes according to their complexity. **CO4:** Students should have an insight of recent activities in the field of the advanced data structure.
PC - 2	Computer Networking	**At the end of this course, each student should be able to:** **CO1:** Recognize the technological trends of Computer Networking. **CO2:** Discuss the key technological components of the Network. **CO3:** Evaluate the challenges in building networks and solutions to those.
PC - 3	Software Engineering	**At the end of this course, each student should be able to:** **CO1:** Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD). **CO2:** Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices. **CO3:** Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

Professional Elective- 1	Network Security And Cryptography	**At the end of this course, each student should be able to:** **CO1:** Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues. **CO2:** Ability to identify information system requirements for both of them such as client and server. **CO3:** Ability to understand the current legal issues towards information security.
Professional Elective- 1	Mobile Application Development	**At the end of this course, each student should be able to:** **CO1:** Analyze architecture of android and current trends in mobile operating systems. **CO2:** Apply suitable software tools and APIs for the development User Interface of a particular mobile application. **CO3:** Apply intents and broadcast receivers in android application. **CO4:** Develop and design apps for mobile devices using SQLiteDatabase.
Professional Elective- 1	Graph Theory	**At the end of this course, each student should be able to:** **CO1:** Able to define the basic concepts of graphs, directed graphs, and weighted graphs. **CO2:** Able to define the properties of bipartite graphs, particularly in trees. **CO3**: Is able to understand the concept of colorings and theory. **CO4:** Is able to understand Eulerian and Hamitonian Graphs. **CO5:** Is able to understand the concept of plane graph and theory.

Professional Elective- 1	Internet Of Things	**At the end of this course, each student should be able to:** **CO1:** Identify the applications of IoT **CO2:** Use Raspberry PI platform in designing IoT based applications **CO3:** Create real time applications that can be used in domestic and health care applications **CO4:** Convert things into smart things.
Professional Elective- 2	Game Theory	**At the end of this course, each student should be able to:** **CO1:** To distinguish a game situation from a pure individual's decision problem. **CO2:** To explain concepts of players, strategies, payoffs, rationality, equilibrium **CO3:** To describe sequential games using game trees, and to use the backward induction to solve such games. **CO4:** To explain concepts of asymmetric information, and to analyze simple signaling games. **CO5:** To analyze repeated games, and to explain the folk-theorem.
Professional Elective- II	Parallel And Distributed Algorithms	**At the end of this course, each student should be able to:** **CO1:** The student should be able to tell parallel from distributed world. **CO2:** Apply techniques and methods presented along the course aiming to design efficient parallel and distribuite algorithms. **CO3:** In addition, the student should be able to analyze required computational resources, in order to assess performance and correctness of algorithms.
Professional Elective- II	Software Architecture And Design Patterns	**At the end of this course, each student should be able to:** **CO1:** Analyze the requirements and generate possible architectural designs .

		CO2: Apply design patterns in designing a software.
Professional Elective- 2	Embedded Systems	**At the end of this course, each student should be able to:** **CO1:** To analyze and design embedded systems and real-time systems **CO2:** Define the unique design problems and challenges of real-time systems **CO3:** Identify the unique characteristics of real-time operating systems and evaluate the need for real-time operating system **CO4:** Explain the general structure of a real-time system and Understand and use RTOS to build an embedded real-time system **CO5:** Gain knowledge and skills necessary to design and develop embedded applications based on real-time operating systems.
	Advanced Algorithms Lab	**At the end of this course, each student should be able to:** **CO1:** Analyse a variety of algorithms with practical applications and the resource requirements of each. **CO2:** Determine the most suitable algorithm for any given task and then apply it to the problem. **CO3:** Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable. **CO4:** Work with advance algorithms

M. TECH. I YEAR II SEMESTER _R17

Code	Course Name	Course Outcomes
PC - 4	Network Programming	**At the end of this course, each student should be able to:** **CO1:** Demonstrate advanced knowledge of networking. **CO2:** Demonstrate advanced knowledge of programming for network communications. **CO3:** Make use of various solutions to perform inter-process communications.
PC - 5	Distributed Systems And Cloud Computing	**At the end of this course, each student should be able to:** **CO1:** Explain distributed system models and cloud service & deployment models. **CO2:** Analyze the need for virtualization in a cloud environment and apply it in compute, memory and storage levels . **CO3:** Explain distributed computation model on large datasets using parallel and distributed programming approaches over cloud platforms. **CO4:** Analyze the security issues on SPI infrastructure and explain the need for Homomorphic encryption. **CO5:** Explain the role of trust and energy efficiency in cloud.
PC - 6	Theory Of Computation	**At the end of this course, each student should be able to:** **CO1:** Able to understand the concept of abstract machines and their power to recognize the languages. **CO2:** Able to employ finite state machines for modeling and solving computing problems. **CO3:** Able to design context free grammars for formal languages. **CO4:** Able to distinguish between decidability and undecidability.

		CO5: Able to gain proficiency with mathematical tools and formal methods.
Professional Elective- III	Data Warehousing And Data Mining	**At the end of this course, each student should be able to:** **CO1:** Design a data mart or data warehouse for any organization . **CO2:** Develop skills to write queries using DMQL **CO3:** Extract knowledge using data mining techniques **CO4:** Adapt to new data mining tools. **CO5:** Explore recent trends in data mining such as web mining, spatial-temporal mining
Professional Elective- III	Storage Area Networks	**At the end of this course, each student should be able to:** **CO1:** Identify the solutions of data storage challenges using SAN. **CO2:** Identify the characteristics and requirements to implements SAN. **CO3:** Use of SAN Protocols 4. Implement various levels of RAID.
Professional Elective- III	Semantic Web And Social Networks	**At the end of this course, each student should be able to:** **CO1:** Demonstrate the semantic web technologies like RDF Ontology and others. **CO2:** Learn the various semantic web applications. **CO3:** Identify the architectures and challenges in building social networks. **CO4:** Analyze the performance of social networks using electronic sources.
Professional Elective- III	Cyber Security	**At the end of this course, each student should be able to:** **CO1:** Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure. **CO2:** Design, develop, test and evaluate secure software. **CO3:** Develop policies and procedures to manage

		enterprise security risks. **CO4:** Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training. **CO5:** Interpret and forensically investigate security incidents.
Professional Elective- IV	Big Data Analytics	**At the end of this course, each student should be able to:** **CO1:** Identify basic terminology of HADOOP , SPARK , IMPALA etc . **CO2:** Analyze the importance of Analytics in business perspective. **CO3:** Apply Big Data tools and Visualization tools.
Professional Elective- IV	Soft Computing	**At the end of this course, each student should be able to:** **CO1:** Apply various soft computing frame works. **CO2:** Design of various neural networks. **CO3:** Use fuzzy logic. **CO4:** Apply genetic programming. **CO5:** Discuss hybrid soft computing.
Professional Elective- IV	Software Process And Project Management	**At the end of this course, each student should be able to:** **CO1:** Identify artifacts of various stages of software development. **CO2:** Use of periodic status assessment in risk mitigation. **CO3:** Apply optimization process to design effective and efficient product.
Professional Elective- IV	Machine Learning	**At the end of this course, each student should be able to:** **CO1:** Identify the way of extracting features that can be used for a particular machine learning approach in various IOT . **CO2:** Explore unsupervised learning techniques . **CO3:** Compare and contrast pros and cons of various machine learning techniques and to get an insight

		of when to apply a particular machine learning approach. **CO4:** Analyze various machine learning approaches and paradigm mathematically. **CO5:** Investigate various learning approaches.
Laboratory II	Internet Technologies And Services Lab	**At the end of this course, each student should be able to:** **CO1:** Analyze a web page and identify its elements and attributes. **CO2:** Create web pages using XHTML and Cascading Style Sheets. **CO3:** Build dynamic web pages using JavaScript (Client side programming). **CO4:** Create XML documents and Schemas.

M. TECH POWER ELECTRONICS AND ELECTRIC DRIVES

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO I. Professional Skills An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

PSO II. Problem-Solving Skills An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO III. Successful career and Entrepreneurship An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

M. TECH. I YEAR I SEMESTER _R17_PEED

Code	Course Name	Course Outcomes
PC-I	Machine Modeling and Analysis	**At the end of this course, each student should be able to:** **CO1:** Write the voltage equation and torque equations for different machines like dc machine, induction motor and Synchronous machines. **CO2:** Model different machines using phase and Active transformations. **CO3:** Identify the different reference frames for modeling of machines.
PC-II	Modern Control Theory	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of state variable analysis **CO2:** Apply the knowledge of basic and modern control system for the real time analysis and design of control systems. **CO3:** Analyze the concept of stability of nonlinear systems and optimal control
PC-III	Power Electronic Devices and Converters	**At the end of this course, each student should be able to:** **CO1:** To choose appropriate device for a particular converter topology. **CO2:** To analyze and design various power converters and controllers
Professional Elective – I	Special Machines	**At the end of this course, each student should be able to:** **CO1:** To understand the operation of different special Machines. **CO2:** To select different special machines as part of control system components. **CO3:** To use special machines as transducers for converting physical signals into electrical signals. **CO4:**To design digital controllers for different machines.

Professional Elective – I	High Frequency Magnetic Components	**At the end of this course, each student should be able to:** **CO1:** To understand the operation of magnetic devices. **CO2:** To appreciate the skin and proximity effects in various windings. **CO3:** To analyze and design the components in power electronic converters. **CO4:** To design transformers of High frequency used in converters.
Professional Elective – I	Programmable Logic Controllers and Applications	**At the end of this course, each student should be able to:** **CO1:** Develop and explain the working of PLC with the help of a block diagram. **CO2:** Execute, debug and test the programs developed for digital and analog operations. **CO3:** Reproduce block diagram representation on industrial applications using PLC.
Professional Elective - II	Electric Traction systems	**At the end of this course, each student should be able to:** **CO1:** Understand Traction systems and its mechanics **CO2:** Identify the power supply equipment for traction Systems. **CO3:** Analyze various types of motors used in traction and differentiate AC and DC traction drives.
Professional Elective - II	Advanced Digital Signal Processing	**At the end of this course, each student should be able to:** **CO1:** Understand types of digital signals and Transforms and its application to signals and systems. **CO2:** Design IIR & FIR filters. **CO3:** Estimate power spectrum using various methods.
Professional Elective - II	Digital Control Systems	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of Digital control systems. **CO2:** Analyze and design discrete systems in state

		variable analysis. **CO3:** Relate the concepts of stability analysis and design discrete time systems.
OE-I	***Open Elective – I**	
Laboratory I	Power Converters Simulation Lab	**At the end of this course, each student should be able to:** **CO1:** Acquire knowledge about potential softwares used in electrical engineering. **CO2:** Choose and simulate any problem related to Power Electronics and allied fields using appropriate Softwares. **CO3:** Validate the obtained results and maintain the Record.

M. TECH. I YEAR II SEMESTER _R17_PEED

Code	Course Name	Course Outcomes
PC-IV	Power Electronic Applications to Renewable Energy	**At the end of this course, each student should be able to:** **CO1:** To acquire knowledge on Non-Conventional energy sources. **CO2:** To analyze various technologies and for renewable energy systems. **CO3:** To develop stand alone DG sets and micro grid systems from renewable energy sources.
PC-V	Embedded Systems for Power Electronic Applications	**At the end of this course, each student should be able to:** **CO1:** To describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems. **CO2:** To become aware of the architecture of the AVR processor and its programming aspects (Assembly Level). **CO3:** To acquire knowledge on key board interfacing, conversion from ADC and DAC. **CO4:** To equipped to design and develop control of drives using embedded system programming.
PC-VI	Power Electronic Control of Drives	**At the end of this course, each student should be able to:** **CO1:** Analyze drive characteristics and converter as well chopper fed dc drives. **CO2:** Develop induction motor for variable speed operations using scalar and vector control techniques. **CO3:** Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives. **CO4:** Develop Controllers for synchronous motor and variable reluctance motor can be developed.

Professional Elective – III	HVDC & FACTS	**At the end of this course, each student should be able to:** **CO1:** Choose proper FACTS controller for the specific application based on system requirements. **CO2:** Analyze the control circuits of Shunt Controllers, Series controllers & Combined controllers for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping. **CO3:** Compare EHV AC and HVDC system and to describe various types of DC links. **CO4:** Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems.
Professional Elective – III	Switched Mode Power Supplies (SMPS)	**At the end of this course, each student should be able to:** **CO1:** Analyze various modes of operation of Dc-Dc Converter. **CO2:** Design different controllers for converter. **CO3:** Design various components of dc-dc converter. **CO4:** Analyze dc-dc converter in view of EMI and thermal considerations.
Professional Elective – III	AI Techniques in Electrical Engineering	**At the end of this course, each student should be able to:** **CO1:** Understand feed forward neural networks, feedback neural networks and learning techniques. **CO2:** Analyze fuzziness involved in various systems and fuzzy set theory. **CO3:** Develop fuzzy logic control for applications in electrical engineering. **CO4**: Develop genetic algorithm for applications in electrical engineering.
		At the end of this course, each student should be able to: **CO1:** Understand electrical machines and its

Professional Elective - IV	Dynamics of Electrical Machines	characteristics **CO2:** Analyze the behavior of electrical machines under steady state and transient state . **CO3:** Model electrical machines under dynamic Conditions.
Professional Elective - IV	Hybrid Electric Vehicles	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts and drivetrain configurations of electric drive vehicles. **CO2:** Interpret different electric propulsion systems and energy storage devices. **CO3:** Appreciate the technology, design methodologies and control strategy of hybrid electric vehicles. **CO4:** Realize battery charger topologies for plug in hybrid electric vehicles.
Professional Elective - IV	Smart Grid Technologies	**At the end of this course, each student should be able to:** **CO1:** Understand technologies for smart grid. **CO2:** Appreciate the smart transmission as well distribution systems. **CO3:** Realize the distribution generation and smart consumption. **CO4:** Know the regulations and market models for smart grid.
OE-II	***Open Elective – II**	
Laboratory II	Power Converters and Drives Lab	**At the end of this course, each student should be able to:** **CO1:** Conduct experiments on drives for different modes of operation using different converter topologies. **CO2:** Select the suitable controller for getting the desired speed performance of drive. **CO3:** Validate the results .

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M. TECH. I YEAR I SEMESTER _R17 (Open Elective – 1)
List of Open Electives Offered by Various Departments
(CIVIL, ECE, EEE, ME, CSE)

Code	Course Name	Course Outcomes
Open Elective – 1	Computer Oriented Numerical Methods	**At the end of this course, each student should be able to:** **CO1:** Apply Numerical analysis which has enormous application in the field of Science and some fields of Engineering. **CO2:** Familiar with finite precision computation. **CO3:** Familiar with numerical solutions of nonlinear equations in a single variable. **CO4:** Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations. **CO5:** Familiar with calculation and interpretation of errors in numerical method.
Open Elective – 1	Principles Of Electronic Communications	**At the end of this course, each student should be able to:** **CO1:** Students are able to work on various types of modulations. **CO2:** Students can be able to use these communication modules in implementation. **CO3:** They will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.
Open Elective – 1	Renewable Energy Systems	**At the end of this course, each student should be able to:** **CO1:** Find different renewable energy sources to produce electrical power. **CO2:** Estimate the use of conventional energy sources to produce electrical energy. **CO3:** Role-play the fact that the conventional energy resources are depleted . **CO4**: Arrange Store energy and to avoid the environmental pollution.

Open Elective – 1	Electrical Installation & Safety	**At the end of this course, each student should be able to:** **CO1:** Acquire the knowledge of different types wires and wiring systems, I.E. rules and Electric supply act. **CO2:** Explain the importance of earthling, rating of wires & cables, procedures for residential, commercial electrification. **CO3:** Able to estimate the length of wire, cable, conduit, earth wire, and earthing and also cost of residential, commercial electrification.
Open Elective – 1	Optimization Techniques And Applications	**At the end of this course, each student should be able to:** **CO1:** Based on the type of optimization problem like single variable or multivariable. **CO2:** Make sensitivity analysis to study effect of changes in parameters of LPP on the optimal solution without reworking. **CO3:** Simulate the system to estimate specified performance measures. **CO4:** Solve integer programming problem by either geometry cutting plane algorithm or branch band method. **CO5:** Apply chance constrained algorithm and solve stochastic linear programme. **CO6:** Formulate GP model and solve it. **CO7:** Solve given optimization problem by genetic algorithm or simulated annealing or PSO.
Open Elective – 1	Fundamentals Of Cyber Security	**At the end of this course, each student should be able to:** **CO1:** Creation of expertise and work force in biomedical electronics domain to deal with design, development, analysis, testing and evaluation of the critical aspects of bio-systems and its core concepts to cater to the requirements of the industry and academia.

		CO2: Facilitate research opportunities in biomedical electronics with computational emphasis on systems aimed at developing state-of-the-art technologies with value based social responsibility. **CO3:** Developing professional competency in healthcare sector and leadership qualities with a harmonious blend of ethics leading to an integrated personality development.

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M. TECH. I YEAR II SEMESTER _R17 (Open Elective-II)
List of Open Electives Offered by Various Departments
(CIVIL, ECE, EEE, ME, CSE)

Code	Course Name	Course Outcomes
Open Elective – II	Finite Element Method	**At the end of this course, each student should be able to:** **CO1:** Realize the importance of behavior of a particle quantum mechanically. **CO2:** Learn concentration estimation of charge carriers in semi conductors. **CO3:** Learn various magnetic dielectric properties and apply them in engineering applications. **CO4:** Know the basic principles and applications of super conductors.
Open Elective – II	Optimization Techniques	**At the end of this course, each student should be able to:** **CO1:** Know basic theoretical principles in optimization. **CO2:** Formulate optimization models and obtain solutions for optimization. **CO3:** Apply methods of sensitivity analysis and analyze post processing of results.
Open Elective – II	Industrial Instrumentation	**At the end of this course, each student should be able to:** **CO1:** Select the transducers and their types, usage and operation and different characteristics of transducers. **CO2:** Calibrate the various instruments and application of various instruments to different fields. **CO3:** Implement process techniques, instrumental setups as well as controlling and monitoring of various processes in the industries.
Open Elective – II	Principles Of Computer Communications And Networks	**At the end of this course, each student should be able to:** **CO1:** Can get the knowledge of networking of computers, data transmission between computers.

		CO2: Will have the exposure about the various communication concepts. **CO3:** Will get awareness about the structure and equipment of computer network structures.
Open Elective – II	Energy From Waste	**At the end of this course, each student should be able to:** **CO1:** Understand technologies for generation of energy from solid waste. **CO2:** Compare methods of solid waste disposal. **CO3:** Identify sources of energy from bio-chemical conversion. **CO4:** Analyze methods for management of e-waste.
Open Elective – II	Distributed Generation And Microgrid	**At the end of this course, each student should be able to:** **CO1:** Find the size and optimal placement DG **CO2:** Analyze the impact of grid integration and control aspects of DGs. **CO3:** Model and analyze a micro grid taking into consideration the planning and operational issues of the DGs to be connected in the system. **CO4:** Describe the technical impacts of DGs in power systems.
Open Elective – II	Reliability Engineering	**At the end of this course, each student should be able to:** **CO1:** Apply fundamental knowledge of Reliability to modeling and analysis of series parallel and Non-series parallel systems. **CO2**: Solve some practical problems related with Generation, Transmission and Utilization Electrical Energy. **CO3:** Understand or become aware of various failures, causes of failures and remedies for failures in practical systems.

Open Elective – II	Engineering Research Methodology	**At the end of this course, each student should be able to:** **CO1:** Summarize and on an overview level discuss important issues and trends within the actual research area. **CO2**: Write a scientific article within a limited topic but with a quality such that the article could be accepted for presentation on an engineering research workshop. **CO3:** Review and give constructive criticism and feedback on a scientific article written by a fellow student. **CO4:** Create a scientifically sound and from an engineering point of view reasonable and well documented plan for a Master thesis project of excellent quality.
Open Elective – II	Machine Learning	**At the end of this course, each student should be able to:** **CO1:** Understand the concepts of computational intelligence like machine learning. **CO2:** Ability to get the skill to apply machine learning techniques to address the real time problems in different areas. **CO3:** Understand the Neural Networks and its usage in machine learning application.