CMR UNIVERSITY
Private University Established in Karnataka State by Act No. 45 of 2013

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Information Technology

COs

2018 Batch

Course Outcomes

Course Code	Course	Course Outcomes(CO) Code	Course Outcomes
1st Semester			
4BMA101	Engineering Mathematics – I	C101.1	List nth order derivatives of different functions. (L1)
		C101.2	Demonstrate the use of partial derivatives. (L2)
		C101.3	Explain the concept of vector differentiation. (L2)
		C101.4	Classify the 1st order differential equation. (L2)
		C101.5	Apply the knowledge of matrices techniques. (L3)
4BCH102/ 20	ENGINEERING CHEMISTRY	C102.1	Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)
		C102.2	Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)
		C102.3	Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)
		C102.4	Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)
		C102.5	Understand the synthesis of nanomaterials by determining appropriate solution method. (L2)
4BME103/ 203	COMPUTER AIDED ENGINEERING DRAWING AND RAPID PROTOTYPING	C103.1	Draw orthographic projections (TV, FV and SV) of points, straight lines, surfaces using instruments and CAD software (L1)
		C103.2	technique. (L3)
		C103.3	surfaces of solid geometry (L3)
		C103.4	Using isometric projections of combination of solids build model (L3)
		C103.5	Create models using rapid prototyping and laser cutting (L6)
		C104.1	Associate basic engineering principles with operations of electronic components, equipment and circuits at an elementary level. (L2)

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4BEC104/ 204	MAKING WITH ELECTRONICS	C104.2	Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)
		C104.3	Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)
		C104.4	Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)
		C104.5	Develop a Project with knowledge of module from Electronics. (L4)
4BHS105/ 205	ENVIRONMENT AND SUSTAINABILITY	C105.1	Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)
		C105.2	Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)
		C105.3	Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)
		C105.4	Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment. (L2)
4BHS106	PROFESSIONAL COMMUNICATION – I	C106.1	Identify and predict accurately use of grammar, punctuation and vocabulary in different types of communication. (L2)
		C106.2	Apply basic skills of paraphrasing and rewriting by taking and making effective notes. (L3)
		C106.3	Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)
		C106.4	Write compelling emails using appropriate writing etiquette and rules of grammar. (L3)
		C106.5	Write compelling formal and informal letters. (L3)
4BHS001	INDUCTION PROGRAM	C107.1	The groups which are formed should function as mentor – Mentee network.
		C107.2	A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc.
		C107.3	For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.
		C107.4	Such a group should remain for the entire 4 – 5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/ discipline.
2nd Semster			
4BMA201	ENGINEERING MATHEMATICS – II	C201.1	Understand discrete and continuous probability distributions to resolve various engineering problems. [L2]
		C201.2	Apply the method of least squares to estimate the parameters of a regression model. [L3]
		C201.3	Implement Test of Hypothesis for a population parameter for small sample and large sample cases. [L3]
		C201.4	Recognizing Complex Number System, Elementary complex functions and analytic functions. [L1]
		C201.5	Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. [L2]
		C202.1	Explain matter waves, Schrodinger's time independent wave equation and various features of wave function. [L1]
		C202.2	Describe applications of Schrodinger time independent wave equation using elementary problems such as infinite potential well, finite potential and potential barrier. [L2]

4BPH122/ 222	ENGINEERING PHYSICS FOR CSE and IT	C202.3	Explain drift and diffusion of charge carriers in semiconductor physics. [L2]
		C202.4	Describe I-V characteristics of PN junction diode and BJT. [L1]
		C202.5	Explain the features of superconductivity and its applications. [L2]
		C202.6	Describe the role of various measuring tools for performing experiments. [L1]
		C202.7	Explain the experimental setup, observed measurements and corresponding results using appropriate physical quantities and theoretical formulae. [L1]
	BASIC	C203.1	Analyze electrical circuits by relevant Laws in DC circuits. (L2)
		C203.2	Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)
		C203.3	Select suitable transformer for a given application by considering its design parameters. (L1)
		C203.4	Describe the working principle of DC Machine, generators and motors (L2)

4BEE103/ 203	ELECTRICAL ENGINEERING	C203.5	Illustrate the concept of rotating magnetic field and applications (L1)
4BME104/ 204	ENGINEERING WORKSHOP PRACTICE	C204.1	Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks (L3)
		C204.2	Creating new models with the help of scrap materials. (L6)
		C204.3	Demonstrate sheet metal model using development techniques, adhesives and fasteners. (L3)
		C204.4	Demonstrate welding technology for model making. (L3)
4BCS105/ 205	PROGRAMMI NG FOR PROBLEM SOLVING	C205.1	Explain the basic constructs of C language. (L2)
		C205.2	Execute, compile and debug programs in C language. (L5)
		C205.3	Implement programs involving user-defined data types, decision structures, loops, functions, pointers, structures and union , enumeration, file handling and pre-processor directives in C. (L3)
		C205.4	Given a computational problem, identify and abstract the programming task involved. (L3)
		C205.5	Develop an application using C programming to solve real-life problem. (L6)
4BHS206	PROFESSIONA L COMMUNICA TION – II	C206.1	Enhance reading comprehension, writing, listening and speaking skills needed to effective communication (L3)
		C206.2	Present effectively through various modes of presentation (L3)
		C206.3	Apply skills of socializing and networking in day to day professional communication. (L3)
		C206.4	Express ideas opinions and to participate in group discussion. (L2)
		C206.5	Understand the cultural sensitivity in communication and use it effectively. (L2)
4BHS107/ 207	MODERN HISTORY OF ENGINEERING	C207.1	Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other (L5)
		C207.2	Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)
		C207.3	Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)
3rd Semester			
4BCS301	DISCRETE MATHEMATI CAL STRUCTURES	C301.1	Apply the propositional and predicate logic in symbolic representations and validity tests. (L3)
		C301.2	Interpret the relations and functions in constructing the applications of Information Science. (L2)
		C301.3	Demonstrate the knowledge of recurrence relation by solving relevant mathematical problems. (L2)
		C301.4	Demonstrate the properties of integers by using Mathematical induction. (L2)
		C301.5	Analyze the message coding, message transmission error detection and correction using group theory. (L3)
4BCS302	ANALOG AND DIGITAL ELECTRONIC S	C302.1	Demonstrate the working principles of BJT and FET. (L2)
		C302.2	Construct and realize Logic gates using transistors. (L3)
		C302.3	Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. (L2)
		C302.4	Design sequential Logic circuits and verify them by implementing them in hardware. (L2).
		C302.5	Demonstrate the knowledge on VHDL by realizing combinational and sequential circuits and also develop Finite state machine. (L2)

4BCS303	DATA STRUCTURES USING C	C303.1	Explain different concepts C programming. (L2)
		C303.2	Apply the programming concepts in C for problem solving. (L3)
		C303.3	Explain the concepts of various data structures. (L2)
		C303.4	Illustrate the applications of data structures. (L2)
		C303.5	Develop a solutions to problem using appropriate data structure. (L3)
4BCS304	COMPUTER ORGANIZATI ON AND ARCHITECTU RE	C304.1	Illustrate the various functional units of digital computers (L2)
		C304.2	Illustrate different concepts of CPU (L2)
		C304.3	Outline instruction execution using pipeline (L2)
		C304.4	Apply various hardware software concepts on instructions to exploit ILP (L3)
		C304.5	Explain Cache optimization techniques to improve system performance (L2)
4BCS305	WEB DESIGNING	C305.1	Build web pages using HTML, CSS and Tables. (L3)
		C305.2	Explain the various concepts of XML and build web pages using XML. (L2)
		C305.3	Validate Web pages using JavaScript concepts. (L3)
		C305.4	Evaluate simple open source programs by appropriately editing and debugging the code to build web pages using XML or CSS or Django. (L5)
		C305.5	Choose a best possible way to build a website by any programming language and web design concepts with listening to various opinions of diverse team and interviewing experts. (L3)
4BHS306	PROFESSIONA L COMMUNICA TION – III	C306.1	Present effectively with an understanding of various aspects of presentation. (L3)
		C306.2	Develop persuasive proposals by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.3	Develop effective reports by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.4	Construct references by using a referencing style that is appropriate to the type of academic writing. (L6)
		C306.5	Construct graphical representation of information by accurately interpreting and visualizing the given data. (L4)
4BHS307	PREPARE PROGRAM – I	C307.1	Apply number theory and speed calculation methods for the quick computation and manipulation of numbers. (L3)
		C307.2	Apply the theory of linear and quadratic equations using methods (indeterminate systems, equation comparisons etc) of equation formation to solve problems in several domains (e.g age problems). (L3)
		C307.3	Analyze distributive and arrangements puzzles to conclude logical solutions that adhere to the given parameters. (L4)
		C307.4	Demonstrate use of integral elements of public communication during a professional presentation. (L3)
		C307.5	Apply Basic English grammar rules (parts of speech, components and types of sentences) to identify errors in texts and construct correct sentences. (L3)
		C308.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C308.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C308.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas (L3)

4BHS308	DESIGN THINKING – I	C308.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4th semester			
4BCS401	ENGINEERING MATHEMATICS for CS and IT	C401.1	Explain the basic concepts of graph theory. [L2]
		C401.2	Solve problems involving vertex and edge colouring [L3]
		C401.3	Solve linear recurrence relations by recognizing homogeneity, linearity and constant coefficients. [L3]
		C401.4	Interpret and solve engineering problems using differential equation. [L2]
		C401.5	Solve linear and non-linear system of equations through numerical techniques. [L3]
4BCS402	DESIGN AND ANALYSIS OF ALGORITHM	C402.1	Identify various algorithm design techniques and strategies. (L1)
		C402.2	Represent various asymptotic performance of algorithm. (L2)
		C402.3	Illustrate the computational complexity of different algorithms. (L5)
		C402.4	Analyse and find the best algorithm for real time problem solving. (L4)
		C402.5	Construct best algorithm for real time problem solving. (L3)
4BCS403	SOFTWARE ENGINEERING	C403.1	Identify the various aspects of Software Product Engineering (L1)
		C403.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C403.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C403.4	Explain the basics of software testing (L2)
		C403.5	Explain the various software cost estimation models (L2)
4BCS404	OBJECT ORIENTED PROGRAMMING USING JAVA	C404.1	Explain the Object Oriented Programming paradigm concepts. [L2]
		C404.2	Apply object oriented programming concepts for problem solving. [L3]
		C404.3	Explain the programming constructs in Java. [L2]
		C404.4	Explain the various packages, classes, interfaces in Java. [L2]
		C404.5	Develop applications in Java. [L3]
4BCS405	OPERATING SYSTEMS	C405.1	Explain different concepts for OS.(L2)
		C405.2	Demonstrate the concepts of process synchronization and deadlocks.(L2)
		C405.3	Illustrate memory management, secondary storage and Input /Output management concepts (L2)
		C405.4	Apply different operating system concepts for solving different scenarios. (L3)
		C405.5	Explain various protection and security issues in OS. (L2)
4BHS406	PROFESSIONAL COMMUNICATION – IV	C406.1	Plan, prepare and create business profile, portfolios, brochures, newsletters, banners and Posters. (L6)
		C406.2	Apply the different aspects technical written communication in writing. (L3)
		C406.3	Compose different types of business Correspondence. (L6)
		C406.4	Compose documents related to professional correspondence. (L6)
		C406.5	Demonstrate different effective strategies of presentation keeping in mind the importance of effective Listening. (L3)

4BHS407	PREPARE PROGRAM – II	C407.1	Apply the concepts of ratio, proportions, percentages and averages to calculate class/set relationships (compound interest, weighted average etc) and complete component analysis (mixtures, distribution of profits in partnership etc). (L3)
		C407.2	Integrate concepts of logical connectives to breakdown linguistic components and solve puzzles that use logical connectors. (L4)
		C407.3	Analyse data through the methods of selection and comparisons to prepare logical solutions to puzzles based on given parameters. (L3)
		C407.4	Recognize the meaning of words using the root-prefix-suffix structure and apply their extensive vocabulary in verbal and written contexts. (L1, L3)
		C407.5	Utilize techniques of public debate within a team by taking on different roles and articulating complex ideas in a persuasive manner. (L4)
4BHS408	DESIGN THINKING – II	C408.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C408.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C408.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas(L3)
		C408.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4BCS481	PROGRAMMIN G WITH C	C409.1	Explain the basic principles of programming in C. (L2)
		C409.2	Apply C programming concepts for problem solving. (L3)
		C409.3	Develop and implement programs using looping concepts in C. (L3)
		C409.4	Analyze the concepts of User defined data types in C. (L4)
		C409.5	Explain the concepts of file management technique in C. (L2)
4BCS482	COMPUTER SYSTEMS FOR ENGINEERS	C410.1	Explain the fundamental programming concepts. (L2)
		C410.2	Identify the various programming constructs to solve problems. (L3)
		C410.3	Explain the concepts of data visualization. (L2)
		C410.4	Explain System Development process. (L2)
		C410.5	Explain the various applications of systems and information technology in different domains. (L2)
4BCS483	SOFTWARE ENGINEERING	C411.1	Identify the various aspects of Software Product Engineering (L1)
		C411.2	Understand common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches (L2)
		C411.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery) (L3)
		C411.4	Understand the basics of software testing (L2)
		C411.5	Explain the various software cost estimation models (L2)
5th Semester			
		C501.1	Demonstrate the concepts related to entrepreneurship issues in business ideas. (L3)
		C501.2	Independently analyse the factors influencing the practice of management in different contexts. (L3)

4BHS5A1/ 6A1	BUSINESS MANAGEMEN T FOR ENGINEERS	C501.3	Develop suitable economic strategy regarding common business problems. (L3)
		C501.4	Analyse the marketing strategy for common engineering business problems. (L4)
		C501.5	Illustrate the leadership qualities in the operation of a new venture. (L4)
4BCS502	ARTIFICIAL INTELLIGENC E	C502.1	Elucidate the basic concepts of Artificial Intelligence. (L2)
		C502.2	Analyse Artificial Intelligence techniques, such as search algorithms, for problem solving. (L4)
		C502.3	Apply techniques of Knowledge Representation and Planning. (L3)
		C502.4	Apply knowledge of reasoning in the presence of incomplete or uncertain information. (L3)
		C502.5	Explain different forms of Learning. (L2)
4BCS503	DATABASE MANAGEMEN T SYSTEMS	C503.1	Explain the fundamental concepts of a database management system. (L2)
		C503.2	Develop the logical design of the database using data modelling concepts. (L3)
		C503.3	Explain SQL programming constructs and relational model concepts. (L2)
		C503.4	Explain the concepts of transaction processing, concurrency control and recovery. (L2)
		C503.5	Make use of SQL to solve wide range of Database problems. (L3)
4BCS504	COMPUTER NETWORKS	C504.1	Outline basic concepts in data communications, OSI and TCP/IP Protocol Stack. (L2)
		C504.2	Understand the transfer of data from source to the destination using different protocols and addressing. (L2)
		C504.3	Summarize the functions of Application layer protocols and how to meet the QoS requirements in networking. (L2)
		C504.4	Identify the limits and importance of compression, encoding, sampling, quantization methods. (L3)
		C504.5	Demonstrate how the communication is achieved securely without using any kind of connection. (L2)
4BCS505	FORMAL LANGUAGE AND AUTOMATA THEORY	C505.1	Explain the concepts in automata theory and formal languages and also apply finite state machines for modeling and solving computing problems. (L3)
		C505.2	Explain and implement the concepts of regular languages and context-free languages for solving problems. (L3)
		C505.3	Construct context free grammars, Push down Automata and explain the mechanism in it. (L3)
		C505.4	Describe the Properties of Context-Free Languages and explain the concepts in Turing Machine. (L2)
		C505.5	Explain decidability and intractability of computational problems. (L2)
4BHS506	PROFESSIONA L COMMUNICA TION – V	C506.1	Compose Abstract and Literature Review as parts of academic writing (L5)
		C506.2	Prepare agenda, Minutes and Memos in specific business set up (L5)
		C506.3	Apply skills of argumentation using various techniques of arguments and deliberation. (L3)
		C506.4	Exhibit basics of interview etiquette in a given professional set up (L3).
		C506.5	Plan and prepare presentation using media and advertisements (L5)

4BME507	PREPARE PROGRAM – III	C507.1	Students will use the concepts of work-time-efficiency and distance- time-speed to solve problems related to the measurement of effort or performance. (L3)
		C507.2	Students will analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)
		C507.3	Students will illustrate their conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)
		C507.4	Students will apply the concepts of input-output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc) from given data to solve problems.(L3)
		C507.5	Students will utilize verbal reasoning logic to solve tasks based on verbal data (para-completion, para- jumbles etc). (L4)
		C507.6	Students will demonstrate their reading and comprehension abilities by understanding a variety of writing styles and differentiating between close interpretations of text. (L3)
4BCS508	MINI PROJECT – I	C508.1	Conduct a survey of several available literature in the preferred field of study. (L5)
		C508.2	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C508.3	Analyze the problem requirements and arrive at workable design solutions. (L4)
		C508.4	Compare and contrast the several existing solutions for the attempted problem. (L5)
		C508.5	Summarize the report and present the findings of the study conducted in the preferred domain. (L2)
4BCS511	DATA MINING	C509.1	Explain the concepts of Data mining and its issues. (L1)
		C509.2	Analyze and apply association rule mining techniques. (L3)
		C509.3	Analyze various classification algorithms. (L2)
		C509.4	Elaborate the clustering algorithms. (L3)
		C509.5	Explain various density based methods. (L1)
4BCS512	CLOUD COMPUTING	C510.1	Explain main concepts, key technologies, strengths and limitations of cloud computing. (L2)
		C510.2	Explain the cloud enabling technologies that help in the development of cloud. (L2)
		C510.3	Develop the ability to use the architecture of compute and storage cloud, service and delivery models. (L3)
		C510.4	Explain core issues of cloud computing such as resource management and security. (L2)
		C510.5	Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud. (L3)
4BCS513	DATA VISUALIZATION	C511.1	Explain the basic concepts of Data Visualization. (L2)
		C511.2	Analyze the basic visualization tools to understand the data. (L4)
		C511.3	Apply specialized visualization tools to make effective decisions. (L3)
		C511.4	Illustrate the advanced visualization tools. (L2)
		C511.5	Analyze geospatial data using visualization tools. (L4)
6th Semester			
4BHS6A1/ 5A1	OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT	C601.1	Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies. (L1)
		C601.2	Analyse the critical issues in social development in the given context. (L2)
		C601.3	Develop technological interventions for social and community development. (L3)
		C602.1	Identify fundamental notions of system security, threats, vulnerabilities, attacks and countermeasures. (L3)

4BCS602	INFORMATIO N AND NETWORK SECURITY	C602.2	Explain the various concepts of information network security. (L2)
		C602.3	Illustrate key distribution, key management issues and different cryptographic standards and certificates. (L2)
		C602.4	Explain the concepts of authentication, cyber law, web security and cyber ethics. (L2)
		C602.5	Develop various network algorithms and simulate wired/wireless networks to evaluate different network parameters. (L3)
4BCS603	MOBILE COMPUTING	C603.1	Explain the fundamental concepts of mobile application development. [L2]
		C603.2	Design responsive user interfaces that work across a wide range of devices. [L6]
		C603.3	Demonstrate the knowledge of data persistence in mobile applications. [L2]
		C603.4	Outline networking and web services concepts in mobile applications. [L2]
		C603.5	Apply the steps involved in publishing mobile application to share with the world. [L3]
4BCS604	COMPILER DESIGN	C604.1	Explain the concepts in different phases of compilation with compile time error handling. (L2)
		C604.2	Compare and explain top down and bottom up parsers, and develop appropriate parser to produce parse treerepresentation of the input. (L3)
		C604.3	Illustrate syntax-directed translation schemes for a given context free grammar and explain the various concepts in run-time environments. (L2)
		C604.4	Explain the various concepts in intermediate code generation and interpret for statements in high level language. (L2)
		C604.5	Apply optimization techniques to intermediate code and construct machine code for high level language program. (L3)
4BCS605	SOFTWARE ENGINEERING	C605.1	Identify the various aspects of Software Product Engineering. (L1)
		C605.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C605.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C605.4	Explain the basics of software testing. (L2)
		C605.5	Explain the various software cost estimation models. (L2)
4BHS606	PROFESSIONA L COMMUNICA TION – VI	C606.1	Demonstrate the advanced skills of presentation. (L3)
		C606.2	Compose Technical Documents following proper format and style (L6)
		C606.3	Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case. (L4)
		C606.4	Apply the registers of technical English in oral and written mode of communication.(L3)
		C606.5	Collaborate and express themselves in an Interview round. (L6)
		C607.1	Students will infer the concepts of permutation, combination, and probability from a given set to solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc). (L4)

		C607.2	Students will apply concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters. (L3)
		C607.3	Students will use indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc). (L3)
		C607.4	Students will examine four types of logical statements to solve puzzles based on syllogisms. (L4)
		C607.5	Students will apply the concepts of venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc . (L3)
4BME607	PREPARE PROGRAM – IV	C607.6	Students will be able to combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks(e.g. para-completion etc) and articulate their ideas. (L4)
		C608.1	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C608.2	Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions (L4)
		C608.3	Conduct a survey of several available literature in the preferred field of study and Compare the several existing solutions for the attempted problem. (L5)
		C608.4	Propose innovative solution for the development of components, processes or technologies in CS/IT field. (L6)
4BCS608	MINI PROJECT – II	C608.5	To report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities. (L3)
		C609.1	Elaborate the fundamental concepts of No-SQL databases. (L2)
		C609.2	Analyze the features and use cases of key-value databases. (L3)
		C609.3	Explain the features and challenges pertaining to document databases. (L2)
		C609.4	Illustrate the characteristics of column oriented No-SQL databases. (L4)
4BCS621	No-SQL DATABASES	C609.5	Describe the design and use cases of graph databases. (L3)
		C610.1	Explain basic concepts for Storage systems (L2)
		C610.2	Apply the concepts of storage networking technologies. (L3)
		C610.3	Explain the concepts in Backup, Archive and Replication. (L2)
		C610.4	Analyse the concepts of cloud computing and virtualization. (L4)
4BCS622	STORAGE AREA NETWORKS	C610.5	Explain various concepts in managing and securing storage infrastructure (L2)
		C611.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C611.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C611.3	Design IIR and FIR filters. (L3)
		C611.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)
4BCS623	DIGITAL SIGNAL PROCESSING	C611.5	Explain the DSP processors and getting the concept of Image processing. (L2)
		7th Semester	
		C701.1	Explain basic concepts of Machine Learning. (L2)
		C701.2	Analyse Data to perform Exploratory Data Analysis. (L4)
		C701.3	Implement Supervised Machine Learning algorithms to solve problems. (L6)
		C701.4	Implement Un-Supervised Machine Learning algorithm to analyse data. (L6)
	MACHINE		

4BCS701	LEARNING	C701.5	Evaluate models to perform Model Selection. (L5)
4BCS702	PYTHON PROGRAMMING	C702.1	Explain the syntax and semantics of Python Programming language. (L2)
		C702.2	Demonstrate proficiency in handling Strings and File systems. (L2)
		C702.3	Apply python packages in solving real-time problems. (L3)
		C702.4	Build Web Services and introduction to Network and Database Programming in Python. (L3)
		C702.5	Interpret Data Visualization concepts in Python. (L2)
4BCS703	INTERNSHIP	C703.1	Demonstrate the skills in professional career goals. (L2)
		C703.2	Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities. (L3)
		C703.3	Develop professional connections with leadership strategy and skill development. (L4)
		C703.4	Identify the professions to suit the interest as a result of this experience. (L3)
		C703.5	Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework. (L4)
4BHS704	PREPARE PROGRAM – V	C704.1	Students will be able to apply number theory concepts and formulas to solve problems of base system, remainder theorem etc. (L3)
		C704.2	Students will be able to categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators.
		C704.3	Students will be able to solve types of pattern recognition problems (fillers, calendar etc) by utilizing different functions that fit the given criteria. (L3)
		C704.4	Students will be able to analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations. (L4)
		C704.5	Students will be able to make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation & combination. (L3)
		C704.6	Students will be able to apply written and verbal communication techniques by articulating themselves in the format of discussion, debate, interview, essay, letter etc. (L3)
4BCS705	CAPSTONE PROJECT – DESIGN	C705.1	Demonstrate engineering knowledge and its framework for its implementation in the project design as well work in groups taking leadership role and communicate effectively (L2)
		C705.2	Survey relevant literature in the chosen field of study that allows interrelation of design and research (L4)
		C705.3	Model a prototype/ concept design that exhibits the feasibility of the solution from cost, engineering and environmental aspects. (L3)
		C705.4	Justify the project design with a structured report that covers all the work carried out between framing the problem statement to the project design. (L5)
		C705.5	Design conceptual ideas that address the issues with respect to real world problems. (L6)
		C706.1	Describe the basics of the ethical hacking. (L2)
		C706.2	Describe the foot printing and scanning. (L2)
		C706.3	Demonstrate the techniques and countermeasures for system hacking. (L3)

		C706.4	Characterize the malware and their attacks. (L2)
4BCS731	ETHICAL HACKING	C706.5	Analyze and prevent the security attacks in different environments. (L4)
		C707.1	Characterize real-time systems and describe their functions. (L2)
		C707.2	Analyze various Clock-Driven Scheduling approaches. (L3)
		C707.3	Apply formal methods to analyze and design a priority-driven scheduling of periodic tasks. (L4)
		C707.4	Compare the methods for scheduling aperiodic and sporadic jobs in priority-driven systems. (L3)
4BCS732	REAL TIME SYSTEMS	C707.5	Analyze various resources and resource access control approaches. (L3)
		C708.1	Describe the framework of quantum computation
		C708.2	Explain the differences between classical computation and quantum computation
		C708.3	Explain the concept of quantum entanglement and quantum teleportation
		C708.4	Implement single cubic gates
4BCS733	QUANTUM COMPUTING	C708.5	Explain how quantum computation may be applied in future technologies
		C709.1	Remember the basic concepts of optimization. (L1)
		C709.2	Recognize methods of optimization techniques. (L2)
		C709.3	Formulate and solve linear programming problems. (L2)
		C709.4	Obtain solutions to constrained and unconstrained Non-linear programming problems. (L2)
4BCS741	OPTIMIZATIO N TECHNIQUES	C709.5	Determine the integer solutions to Linear Programming Problems. (L2)
		C710.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C710.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C710.3	Design IIR and FIR filters. (L3)
		C710.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)
4BCS742	DIGITAL SIGNAL PROCESSING	C710.5	Explain the DSP processors and getting the concept of Image processing. (L2)
		C711.1	Classify an Embedded systems based on its attributes and illustrate various steps in design process.
		C711.2	Distinguish various I/O ports, communication protocols and Timers used in an Embedded system.
		C711.3	Classify and explain various peripherals of an Embedded Systems.
		C711.4	Demonstrate characteristics and attributes of an embedded system, hardware /software co- design and firmware design approaches. (L2)
4BCS743	EMBEDDED SYSTEMS	C711.5	Explain the need of real time operating system for embedded system applications. (L2)
		8th Semester	
		C801.1	Describe the Moral Values and Ethics. (L1)
		C801.2	Explain the Engineering Ethics. (L1)
		C801.3	Discuss the Responsibility as Engineers. (L2)
		C801.4	Examine the Safety and Risk. (L2)
4BHS801	PROFESSIONA L ETHICS FOR ENGINEERS	C801.5	Predict the working Ethics for Engineers. (L2)
		C802.1	Apply software testing knowledge and engineering methods. (L3)

		C802.2	Identify various software testing problems, and solve the problems. (L2)
4BCS802	SOFTWARE TESTING	C802.3	Design and conduct various levels of software testing for a software project. (L4)
		C802.4	Apply various communication methods and ethical skills in practice-oriented software testing projects. (L3)
		C802.5	Analyze the needs of software test automation and develop a test tool to support test automation. (L2)
4BCS803	DEEP LEARNING	C803.1	Apply concepts of RNN and LSTM. (L3)
		C803.2	Demonstrate concepts of Self-organizing maps in real-world applications. (L3)
		C803.3	Illustrate Problems through pre trained model such as auto-encoders. (L3)
		C803.4	Interpret about Boltzmann machines and its applications. (L3)
		C803.5	Apply the concept of GANs and know its applications. (L4)
4BCS804	INTERNET OF THINGS	C804.1	Explain the concept of IoT. (L2)
		C804.2	Analyze various protocols for IoT. (L2)
		C804.3	Design a PoC of an IoT system using Rasperry Pi/Arduino. (L4)
		C804.4	Apply data analytics and use cloud offerings related to IoT. (L3)
		C804.5	Analyze applications of IoT in real time scenario. (L2)
4BCS805	CAPSTONE PROJECT – BUILD	C805.1	Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. (L4)
		C805.2	Utilize proper project management techniques and planning methods to produce cost effective projects (L3)
		C805.3	Recommend the need to implement the project with supporting justification and possible areas to improve it and Compile a clear report containing the step by step process of building the project that includes all calculations, analysis and fabrication methods involved. (L5)
		C805.4	Build the real world implementation of the design that will realize the objectives of the prototype/ design. (L6)
		C805.5	Demonstrate working in groups taking leadership role and communicating effectively. (L2)
4BCS851	COMPUTER VISION	C806.1	Identify fundamental image processing techniques required for computer vision. (L1)
		C806.2	Represent chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections, 3D vision techniques. (L2)
		C806.3	Illustrate boundary tracking techniques. (L5)
		C806.4	Analyze and Implement motion related techniques. (L4)
		C806.5	Construct applications using computer vision techniques. (L3)
4BCS852	NATURAL LANGUAGE PROCESSING	C807.1	Analyze the natural language text. (L4)
		C807.2	Create the natural language. (L6)
		C807.3	Analyze Text mining. (L4)
		C807.4	Evaluation of Self Explanation (L2)
		C807.5	Apply information retrieval techniques. (L3)
4BCS853	DATA MINING	C808.1	Explain the concepts of Data mining and its issues. (L1)
		C808.2	Analyze and apply association rule mining techniques. (L3)
		C808.3	Analyze various classification algorithms. (L2)
		C808.4	Elaborate the clustering algorithms. (L3)
		C808.5	Explain various density based methods. (L1)
	DIGITAL	C809.1	Explain the fundamentals of Digital forensics. (L2)
		C809.2	Illustrate computer forensic techniques to identify the digital forensics associated with criminal activities. (L2)
		C809.3	Apply forensic analysis tools to recover important evidence for identifying computer crime. (L3)
		C809.4	Explain Computer Crime and Criminals and Liturgical Procedures. (L2)

4BCS854	FORENSICS	C809.5	Analyze laws and ethics involved in cybercrime. (L4)
4BCS8555	DISTRIBUTED COMPUTING	C810.1	Explain the models of distributed computing. (L2)
		C810.2	Analyze distributed shared memory models. (L4)
		C810.3	Design and Implement distributed file systems. (L6)
		C810.4	Build the distributed algorithms for handling deadlocks. (L3)
		C810.5	Importance of the inherent difficulties that arise due to distributedness of computing resources. (L5)

CMR UNIVERSITY
Private University Established in Karnataka State by Act No. 45 of 2013

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Information Technology

COs

2019 Batch

Course Outcomes

Course Code	Course	Course Outcomes(CO) Code	Course Outcomes
1st Semester			
4BMA101	Engineering Mathematics – I	C101.1	List nth order derivatives of different functions. (L1)
		C101.2	Demonstrate the use of partial derivatives. (L2)
		C101.3	Explain the concept of vector differentiation. (L2)
		C101.4	Classify the 1st order differential equation. (L2)
		C101.5	Apply the knowledge of matrices techniques. (L3)
4BCH102/ 20	ENGINEERING CHEMISTRY	C102.1	Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)
		C102.2	Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)
		C102.3	Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)
		C102.4	Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)
		C102.5	Understand the synthesis of nanomaterials by determining appropriate solution method. (L2)
4BME103/ 203	COMPUTER AIDED ENGINEERING DRAWING AND RAPID PROTOTYPING	C103.1	Draw orthographic projections (TV, FV and SV) of points, straight lines, surfaces using instruments and CAD software (L1)
		C103.2	technique. (L3)
		C103.3	surfaces of solid geometry (L3)
		C103.4	Using isometric projections of combination of solids build model (L3)
		C103.5	Create models using rapid prototyping and laser cutting (L6)

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4BEC104/ 204	MAKING WITH ELECTRONICS	C104.1	Associate basic engineering principles with operations of electronic components, equipment and circuits at an elementary level. (L2)
		C104.2	Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)
		C104.3	Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)
		C104.4	Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)
		C104.5	Develop a Project with knowledge of module from Electronics. (L4)
4BHS105/ 205	ENVIRONMENT AND SUSTAINABILITY	C105.1	Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)
		C105.2	Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)
		C105.3	Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)
		C105.4	Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment. (L2)
4BHS106	PROFESSIONAL COMMUNICATION – I	C106.1	Identify and predict accurately use of grammar, punctuation and vocabulary in different types of communication. (L2)
		C106.2	Apply basic skills of paraphrasing and rewriting by taking and making effective notes. (L3)
		C106.3	Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)
		C106.4	Write compelling emails using appropriate writing etiquette and rules of grammar. (L3)
		C106.5	Write compelling formal and informal letters. (L3)
4BHS001	INDUCTION PROGRAM	C107.1	The groups which are formed should function as mentor – Mentee network.
		C107.2	A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc.
		C107.3	For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.
		C107.4	Such a group should remain for the entire 4 – 5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/ discipline.
2nd Semster			
4BMA201	ENGINEERING MATHEMATICS – II	C201.1	Understand discrete and continuous probability distributions to resolve various engineering problems. [L2]
		C201.2	Apply the method of least squares to estimate the parameters of a regression model. [L3]
		C201.3	Implement Test of Hypothesis for a population parameter for small sample and large sample cases. [L3]
		C201.4	Recognizing Complex Number System, Elementary complex functions and analytic functions. [L1]
		C201.5	Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. [L2]
		C202.1	Explain matter waves, Schrodinger's time independent wave equation and various features of wave function. [L1]

4BPH122/ 222	ENGINEERING PHYSICS FOR CSE and IT	C202.2	Describe applications of Schrodinger time independent wave equation using elementary problems such as infinite potential well, finite potential and potential barrier. [L2]
		C202.3	Explain drift and diffusion of charge carriers in semiconductor physics. [L2]
		C202.4	Describe I-V characteristics of PN junction diode and BJT. [L1]
		C202.5	Explain the features of superconductivity and its applications. [L2]
		C202.6	Describe the role of various measuring tools for performing experiments. [L1]
		C202.7	Explain the experimental setup, observed measurements and corresponding results using appropriate physical quantities and theoretical formulae. [L1]
4BEE103/ 203	BASIC ELECTRICAL ENGINEERING	C203.1	Analyze electrical circuits by relevant Laws in DC circuits. (L2)
		C203.2	Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)
		C203.3	Select suitable transformer for a given application by considering its design parameters. (L1)
		C203.4	Describe the working principle of DC Machine, generators and motors (L2)
		C203.5	Illustrate the concept of rotating magnetic field and applications (L1)
4BME104/ 204	ENGINEERING WORKSHOP PRACTICE	C204.1	Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks (L3)
		C204.2	Creating new models with the help of scrap materials. (L6)
		C204.3	Demonstrate sheet metal model using development techniques, adhesives and fasteners. (L3)
		C204.4	Demonstrate welding technology for model making. (L3)
4BCS105/ 205	PROGRAMMI NG FOR PROBLEM SOLVING	C205.1	Explain the basic constructs of C language. (L2)
		C205.2	Execute, compile and debug programs in C language. (L5)
		C205.3	Implement programs involving user-defined data types, decision structures, loops, functions, pointers, structures and union , enumeration, file handling and pre-processor directives in C. (L3)
		C205.4	Given a computational problem, identify and abstract the programming task involved. (L3)
		C205.5	Develop an application using C programming to solve real-life problem. (L6)
4BHS206	PROFESSIONA L COMMUNICA TION – II	C206.1	Enhance reading comprehension, writing, listening and speaking skills needed to effective communication (L3)
		C206.2	Present effectively through various modes of presentation (L3)
		C206.3	Apply skills of socializing and networking in day to day professional communication. (L3)
		C206.4	Express ideas opinions and to participate in group discussion. (L2)
		C206.5	Understand the cultural sensitivity in communication and use it effectively. (L2)
4BHS107/ 207	MODERN HISTORY OF ENGINEERING	C207.1	Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other (L5)
		C207.2	Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)
		C207.3	Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)

School of Engineering and Technology

Department of Information Technology (2019 Batch)

3rd Semester			
4BCS301	DISCRETE MATHEMATI CAL STRUCTURES	C301.1	Apply the propositional and predicate logic in symbolic representations and validity tests. (L3)
		C301.2	Interpret the relations and functions in constructing the applications of Information Science. (L2)
		C301.3	Demonstrate the knowledge of recurrence relation by solving relevant mathematical problems. (L2)
		C301.4	Demonstrate the properties of integers by using Mathematical induction. (L2)
		C301.5	Analyze the message coding, message transmission error detection and correction using group theory. (L3)
4BCS302	ANALOG AND DIGITAL ELECTRONIC S	C302.1	Demonstrate the working principles of BJT and FET. (L2)
		C302.2	Construct and realize Logic gates using transistors. (L3)
		C302.3	Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. (L2)
		C302.4	Design sequential Logic circuits and verify them by implementing them in hardware. (L2).
		C302.5	Demonstrate the knowledge on VHDL by realizing combinational and sequential circuits and also develop Finite state machine. (L2)
4BCS303	DATA STRUCTURES USING C	C303.1	Explain different concepts C programming. (L2)
		C303.2	Apply the programming concepts in C for problem solving. (L3)
		C303.3	Explain the concepts of various data structures. (L2)
		C303.4	Illustrate the applications of data structures. (L2)
		C303.5	Develop a solutions to problem using appropriate data structure. (L3)
4BCS304	COMPUTER ORGANIZATI ON AND ARCHITECTU RE	C304.1	Illustrate the various functional units of digital computers (L2)
		C304.2	Illustrate different concepts of CPU (L2)
		C304.3	Outline instruction execution using pipeline (L2)
		C304.4	Apply various hardware software concepts on instructions to exploit ILP (L3)
		C304.5	Explain Cache optimization techniques to improve system performance (L2)
4BCS305	WEB DESIGNING	C305.1	Build web pages using HTML, CSS and Tables. (L3)
		C305.2	Explain the various concepts of XML and build web pages using XML. (L2)
		C305.3	Validate Web pages using JavaScript concepts. (L3)
		C305.4	Evaluate simple open source programs by appropriately editing and debugging the code to build web pages using XML or CSS or Django. (L5)
		C305.5	Choose a best possible way to build a website by any programming language and web design concepts with listening to various opinions of diverse team and interviewing experts. (L3)
4BHS306	PROFESSIONA L COMMUNICA TION – III	C306.1	Present effectively with an understanding of various aspects of presentation. (L3)
		C306.2	Develop persuasive proposals by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.3	Develop effective reports by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.4	Construct references by using a referencing style that is appropriate to the type of academic writing. (L6)
		C306.5	Construct graphical representation of information by accurately interpreting and visualizing the given data. (L4)
		C307.1	Apply number theory and speed calculation methods for the quick computation and manipulation of numbers. (L3)

4BHS307	PREPARE PROGRAM – I	C307.2	Apply the theory of linear and quadratic equations using methods (indeterminate systems, equation comparisons etc) of equation formation to solve problems in several domains (e.g age problems). (L3)
		C307.3	Analyze distributive and arrangements puzzles to conclude logical solutions that adhere to the given parameters. (L4)
		C307.4	Demonstrate use of integral elements of public communication during a professional presentation. (L3)
		C307.5	Apply Basic English grammar rules (parts of speech, components and types of sentences) to identify errors in texts and construct correct sentences. (L3)
4BHS308	DESIGN THINKING – I	C308.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C308.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C308.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas (L3)
		C308.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4th semester			
4BCS401	ENGINEERING MATHEMATICS for CS and IT	C401.1	Explain the basic concepts of graph theory. [L2]
		C401.2	Solve problems involving vertex and edge colouring [L3]
		C401.3	Solve linear recurrence relations by recognizing homogeneity, linearity and constant coefficients. [L3]
		C401.4	Interpret and solve engineering problems using differential equation. [L2]
		C401.5	Solve linear and non-linear system of equations through numerical techniques. [L3]
4BCS402	DESIGN AND ANALYSIS OF ALGORITHM	C402.1	Identify various algorithm design techniques and strategies. (L1)
		C402.2	Represent various asymptotic performance of algorithm. (L2)
		C402.3	Illustrate the computational complexity of different algorithms. (L5)
		C402.4	Analyse and find the best algorithm for real time problem solving. (L4)
		C402.5	Construct best algorithm for real time problem solving. (L3)
4BCS403	SOFTWARE ENGINEERING	C403.1	Identify the various aspects of Software Product Engineering (L1)
		C403.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C403.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C403.4	Explain the basics of software testing (L2)
		C403.5	Explain the various software cost estimation models (L2)
4BCS404	OBJECT ORIENTED PROGRAMMING USING JAVA	C404.1	Explain the Object Oriented Programming paradigm concepts. [L2]
		C404.2	Apply object oriented programming concepts for problem solving. [L3]
		C404.3	Explain the programming constructs in Java. [L2]
		C404.4	Explain the various packages, classes, interfaces in Java. [L2]
		C404.5	Develop applications in Java. [L3]

4BCS405	OPERATING SYSTEMS	C405.1	Explain different concepts for OS.(L2)
		C405.2	Demonstrate the concepts of process synchronization and deadlocks.(L2)
		C405.3	Illustrate memory management, secondary storage and Input /Output management concepts (L2)
		C405.4	Apply different operating system concepts for solving different scenarios. (L3)
		C405.5	Explain various protection and security issues in OS. (L2)
4BHS406	PROFESSIONA L COMMUNICA TION – IV	C406.1	Plan, prepare and create business profile, portfolios, brochures, newsletters, banners and Posters. (L6)
		C406.2	Apply the different aspects technical written communication in writing. (L3)
		C406.3	Compose different types of business Correspondence. (L6)
		C406.4	Compose documents related to professional correspondence. (L6)
		C406.5	Demonstrate different effective strategies of presentation keeping in mind the importance of effective Listening. (L3)
4BHS407	PREPARE PROGRAM – II	C407.1	Apply the concepts of ratio, proportions, percentages and averages to calculate class/set relationships (compound interest, weighted average etc) and complete component analysis (mixtures, distribution of profits in partnership etc). (L3)
		C407.2	Integrate concepts of logical connectives to breakdown linguistic components and solve puzzles that use logical connectors. (L4)
		C407.3	Analyse data through the methods of selection and comparisons to prepare logical solutions to puzzles based on given parameters. (L3)
		C407.4	Recognize the meaning of words using the root-prefix-suffix structure and apply their extensive vocabulary in verbal and written contexts. (L1, L3)
		C407.5	Utilize techniques of public debate within a team by taking on different roles and articulating complex ideas in a persuasive manner. (L4)
4BHS408	DESIGN THINKING – II	C408.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C408.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C408.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas(L3)
		C408.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4BCS481	PROGRAMMIN G WITH C	C409.1	Explain the basic principles of programming in C. (L2)
		C409.2	Apply C programming concepts for problem solving. (L3)
		C409.3	Develop and implement programs using looping concepts in C. (L3)
		C409.4	Analyze the concepts of User defined data types in C. (L4)
		C409.5	Explain the concepts of file management technique in C. (L2)
4BCS482	COMPUTER SYSTEMS FOR ENGINEERS	C410.1	Explain the fundamental programming concepts. (L2)
		C410.2	Identify the various programming constructs to solve problems. (L3)
		C410.3	Explain the concepts of data visualization. (L2)
		C410.4	Explain System Development process. (L2)
		C410.5	Explain the various applications of systems and information technology in different domains. (L2)
		C411.1	Identify the various aspects of Software Product Engineering (L1)

		C411.2	Understand common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches (L2)
		C411.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery) (L3)
		C411.4	Understand the basics of software testing (L2)
4BCS483	SOFTWARE ENGINEERING	C411.5	Explain the various software cost estimation models (L2)
		5th Semester	
		C501.1	Demonstrate the concepts related to entrepreneurship issues in business ideas. (L3)
		C501.2	Independently analyse the factors influencing the practice of management in different contexts. (L3)
		C501.3	Develop suitable economic strategy regarding common business problems. (L3)
4BHS5A1/ 6A1	BUSINESS MANAGEMEN T FOR ENGINEERS	C501.4	Analyse the marketing strategy for common engineering business problems. (L4)
		C501.5	Illustrate the leadership qualities in the operation of a new venture. (L4)
		C502.1	Elucidate the basic concepts of Artificial Intelligence. (L2)
		C502.2	Analyse Artificial Intelligence techniques, such as search algorithms, for problem solving. (L4)
		C502.3	Apply techniques of Knowledge Representation and Planning. (L3)
4BCS502	ARTIFICIAL INTELLIGENC E	C502.4	Apply knowledge of reasoning in the presence of incomplete or uncertain information. (L3)
		C502.5	Explain different forms of Learning. (L2)
		C503.1	Explain the fundamental concepts of a database management system. (L2)
		C503.2	Develop the logical design of the database using data modelling concepts. (L3)
		C503.3	Explain SQL programming constructs and relational model concepts. (L2)
		C503.4	Explain the concepts of transaction processing, concurrency control and recovery. (L2)
4BCS503	DATABASE MANAGEMEN T SYSTEMS	C503.5	Make use of SQL to solve wide range of Database problems. (L3)
		C504.1	Outline basic concepts in data communications, OSI and TCP/IP Protocol Stack. (L2)
		C504.2	Understand the transfer of data from source to the destination using different protocols and addressing. (L2)
		C504.3	Summarize the functions of Application layer protocols and how to meet the QoS requirements in networking. (L2)
		C504.4	Identify the limits and importance of compression, encoding, sampling, quantization methods. (L3)
4BCS504	COMPUTER NETWORKS	C504.5	Demonstrate how the communication is achieved securely without using any kind of connection. (L2)
		C505.1	Explain the concepts in automata theory and formal languages and also apply finite state machines for modeling and solving computing problems. (L3)
		C505.2	Explain and implement the concepts of regular languages and context-free languages for solving problems. (L3)
		C505.3	Construct context free grammars, Push down Automata and explain the mechanism in it. (L3)
	FORMAL LANGUAGE AND	C505.4	Describe the Properties of Context-Free Languages and explain the concepts in Turing Machine. (L2)

4BCS505	AUTOMATA THEORY	C505.5	Explain decidability and intractability of computational problems. (L2)
4BHS506	PROFESSIONA L COMMUNICA TION – V	C506.1	Compose Abstract and Literature Review as parts of academic writing (L5)
		C506.2	Prepare agenda, Minutes and Memos in specific business set up (L5)
		C506.3	Apply skills of argumentation using various techniques of arguments and deliberation. (L3)
		C506.4	Exhibit basics of interview etiquette in a given professional set up (L3).
		C506.5	Plan and prepare presentation using media and advertisements (L5)
4BME507	PREPARE PROGRAM – III	C507.1	Students will use the concepts of work-time-efficiency and distance- time-speed to solve problems related to the measurement of effort or performance. (L3)
		C507.2	Students will analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)
		C507.3	Students will illustrate their conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)
		C507.4	Students will apply the concepts of input-output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc) from given data to solve problems.(L3)
		C507.5	Students will utilize verbal reasoning logic to solve tasks based on verbal data (para-completion, para- jumbles etc). (L4)
		C507.6	Students will demonstrate their reading and comprehension abilities by understanding a variety of writing styles and differentiating between close interpretations of text. (L3)
4BCS508	MINI PROJECT – I	C508.1	Conduct a survey of several available literature in the preferred field of study. (L5)
		C508.2	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C508.3	Analyze the problem requirements and arrive at workable design solutions. (L4)
		C508.4	Compare and contrast the several existing solutions for the attempted problem. (L5)
		C508.5	Summarize the report and present the findings of the study conducted in the preferred domain. (L2)
4BCS511	DATA MINING	C509.1	Explain the concepts of Data mining and its issues. (L1)
		C509.2	Analyze and apply association rule mining techniques. (L3)
		C509.3	Analyze various classification algorithms. (L2)
		C509.4	Elaborate the clustering algorithms. (L3)
		C509.5	Explain various density based methods. (L1)
4BCS512	CLOUD COMPUTING	C510.1	Explain main concepts, key technologies, strengths and limitations of cloud computing. (L2)
		C510.2	Explain the cloud enabling technologies that help in the development of cloud. (L2)
		C510.3	Develop the ability to use the architecture of compute and storage cloud, service and delivery models. (L3)
		C510.4	Explain core issues of cloud computing such as resource management and security. (L2)
		C510.5	Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud. (L3)
		C511.1	Explain the basic concepts of Data Visualization. (L2)
		C511.2	Analyze the basic visualization tools to understand the data. (L4)
		C511.3	Apply specialized visualization tools to make effective decisions. (L3)

4BCS513	DATA VISUALIZATION	C511.4	Illustrate the advanced visualization tools. (L2)
		C511.5	Analyze geospatial data using visualization tools. (L4)
6th Semester			
4BHS6A1/ 5A1	OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT	C601.1	Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies. (L1)
		C601.2	Analyse the critical issues in social development in the given context. (L2)
		C601.3	Develop technological interventions for social and community development. (L3)
4BCS602	INFORMATION AND NETWORK SECURITY	C602.1	Identify fundamental notions of system security, threats, vulnerabilities, attacks and countermeasures. (L3)
		C602.2	Explain the various concepts of information network security. (L2)
		C602.3	Illustrate key distribution, key management issues and different cryptographic standards and certificates. (L2)
		C602.4	Explain the concepts of authentication, cyber law, web security and cyber ethics. (L2)
		C602.5	Develop various network algorithms and simulate wired/wireless networks to evaluate different network parameters. (L3)
4BCS603	MOBILE COMPUTING	C603.1	Explain the fundamental concepts of mobile application development. [L2]
		C603.2	Design responsive user interfaces that work across a wide range of devices. [L6]
		C603.3	Demonstrate the knowledge of data persistence in mobile applications. [L2]
		C603.4	Outline networking and web services concepts in mobile applications. [L2]
		C603.5	Apply the steps involved in publishing mobile application to share with the world. [L3]
4BIT641	Microservice	C641.1	Explain the foundations and concepts of service based computing (L2)
		C642.2	Illustrate the basic operational model of web services (L2)
		C643.3	Analyse key technologies in the service oriented computing arena. (L4)
		C644.4	Build the web service framework with respect to SOA. (L3)
		C645.5	Develop web services using SOA (L3)
4BCS605	SOFTWARE ENGINEERING	C605.1	Identify the various aspects of Software Product Engineering. (L1)
		C605.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C605.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C605.4	Explain the basics of software testing. (L2)
		C605.5	Explain the various software cost estimation models. (L2)
		C606.1	Demonstrate the advanced skills of presentation. (L3)
		C606.2	Compose Technical Documents following proper format and style (L6)

4BHS606	PROFESSIONA L COMMUNICA TION – VI	C606.3	Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case. (L4)
		C606.4	Apply the registers of technical English in oral and written mode of communication.(L3)
		C606.5	Collaborate and express themselves in an Interview round. (L6)
4BME607	PREPARE PROGRAM – IV	C607.1	Students will infer the concepts of permutation, combination, and probability from a given set to solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc). (L4)
		C607.2	Students will apply concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters. (L3)
		C607.3	Students will use indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc). (L3)
		C607.4	Students will examine four types of logical statements to solve puzzles based on syllogisms. (L4)
		C607.5	Students will apply the concepts of venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc . (L3)
		C607.6	Students will be able to combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks(e.g. para-completion etc) and articulate their ideas. (L4)
4BCS608	MINI PROJECT – II	C608.1	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C608.2	Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions (L4)
		C608.3	Conduct a survey of several available literature in the preferred field of study and Compare the several existing solutions for the attempted problem. (L5)
		C608.4	Propose innovative solution for the development of components, processes or technologies in CS/IT field. (L6)
		C608.5	To report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities. (L3)
4BCS621	No-SQL DATABASES	C609.1	Elaborate the fundamental concepts of No-SQL databases. (L2)
		C609.2	Analyze the features and use cases of key-value databases. (L3)
		C609.3	Explain the features and challenges pertaining to document databases. (L2)
		C609.4	Illustrate the characteristics of column oriented No-SQL databases. (L4)
		C609.5	Describe the design and use cases of graph databases. (L3)
4BCS622	STORAGE AREA NETWORKS	C610.1	Explain basic concepts for Storage systems (L2)
		C610.2	Apply the concepts of storage networking technologies. (L3)
		C610.3	Explain the concepts in Backup, Archive and Replication. (L2)
		C610.4	Analyse the concepts of cloud computing and virtualization. (L4)
		C610.5	Explain various concepts in managing and securing storage infrastructure (L2)
		C611.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C611.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C611.3	Design IIR and FIR filters. (L3)
		C611.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)

4BCS623	DIGITAL SIGNAL PROCESSING	C611.5	Explain the DSP processors and getting the concept of Image processing. (L2)
		7th Semester	
4BCS701	MACHINE LEARNING	C701.1	Explain basic concepts of Machine Learning. (L2)
		C701.2	Analyse Data to perform Exploratory Data Analysis. (L4)
		C701.3	Implement Supervised Machine Learning algorithms to solve problems. (L6)
		C701.4	Implement Un-Supervised Machine Learning algorithm to analyses data. (L6)
		C701.5	Evaluate models to perform Model Selection. (L5)
4BCS702	PYTHON PROGRAMMING	C702.1	Explain the syntax and semantics of Python Programming language. (L2)
		C702.2	Demonstrate proficiency in handling Strings and File systems. (L2)
		C702.3	Apply python packages in solving real-time problems. (L3)
		C702.4	Build Web Services and introduction to Network and Database Programming in Python. (L3)
		C702.5	Interpret Data Visualization concepts in Python. (L2)
4BCS703	INTERNSHIP	C703.1	Demonstrate the skills in professional career goals. (L2)
		C703.2	Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities. (L3)
		C703.3	Develop professional connections with leadership strategy and skill development. (L4)
		C703.4	Identify the professions to suit the interest as a result of this experience. (L3)
		C703.5	Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework. (L4)
4BHS704	PREPARE PROGRAM – V	C704.1	Students will be able to apply number theory concepts and formulas to solve problems of base system, remainder theorem etc. (L3)
		C704.2	Students will be able to categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators.
		C704.3	Students will be able to solve types of pattern recognition problems (fillers, calendar etc) by utilizing different functions that fit the given criteria. (L3)
		C704.4	Students will be able to analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations. (L4)
		C704.5	Students will be able to make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation & combination. (L3)
		C704.6	Students will be able to apply written and verbal communication techniques by articulating themselves in the format of discussion, debate, interview, essay, letter etc. (L3)
		C705.1	Demonstrate engineering knowledge and its framework for its implementation in the project design as well work in groups taking leadership role and communicate effectively (L2)
		C705.2	Survey relevant literature in the chosen field of study that allows interrelation of design and research (L4)
		C705.3	Model a prototype/ concept design that exhibits the feasibility of the solution from cost, engineering and environmental aspects. (L3)

4BCS705	CAPSTONE PROJECT – DESIGN	C705.4	Justify the project design with a structured report that covers all the work carried out between framing the problem statement to the project design. (L5)
		C705.5	Design conceptual ideas that address the issues with respect to real world problems. (L6)
4BCS731	ETHICAL HACKING	C706.1	Describe the basics of the ethical hacking. (L2)
		C706.2	Describe the foot printing and scanning. (L2)
		C706.3	Demonstrate the techniques and countermeasures for system hacking. (L3)
		C706.4	Characterize the malware and their attacks. (L2)
		C706.5	Analyze and prevent the security attacks in different environments. (L4)
4BCS732	REAL TIME SYSTEMS	C707.1	Characterize real-time systems and describe their functions. (L2)
		C707.2	Analyze various Clock-Driven Scheduling approaches. (L3)
		C707.3	Apply formal methods to analyze and design a priority-driven scheduling of periodic tasks. (L4)
		C707.4	Compare the methods for scheduling aperiodic and sporadic jobs in priority-driven systems. (L3)
		C707.5	Analyze various resources and resource access control approaches. (L3)
4BCS733	QUANTUM COMPUTING	C708.1	Describe the framework of quantum computation
		C708.2	Explain the differences between classical computation and quantum computation
		C708.3	Explain the concept of quantum entanglement and quantum teleportation
		C708.4	Implement single cubic gates
		C708.5	Explain how quantum computation may be applied in future technologies
4BCS741	OPTIMIZATIO N TECHNIQUES	C709.1	Remember the basic concepts of optimization. (L1)
		C709.2	Recognize methods of optimization techniques. (L2)
		C709.3	Formulate and solve linear programming problems. (L2)
		C709.4	Obtain solutions to constrained and unconstrained Non-linear programming problems. (L2)
		C709.5	Determine the integer solutions to Linear Programming Problems. (L2)
4BCS742	DIGITAL SIGNAL PROCESSING	C710.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C710.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C710.3	Design IIR and FIR filters. (L3)
		C710.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)
		C710.5	Explain the DSP processors and getting the concept of Image processing. (L2)
4BCS743	EMBEDDED SYSTEMS	C711.1	Classify an Embedded systems based on its attributes and illustrate various steps in design process.
		C711.2	Distinguish various I/O ports, communication protocols and Timers used in an Embedded system.
		C711.3	Classify and explain various peripherals of an Embedded Systems.
		C711.4	Demonstrate characteristics and attributes of an embedded system, hardware /software co- design and firmware design approaches. (L2)
		C711.5	Explain the need of real time operating system for embedded system applications. (L2)

8th Semester			
4BHS801	PROFESSIONAL ETHICS FOR ENGINEERS	C801.1	Describe the Moral Values and Ethics. (L1)
		C801.2	Explain the Engineering Ethics. (L1)
		C801.3	Discuss the Responsibility as Engineers. (L2)
		C801.4	Examine the Safety and Risk. (L2)
		C801.5	Predict the working Ethics for Engineers. (L2)
4BCS802	SOFTWARE TESTING	C802.1	Apply software testing knowledge and engineering methods. (L3)
		C802.2	Identify various software testing problems, and solve the problems. (L2)
		C802.3	Design and conduct various levels of software testing for a software project. (L4)
		C802.4	Apply various communication methods and ethical skills in practice-oriented software testing projects. (L3)
		C802.5	Analyze the needs of software test automation and develop a test tool to support test automation. (L2)
4BCS803	DEEP LEARNING	C803.1	Apply concepts of RNN and LSTM. (L3)
		C803.2	Demonstrate concepts of Self-organizing maps in real-world applications. (L3)
		C803.3	Illustrate Problems through pre trained model such as auto-encoders. (L3)
		C803.4	Interpret about Boltzmann machines and its applications. (L3)
		C803.5	Apply the concept of GANs and know its applications. (L4)
4BCS804	INTERNET OF THINGS	C804.1	Explain the concept of IoT. (L2)
		C804.2	Analyze various protocols for IoT. (L2)
		C804.3	Design a PoC of an IoT system using Rasperry Pi/Arduino. (L4)
		C804.4	Apply data analytics and use cloud offerings related to IoT. (L3)
		C804.5	Analyze applications of IoT in real time scenario. (L2)
4BCS805	CAPSTONE PROJECT – BUILD	C805.1	Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. (L4)
		C805.2	Utilize proper project management techniques and planning methods to produce cost effective projects (L3)
		C805.3	Recommend the need to implement the project with supporting justification and possible areas to improve it and Compile a clear report containing the step by step process of building the project that includes all calculations, analysis and fabrication methods involved. (L5)
		C805.4	Build the real world implementation of the design that will realize the objectives of the prototype/ design. (L6)
		C805.5	Demonstrate working in groups taking leadership role and communicating effectively. (L2)
4BCS851	COMPUTER VISION	C806.1	Identify fundamental image processing techniques required for computer vision. (L1)
		C806.2	Represent chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections, 3D vision techniques. (L2)
		C806.3	Illustrate boundary tracking techniques. (L5)
		C806.4	Analyze and Implement motion related techniques. (L4)
		C806.5	Construct applications using computer vision techniques. (L3)
4BCS852	NATURAL LANGUAGE PROCESSING	C807.1	Analyze the natural language text. (L4)
		C807.2	Create the natural language. (L6)
		C807.3	Analyze Text mining. (L4)
		C807.4	Evaluation of Self Explanation (L2)
		C807.5	Apply information retrieval techniques. (L3)
		C808.1	Explain the concepts of Data mining and its issues. (L1)
		C808.2	Analyze and apply association rule mining techniques. (L3)
		C808.3	Analyze various classification algorithms. (L2)
		C808.4	Elaborate the clustering algorithms. (L3)
		C808.5	Explain various density based methods. (L1)

4BCS853	DATA MINING		
		C809.1	Explain the fundamentals of Digital forensics. (L2)
		C809.2	Illustrate computer forensic techniques to identify the digital forensics associated with criminal activities. (L2)
		C809.3	Apply forensic analysis tools to recover important evidence for identifying computer crime. (L3)
		C809.4	Explain Computer Crime and Criminals and Liturgical Procedures. (L2)
4BCS854	DIGITAL FORENSICS	C809.5	Analyze laws and ethics involved in cybercrime. (L4)
		C810.1	Explain the models of distributed computing. (L2)
		C810.2	Analyze distributed shared memory models. (L4)
		C810.3	Design and Implement distributed file systems. (L6)
		C810.4	Build the distributed algorithms for handling deadlocks. (L3)
4BCS8555	DISTRIBUTED COMPUTING	C810.5	Importance of the inherent difficulties that arise due to distributedness of computing resources. (L5)

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Information Technology

COs

2020 Batch

Course Outcomes

Course Code	Course	Course Outcomes(CO) Code	Course Outcomes
1st Semester			
4BMA101	Engineering Mathematics – I	C101.1	List nth order derivatives of different functions. (L1)
		C101.2	Demonstrate the use of partial derivatives. (L2)
		C101.3	Explain the concept of vector differentiation. (L2)
		C101.4	Classify the 1st order differential equation. (L2)
		C101.5	Apply the knowledge of matrices techniques. (L3)
4BCH102/ 20	ENGINEERING CHEMISTRY	C102.1	Illustrate the concept of electrochemical cell by writing balanced redox reactions. (L2)
		C102.2	Explain the mechanism of corrosion in metals by framing stoichiometric chemical reaction. (L2)
		C102.3	Explain the polymer composites for photocatalytic and photovoltaic applications by examining the photogenerated charged carrier dynamics. (L2)
		C102.4	Classify different types of carbon forms and its applications by interpreting their structural properties. (L2)
		C102.5	Understand the synthesis of nanomaterials by determining appropriate solution method. (L2)
4BME103/ 203	COMPUTER AIDED ENGINEERING DRAWING AND RAPID PROTOTYPING	C103.1	Draw orthographic projections (TV, FV and SV) of points, straight lines, surfaces using instruments and CAD software (L1)
		C103.2	technique. (L3)
		C103.3	surfaces of solid geometry (L3)
		C103.4	Using isometric projections of combination of solids build model (L3)
		C103.5	Create models using rapid prototyping and laser cutting (L6)
		C104.1	Associate basic engineering principles with operations of electronic components, equipment and circuits at an elementary level. (L2)

4BEC104/ 204	MAKING WITH ELECTRONICS	C104.2	Identify and analyze basic electronic components and concepts using working models and experiments. (L1, L4)
		C104.3	Apply concepts learnt to design basic circuits to achieve desired specific outputs. (L3)
		C104.4	Develop in teams, simple interactive projects using Arduino that use the knowledge of circuit design and electronic components gained in the course. (L4)
		C104.5	Develop a Project with knowledge of module from Electronics. (L4)
4BHS105/ 205	ENVIRONMENT AND SUSTAINABILITY	C105.1	Outline the expected consequences of continuous environment degradation in the society by relevant data analysis. (L2)
		C105.2	Demonstrate a rationale for climate change adaptation and mitigation by proposing appropriate actions in key sectors. (L2)
		C105.3	Explain the key issues under negotiation by summarizing the international climate change legal and policy framework. (L2)
		C105.4	Demonstrate knowledge of environment sustainability by analyzing relevant data about industrial impact on environment. (L2)
4BHS106	PROFESSIONAL COMMUNICATION – I	C106.1	Identify and predict accurately use of grammar, punctuation and vocabulary in different types of communication. (L2)
		C106.2	Apply basic skills of paraphrasing and rewriting by taking and making effective notes. (L3)
		C106.3	Compose engaging creative writing pieces through techniques of speculation and prediction. (L6)
		C106.4	Write compelling emails using appropriate writing etiquette and rules of grammar. (L3)
		C106.5	Write compelling formal and informal letters. (L3)
4BHS001	INDUCTION PROGRAM	C107.1	The groups which are formed should function as mentor – Mentee network.
		C107.2	A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc.
		C107.3	For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.
		C107.4	Such a group should remain for the entire 4 – 5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/ discipline.
2nd Semster			
4BMA201	ENGINEERING MATHEMATICS – II	C201.1	Understand discrete and continuous probability distributions to resolve various engineering problems. [L2]
		C201.2	Apply the method of least squares to estimate the parameters of a regression model. [L3]
		C201.3	Implement Test of Hypothesis for a population parameter for small sample and large sample cases. [L3]
		C201.4	Recognizing Complex Number System, Elementary complex functions and analytic functions. [L1]
		C201.5	Interpret Cauchy integral formula and Cauchy Residue theorem to solve the complex integration. [L2]
		C202.1	Explain matter waves, Schrodinger's time independent wave equation and various features of wave function. [L1]
		C202.2	Describe applications of Schrodinger time independent wave equation using elementary problems such as infinite potential well, finite potential and potential barrier. [L2]

4BPH122/ 222	ENGINEERING PHYSICS FOR CSE and IT	C202.3	Explain drift and diffusion of charge carriers in semiconductor physics. [L2]
		C202.4	Describe I-V characteristics of PN junction diode and BJT. [L1]
		C202.5	Explain the features of superconductivity and its applications. [L2]
		C202.6	Describe the role of various measuring tools for performing experiments. [L1]
		C202.7	Explain the experimental setup, observed measurements and corresponding results using appropriate physical quantities and theoretical formulae. [L1]
BEE103/ 203	BASIC ELECTRICAL ENGINEERING	C203.1	Analyze electrical circuits by relevant Laws in DC circuits. (L2)
		C203.2	Demonstrate the knowledge of single phase and three-phase power generation by using the phasor diagrams. (L2)
		C203.3	Select suitable transformer for a given application by considering its design parameters. (L1)
		C203.4	Describe the working principle of DC Machine, generators and motors (L2)
		C203.5	Illustrate the concept of rotating magnetic field and applications (L1)
4BME104/ 204	ENGINEERING WORKSHOP PRACTICE	C204.1	Select appropriate hand and power tools, machines, equipment and materials and demonstrate their correct use for simple making tasks (L3)
		C204.2	Creating new models with the help of scrap materials. (L6)
		C204.3	Demonstrate sheet metal model using development techniques, adhesives and fasteners. (L3)
		C204.4	Demonstrate welding technology for model making. (L3)
4BCS105/ 205	PROGRAMMI NG FOR PROBLEM SOLVING	C205.1	Explain the basic constructs of C language. (L2)
		C205.2	Execute, compile and debug programs in C language. (L5)
		C205.3	Implement programs involving user-defined data types, decision structures, loops, functions, pointers, structures and union , enumeration, file handling and pre-processor directives in C. (L3)
		C205.4	Given a computational problem, identify and abstract the programming task involved. (L3)
		C205.5	Develop an application using C programming to solve real-life problem. (L6)
4BHS206	PROFESSIONA L COMMUNICA TION – II	C206.1	Enhance reading comprehension, writing, listening and speaking skills needed to effective communication (L3)
		C206.2	Present effectively through various modes of presentation (L3)
		C206.3	Apply skills of socializing and networking in day to day professional communication. (L3)
		C206.4	Express ideas opinions and to participate in group discussion. (L2)
		C206.5	Understand the cultural sensitivity in communication and use it effectively. (L2)
4BHS107/ 207	MODERN HISTORY OF ENGINEERING	C207.1	Formulate original thought, opinions and insights on engineering by critically analyzing the relationship between Engineering and Society, Environment, Philosophy, Economics and Polity by considering their positive and negative impact on each other (L5)
		C207.2	Compare engineering innovations/ innovators from different periods of history by explaining their historical significance. (L2)
		C207.3	Explain the value and importance of professional and ethical responsibility in the engineering profession by analyzing impact of engineering on the world. (L2)
3rd Semester			
		C301.1	Apply the propositional and predicate logic in symbolic representations and validity tests. (L3)

4BCS301	DISCRETE MATHEMATI CAL STRUCTURES	C301.2	Interpret the relations and functions in constructing the applications of Information Science. (L2)
		C301.3	Demonstrate the knowledge of recurrence relation by solving relevant mathematical problems. (L2)
		C301.4	Demonstrate the properties of integers by using Mathematical induction. (L2)
		C301.5	Analyze the message coding, message transmission error detection and correction using group theory. (L3)
4BCS302	ANALOG AND DIGITAL ELECTRONIC S	C302.1	Demonstrate the working principles of BJT and FET. (L2)
		C302.2	Construct and realize Logic gates using transistors. (L3)
		C302.3	Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. (L2)
		C302.4	Design sequential Logic circuits and verify them by implementing them in hardware. (L2).
		C302.5	Demonstrate the knowledge on VHDL by realizing combinational and sequential circuits and also develop Finite state machine. (L2)
4BCS303	DATA STRUCTURES USING C	C303.1	Explain different concepts C programming. (L2)
		C303.2	Apply the programming concepts in C for problem solving. (L3)
		C303.3	Explain the concepts of various data structures. (L2)
		C303.4	Illustrate the applications of data structures. (L2)
		C303.5	Develop a solutions to problem using appropriate data structure. (L3)
4BCS304	COMPUTER ORGANIZATI ON AND ARCHITECTU RE	C304.1	Illustrate the various functional units of digital computers (L2)
		C304.2	Illustrate different concepts of CPU (L2)
		C304.3	Outline instruction execution using pipeline (L2)
		C304.4	Apply various hardware software concepts on instructions to exploit ILP (L3)
		C304.5	Explain Cache optimization techniques to improve system performance (L2)
4BCS305	WEB DESIGNING	C305.1	Build web pages using HTML, CSS and Tables. (L3)
		C305.2	Explain the various concepts of XML and build web pages using XML. (L2)
		C305.3	Validate Web pages using JavaScript concepts. (L3)
		C305.4	Evaluate simple open source programs by appropriately editing and debugging the code to build web pages using XML or CSS or Django. (L5)
		C305.5	Choose a best possible way to build a website by any programming language and web design concepts with listening to various opinions of diverse team and interviewing experts. (L3)
4BHS306	PROFESSIONA L COMMUNICA TION – III	C306.1	Present effectively with an understanding of various aspects of presentation. (L3)
		C306.2	Develop persuasive proposals by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.3	Develop effective reports by incorporating fundamental writing techniques at an intermediate level. (L3)
		C306.4	Construct references by using a referencing style that is appropriate to the type of academic writing. (L6)
		C306.5	Construct graphical representation of information by accurately interpreting and visualizing the given data. (L4)
		C307.1	Apply number theory and speed calculation methods for the quick computation and manipulation of numbers. (L3)
		C307.2	Apply the theory of linear and quadratic equations using methods (indeterminate systems, equation comparisons etc) of equation formation to solve problems in several domains (e.g age problems). (L3)

4BHS307	PREPARE PROGRAM – I	C307.3	Analyze distributive and arrangements puzzles to conclude logical solutions that adhere to the given parameters. (L4)
		C307.4	Demonstrate use of integral elements of public communication during a professional presentation. (L3)
		C307.5	Apply Basic English grammar rules (parts of speech, components and types of sentences) to identify errors in texts and construct correct sentences. (L3)
4BHS308	DESIGN THINKING – I	C308.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C308.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C308.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas (L3)
		C308.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4th semester			
4BCS401	ENGINEERING MATHEMATICS for CS and IT	C401.1	Explain the basic concepts of graph theory. [L2]
		C401.2	Solve problems involving vertex and edge colouring [L3]
		C401.3	Solve linear recurrence relations by recognizing homogeneity, linearity and constant coefficients. [L3]
		C401.4	Interpret and solve engineering problems using differential equation. [L2]
		C401.5	Solve linear and non-linear system of equations through numerical techniques. [L3]
4BCS402	DESIGN AND ANALYSIS OF ALGORITHM	C402.1	Identify various algorithm design techniques and strategies. (L1)
		C402.2	Represent various asymptotic performance of algorithm. (L2)
		C402.3	Illustrate the computational complexity of different algorithms. (L5)
		C402.4	Analyse and find the best algorithm for real time problem solving. (L4)
		C402.5	Construct best algorithm for real time problem solving. (L3)
4BCS403	SOFTWARE ENGINEERING	C403.1	Identify the various aspects of Software Product Engineering (L1)
		C403.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C403.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C403.4	Explain the basics of software testing (L2)
		C403.5	Explain the various software cost estimation models (L2)
4BCS404	OBJECT ORIENTED PROGRAMMING USING JAVA	C404.1	Explain the Object Oriented Programming paradigm concepts. [L2]
		C404.2	Apply object oriented programming concepts for problem solving. [L3]
		C404.3	Explain the programming constructs in Java. [L2]
		C404.4	Explain the various packages, classes, interfaces in Java. [L2]
		C404.5	Develop applications in Java. [L3]
		C405.1	Explain different concepts for OS.(L2)
		C405.2	Demonstrate the concepts of process synchronization and deadlocks.(L2)

4BCS405	OPERATING SYSTEMS	C405.3	Illustrate memory management, secondary storage and Input /Output management concepts (L2)
		C405.4	Apply different operating system concepts for solving different scenarios. (L3)
		C405.5	Explain various protection and security issues in OS. (L2)
4BHS406	PROFESSIONA L COMMUNICA TION – IV	C406.1	Plan, prepare and create business profile, portfolios, brochures, newsletters, banners and Posters. (L6)
		C406.2	Apply the different aspects technical written communication in writing. (L3)
		C406.3	Compose different types of business Correspondence. (L6)
		C406.4	Compose documents related to professional correspondence. (L6)
		C406.5	Demonstrate different effective strategies of presentation keeping in mind the importance of effective Listening. (L3)
4BHS407	PREPARE PROGRAM – II	C407.1	Apply the concepts of ratio, proportions, percentages and averages to calculate class/set relationships (compound interest, weighted average etc) and complete component analysis (mixtures, distribution of profits in partnership etc). (L3)
		C407.2	Integrate concepts of logical connectives to breakdown linguistic components and solve puzzles that use logical connectors. (L4)
		C407.3	Analyse data through the methods of selection and comparisons to prepare logical solutions to puzzles based on given parameters. (L3)
		C407.4	Recognize the meaning of words using the root-prefix-suffix structure and apply their extensive vocabulary in verbal and written contexts. (L1, L3)
		C407.5	Utilize techniques of public debate within a team by taking on different roles and articulating complex ideas in a persuasive manner. (L4)
4BHS408	DESIGN THINKING – II	C408.1	Analysis user needs using structured techniques to discover unique product opportunity areas (L4)
		C408.2	Design solutions that tackle a given challenge by using iterative ideation techniques to generate alternative ideas, refine concepts and select the appropriate solution (L6)
		C408.3	Apply techniques of effective communication and collaboration to deliver convincing presentations, share and receive feedback, work effectively in teams and visualize their ideas(L3)
		C408.4	Demonstrate professionalism by adhering to deadlines, focusing on quality of work, maintaining detailed documentation and effectively using platforms for digital collaboration (L2)
4BCS481	PROGRAMMIN G WITH C	C409.1	Explain the basic principles of programming in C. (L2)
		C409.2	Apply C programming concepts for problem solving. (L3)
		C409.3	Develop and implement programs using looping concepts in C. (L3)
		C409.4	Analyze the concepts of User defined data types in C. (L4)
		C409.5	Explain the concepts of file management technique in C. (L2)
4BCS482	COMPUTER SYSTEMS FOR ENGINEERS	C410.1	Explain the fundamental programming concepts. (L2)
		C410.2	Identify the various programming constructs to solve problems. (L3)
		C410.3	Explain the concepts of data visualization. (L2)
		C410.4	Explain System Development process. (L2)
		C410.5	Explain the various applications of systems and information technology in different domains. (L2)
		C411.1	Identify the various aspects of Software Product Engineering (L1)

		C411.2	Understand common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches (L2)
		C411.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery) (L3)
		C411.4	Understand the basics of software testing (L2)
4BCS483	SOFTWARE ENGINEERING	C411.5	Explain the various software cost estimation models (L2)
		5th Semester	
		C501.1	Demonstrate the concepts related to entrepreneurship issues in business ideas. (L3)
		C501.2	Independently analyse the factors influencing the practice of management in different contexts. (L3)
		C501.3	Develop suitable economic strategy regarding common business problems. (L3)
4BHS5A1/ 6A1	BUSINESS MANAGEMEN T FOR ENGINEERS	C501.4	Analyse the marketing strategy for common engineering business problems. (L4)
		C501.5	Illustrate the leadership qualities in the operation of a new venture. (L4)
		C502.1	Elucidate the basic concepts of Artificial Intelligence. (L2)
		C502.2	Analyse Artificial Intelligence techniques, such as search algorithms, for problem solving. (L4)
		C502.3	Apply techniques of Knowledge Representation and Planning. (L3)
4BCS502	ARTIFICIAL INTELLIGENC E	C502.4	Apply knowledge of reasoning in the presence of incomplete or uncertain information. (L3)
		C502.5	Explain different forms of Learning. (L2)
		C503.1	Explain the fundamental concepts of a database management system. (L2)
		C503.2	Develop the logical design of the database using data modelling concepts. (L3)
		C503.3	Explain SQL programming constructs and relational model concepts. (L2)
		C503.4	Explain the concepts of transaction processing, concurrency control and recovery. (L2)
4BCS503	DATABASE MANAGEMEN T SYSTEMS	C503.5	Make use of SQL to solve wide range of Database problems. (L3)
		C504.1	Outline basic concepts in data communications, OSI and TCP/IP Protocol Stack. (L2)
		C504.2	Understand the transfer of data from source to the destination using different protocols and addressing. (L2)
		C504.3	Summarize the functions of Application layer protocols and how to meet the QoS requirements in networking. (L2)
		C504.4	Identify the limits and importance of compression, encoding, sampling, quantization methods. (L3)
4BCS504	COMPUTER NETWORKS	C504.5	Demonstrate how the communication is achieved securely without using any kind of connection. (L2)
		C505.1	Explain the concepts in automata theory and formal languages and also apply finite state machines for modeling and solving computing problems. (L3)
		C505.2	Explain and implement the concepts of regular languages and context-free languages for solving problems. (L3)
		C505.3	Construct context free grammars, Push down Automata and explain the mechanism in it. (L3)
	FORMAL LANGUAGE AND	C505.4	Describe the Properties of Context-Free Languages and explain the concepts in Turing Machine. (L2)

4BCS505	AUTOMATA THEORY	C505.5	Explain decidability and intractability of computational problems. (L2)
4BHS506	PROFESSIONA L COMMUNICA TION – V	C506.1	Compose Abstract and Literature Review as parts of academic writing (L5)
		C506.2	Prepare agenda, Minutes and Memos in specific business set up (L5)
		C506.3	Apply skills of argumentation using various techniques of arguments and deliberation. (L3)
		C506.4	Exhibit basics of interview etiquette in a given professional set up (L3).
		C506.5	Plan and prepare presentation using media and advertisements (L5)
4BME507	PREPARE PROGRAM – III	C507.1	Students will use the concepts of work-time-efficiency and distance- time-speed to solve problems related to the measurement of effort or performance. (L3)
		C507.2	Students will analyze geometric shapes and use mensuration formulas to mathematically measure 2D and 3D solids. (L4)
		C507.3	Students will illustrate their conceptual knowledge of blood relationships and direction sense through the creation of schematic diagrams and solving related problems. (L3)
		C507.4	Students will apply the concepts of input-output, series, as well as coding and decoding to discern specific patterns (finding the odd term, types of codes etc) from given data to solve problems.(L3)
		C507.5	Students will utilize verbal reasoning logic to solve tasks based on verbal data (para-completion, para- jumbles etc). (L4)
		C507.6	Students will demonstrate their reading and comprehension abilities by understanding a variety of writing styles and differentiating between close interpretations of text. (L3)
4BCS508	MINI PROJECT – I	C508.1	Conduct a survey of several available literature in the preferred field of study. (L5)
		C508.2	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C508.3	Analyze the problem requirements and arrive at workable design solutions. (L4)
		C508.4	Compare and contrast the several existing solutions for the attempted problem. (L5)
		C508.5	Summarize the report and present the findings of the study conducted in the preferred domain. (L2)
4BCS511	DATA MINING	C509.1	Explain the concepts of Data mining and its issues. (L1)
		C509.2	Analyze and apply association rule mining techniques. (L3)
		C509.3	Analyze various classification algorithms. (L2)
		C509.4	Elaborate the clustering algorithms. (L3)
		C509.5	Explain various density based methods. (L1)
4BCS512	CLOUD COMPUTING	C510.1	Explain main concepts, key technologies, strengths and limitations of cloud computing. (L2)
		C510.2	Explain the cloud enabling technologies that help in the development of cloud. (L2)
		C510.3	Develop the ability to use the architecture of compute and storage cloud, service and delivery models. (L3)
		C510.4	Explain core issues of cloud computing such as resource management and security. (L2)
		C510.5	Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud. (L3)
		C511.1	Explain the basic concepts of Data Visualization. (L2)
		C511.2	Analyze the basic visualization tools to understand the data. (L4)
		C511.3	Apply specialized visualization tools to make effective decisions. (L3)

4BCS513	DATA VISUALIZATION	C511.4	Illustrate the advanced visualization tools. (L2)
		C511.5	Analyze geospatial data using visualization tools. (L4)
6th Semester			
4BHS6A1/ 5A1	OF GLOBALIZATION AND SUSTAINABLE DEVELOPMENT	C601.1	Demonstrate understanding of globalization process with emphasis on inter-dependence of communities and societies. (L1)
		C601.2	Analyse the critical issues in social development in the given context. (L2)
		C601.3	Develop technological interventions for social and community development. (L3)
4BCS602	INFORMATION AND NETWORK SECURITY	C602.1	Identify fundamental notions of system security, threats, vulnerabilities, attacks and countermeasures. (L3)
		C602.2	Explain the various concepts of information network security. (L2)
		C602.3	Illustrate key distribution, key management issues and different cryptographic standards and certificates. (L2)
		C602.4	Explain the concepts of authentication, cyber law, web security and cyber ethics. (L2)
		C602.5	Develop various network algorithms and simulate wired/wireless networks to evaluate different network parameters. (L3)
4BCS603	MOBILE COMPUTING	C603.1	Explain the fundamental concepts of mobile application development. [L2]
		C603.2	Design responsive user interfaces that work across a wide range of devices. [L6]
		C603.3	Demonstrate the knowledge of data persistence in mobile applications. [L2]
		C603.4	Outline networking and web services concepts in mobile applications. [L2]
		C603.5	Apply the steps involved in publishing mobile application to share with the world. [L3]
4BIT641	Microservice	C641.1	Explain the foundations and concepts of service based computing (L2)
		C642.2	Illustrate the basic operational model of web services (L2)
		C643.3	Analyse key technologies in the service oriented computing arena. (L4)
		C644.4	Build the web service framework with respect to SOA. (L3)
		C645.5	Develop web services using SOA (L3)
4BCS605	SOFTWARE ENGINEERING	C605.1	Identify the various aspects of Software Product Engineering. (L1)
		C605.2	Explain common Software Lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. (L2)
		C605.3	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). (L3)
		C605.4	Explain the basics of software testing. (L2)
		C605.5	Explain the various software cost estimation models. (L2)
		C606.1	Demonstrate the advanced skills of presentation. (L3)
		C606.2	Compose Technical Documents following proper format and style (L6)

4BHS606	PROFESSIONA L COMMUNICA TION – VI	C606.3	Evaluate cases pertaining to a specific domain and recommend innovative suggestion/s to the case. (L4)
		C606.4	Apply the registers of technical English in oral and written mode of communication.(L3)
		C606.5	Collaborate and express themselves in an Interview round. (L6)
4BME607	PREPARE PROGRAM – IV	C607.1	Students will infer the concepts of permutation, combination, and probability from a given set to solve problems of various arrangements (circular, linear etc) and criteria (expected value, biased dice etc). (L4)
		C607.2	Students will apply concepts from statistics (mean, median etc) and progressions (AP, GP, HP) to analyze groups of numbers on the mentioned parameters. (L3)
		C607.3	Students will use indices and surds to solve problems related to representation of numbers (large integers, irrational roots etc). (L3)
		C607.4	Students will examine four types of logical statements to solve puzzles based on syllogisms. (L4)
		C607.5	Students will apply the concepts of venn diagrams and cubes to solve puzzles using set theory, breaking-building rules etc . (L3)
		C607.6	Students will be able to combine logic with their knowledge of advanced English vocabulary and grammar to solve verbal data tasks(e.g. para-completion etc) and articulate their ideas. (L4)
4BCS608	MINI PROJECT – II	C608.1	Demonstrate practical knowledge within the chosen area of technology for project development. (L2)
		C608.2	Identify, analyze, formulate and handle computer/IT projects with a comprehensive and systematic approach to give workable design solutions (L4)
		C608.3	Conduct a survey of several available literature in the preferred field of study and Compare the several existing solutions for the attempted problem. (L5)
		C608.4	Propose innovative solution for the development of components, processes or technologies in CS/IT field. (L6)
		C608.5	To report and present the findings of the study conducted in the preferred domain as well develop effective communication skills for presentation of project related activities. (L3)
4BCS621	No-SQL DATABASES	C609.1	Elaborate the fundamental concepts of No-SQL databases. (L2)
		C609.2	Analyze the features and use cases of key-value databases. (L3)
		C609.3	Explain the features and challenges pertaining to document databases. (L2)
		C609.4	Illustrate the characteristics of column oriented No-SQL databases. (L4)
		C609.5	Describe the design and use cases of graph databases. (L3)
4BCS622	STORAGE AREA NETWORKS	C610.1	Explain basic concepts for Storage systems (L2)
		C610.2	Apply the concepts of storage networking technologies. (L3)
		C610.3	Explain the concepts in Backup, Archive and Replication. (L2)
		C610.4	Analyse the concepts of cloud computing and virtualization. (L4)
		C610.5	Explain various concepts in managing and securing storage infrastructure (L2)
		C611.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C611.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C611.3	Design IIR and FIR filters. (L3)
		C611.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)

4BCS623	DIGITAL SIGNAL PROCESSING	C611.5	Explain the DSP processors and getting the concept of Image processing. (L2)
		7th Semester	
4BCS701	MACHINE LEARNING	C701.1	Explain basic concepts of Machine Learning. (L2)
		C701.2	Analyse Data to perform Exploratory Data Analysis. (L4)
		C701.3	Implement Supervised Machine Learning algorithms to solve problems. (L6)
		C701.4	Implement Un-Supervised Machine Learning algorithm to analyses data. (L6)
		C701.5	Evaluate models to perform Model Selection. (L5)
4BCS702	PYTHON PROGRAMMING	C702.1	Explain the syntax and semantics of Python Programming language. (L2)
		C702.2	Demonstrate proficiency in handling Strings and File systems. (L2)
		C702.3	Apply python packages in solving real-time problems. (L3)
		C702.4	Build Web Services and introduction to Network and Database Programming in Python. (L3)
		C702.5	Interpret Data Visualization concepts in Python. (L2)
4BCS703	INTERNSHIP	C703.1	Demonstrate the skills in professional career goals. (L2)
		C703.2	Administer the insight into a possible career path of interest with organizational structure, roles and responsibilities. (L3)
		C703.3	Develop professional connections with leadership strategy and skill development. (L4)
		C703.4	Identify the professions to suit the interest as a result of this experience. (L3)
		C703.5	Conquer additional skills that will need to be developed to ensure career readiness such as new technology, developing a broader network, additional coursework. (L4)
4BHS704	PREPARE PROGRAM – V	C704.1	Students will be able to apply number theory concepts and formulas to solve problems of base system, remainder theorem etc. (L3)
		C704.2	Students will be able to categorize contradictions within the area of binary logic to solve problems using concepts of contradictions truth tellers, liars and alternators.
		C704.3	Students will be able to solve types of pattern recognition problems (fillers, calendar etc) by utilizing different functions that fit the given criteria. (L3)
		C704.4	Students will be able to analyze the sufficiency of data and interpret its specific components by solving problems using data reasoning and interpretation of its numerical and graphic representations. (L4)
		C704.5	Students will be able to make use of advanced arithmetic, algebra and mensuration techniques to solve a variety of problems using a range of concepts from partnership to permutation & combination. (L3)
		C704.6	Students will be able to apply written and verbal communication techniques by articulating themselves in the format of discussion, debate, interview, essay, letter etc. (L3)
		C705.1	Demonstrate engineering knowledge and its framework for its implementation in the project design as well work in groups taking leadership role and communicate effectively (L2)
		C705.2	Survey relevant literature in the chosen field of study that allows interrelation of design and research (L4)
		C705.3	Model a prototype/ concept design that exhibits the feasibility of the solution from cost, engineering and environmental aspects. (L3)

4BCS705	CAPSTONE PROJECT – DESIGN	C705.4	Justify the project design with a structured report that covers all the work carried out between framing the problem statement to the project design. (L5)
		C705.5	Design conceptual ideas that address the issues with respect to real world problems. (L6)
4BCS731	ETHICAL HACKING	C706.1	Describe the basics of the ethical hacking. (L2)
		C706.2	Describe the foot printing and scanning. (L2)
		C706.3	Demonstrate the techniques and countermeasures for system hacking. (L3)
		C706.4	Characterize the malware and their attacks. (L2)
		C706.5	Analyze and prevent the security attacks in different environments. (L4)
4BCS732	REAL TIME SYSTEMS	C707.1	Characterize real-time systems and describe their functions. (L2)
		C707.2	Analyze various Clock-Driven Scheduling approaches. (L3)
		C707.3	Apply formal methods to analyze and design a priority-driven scheduling of periodic tasks. (L4)
		C707.4	Compare the methods for scheduling aperiodic and sporadic jobs in priority-driven systems. (L3)
		C707.5	Analyze various resources and resource access control approaches. (L3)
4BCS733	QUANTUM COMPUTING	C708.1	Describe the framework of quantum computation
		C708.2	Explain the differences between classical computation and quantum computation
		C708.3	Explain the concept of quantum entanglement and quantum teleportation
		C708.4	Implement single cubic gates
		C708.5	Explain how quantum computation may be applied in future technologies
4BCS741	OPTIMIZATIO N TECHNIQUES	C709.1	Remember the basic concepts of optimization. (L1)
		C709.2	Recognize methods of optimization techniques. (L2)
		C709.3	Formulate and solve linear programming problems. (L2)
		C709.4	Obtain solutions to constrained and unconstrained Non-linear programming problems. (L2)
		C709.5	Determine the integer solutions to Linear Programming Problems. (L2)
4BCS742	DIGITAL SIGNAL PROCESSING	C710.1	Explain the sampling theorem and characterize basic properties of discrete time signals and systems and also estimate the response of the system through convolution. (L2)
		C710.2	Demonstrate the frequency transforms for the signal using DFT, FFT and DCT. (L2)
		C710.3	Design IIR and FIR filters. (L3)
		C710.4	Familiarize the basic mechanism of speech production and learn the basic concepts of methods for speech analysis and parametric representation of speech. (L2)
		C710.5	Explain the DSP processors and getting the concept of Image processing. (L2)
4BCS743	EMBEDDED SYSTEMS	C711.1	Classify an Embedded systems based on its attributes and illustrate various steps in design process.
		C711.2	Distinguish various I/O ports, communication protocols and Timers used in an Embedded system.
		C711.3	Classify and explain various peripherals of an Embedded Systems.
		C711.4	Demonstrate characteristics and attributes of an embedded system, hardware /software co- design and firmware design approaches. (L2)
		C711.5	Explain the need of real time operating system for embedded system applications. (L2)

8th Semester			
4BHS801	PROFESSIONAL ETHICS FOR ENGINEERS	C801.1	Describe the Moral Values and Ethics. (L1)
		C801.2	Explain the Engineering Ethics. (L1)
		C801.3	Discuss the Responsibility as Engineers. (L2)
		C801.4	Examine the Safety and Risk. (L2)
		C801.5	Predict the working Ethics for Engineers. (L2)
4BCS802	SOFTWARE TESTING	C802.1	Apply software testing knowledge and engineering methods. (L3)
		C802.2	Identify various software testing problems, and solve the problems. (L2)
		C802.3	Design and conduct various levels of software testing for a software project. (L4)
		C802.4	Apply various communication methods and ethical skills in practice-oriented software testing projects. (L3)
		C802.5	Analyze the needs of software test automation and develop a test tool to support test automation. (L2)
4BCS803	DEEP LEARNING	C803.1	Apply concepts of RNN and LSTM. (L3)
		C803.2	Demonstrate concepts of Self-organizing maps in real-world applications. (L3)
		C803.3	Illustrate Problems through pre trained model such as auto-encoders. (L3)
		C803.4	Interpret about Boltzmann machines and its applications. (L3)
		C803.5	Apply the concept of GANs and know its applications. (L4)
4BCS804	INTERNET OF THINGS	C804.1	Explain the concept of IoT. (L2)
		C804.2	Analyze various protocols for IoT. (L2)
		C804.3	Design a PoC of an IoT system using Rasperry Pi/Arduino. (L4)
		C804.4	Apply data analytics and use cloud offerings related to IoT. (L3)
		C804.5	Analyze applications of IoT in real time scenario. (L2)
4BCS805	CAPSTONE PROJECT – BUILD	C805.1	Compare the project built with other possible existing solutions to come to a conclusion about its feasibility and reliability. (L4)
		C805.2	Utilize proper project management techniques and planning methods to produce cost effective projects (L3)
		C805.3	Recommend the need to implement the project with supporting justification and possible areas to improve it and Compile a clear report containing the step by step process of building the project that includes all calculations, analysis and fabrication methods involved. (L5)
		C805.4	Build the real world implementation of the design that will realize the objectives of the prototype/ design. (L6)
		C805.5	Demonstrate working in groups taking leadership role and communicating effectively. (L2)
4BCS851	COMPUTER VISION	C806.1	Identify fundamental image processing techniques required for computer vision. (L1)
		C806.2	Represent chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections, 3D vision techniques. (L2)
		C806.3	Illustrate boundary tracking techniques. (L5)
		C806.4	Analyze and Implement motion related techniques. (L4)
		C806.5	Construct applications using computer vision techniques. (L3)
4BCS852	NATURAL LANGUAGE PROCESSING	C807.1	Analyze the natural language text. (L4)
		C807.2	Create the natural language. (L6)
		C807.3	Analyze Text mining. (L4)
		C807.4	Evaluation of Self Explanation (L2)
		C807.5	Apply information retrieval techniques. (L3)
		C808.1	Explain the concepts of Data mining and its issues. (L1)
		C808.2	Analyze and apply association rule mining techniques. (L3)
		C808.3	Analyze various classification algorithms. (L2)
		C808.4	Elaborate the clustering algorithms. (L3)
		C808.5	Explain various density based methods. (L1)

4BCS853	DATA MINING		
		C809.1	Explain the fundamentals of Digital forensics. (L2)
		C809.2	Illustrate computer forensic techniques to identify the digital forensics associated with criminal activities. (L2)
		C809.3	Apply forensic analysis tools to recover important evidence for identifying computer crime. (L3)
		C809.4	Explain Computer Crime and Criminals and Liturgical Procedures. (L2)
4BCS854	DIGITAL FORENSICS	C809.5	Analyze laws and ethics involved in cybercrime. (L4)
		C810.1	Explain the models of distributed computing. (L2)
		C810.2	Analyze distributed shared memory models. (L4)
		C810.3	Design and Implement distributed file systems. (L6)
		C810.4	Build the distributed algorithms for handling deadlocks. (L3)
4BCS8555	DISTRIBUTED COMPUTING	C810.5	Importance of the inherent difficulties that arise due to distributedness of computing resources. (L5)

SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Information Technology

COs

2023 Batch

I SEMESTER

4MATH1011: ENGINEERING MATHEMATICS-I
Course Outcomes:
On successful completion of the course, students will be able to: **CO1: Apply the knowledge of calculus to analyze and approximate the functions. L3** **CO2: Calculate rates of change of multivariate functions. L3** **CO3: Solve multiple integrals for computing area and volume. L3** **CO4: Make use of Gradient, divergence and curl for solving Engineering problems. L3** **CO5: Use the concept vector integration to solve the flow problems. L3**

4PHYS1011: ENGINEERING PHYSICS
Course Outcomes:
On successful completion of the course, students will be able to: **CO1:** Plot the I-V characteristics of photo-diode, LED and solar cells. L3 **CO2:** Make use of Lasers and Optical fibers for different industrial applications. L3 **CO3:** Explain the use of Semiconducting and Superconducting materials for different Engineering applications. L2 **CO4:** Analyze the applications of quantum mechanics in technology. L4 **CO5:** Infer the results obtained in different experiments. L4

4ENEE1081: ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Outcomes:
On successful completion of the course, students will be able to: **CO1: Analyze electrical circuits by relevant Laws in DC circuits. L4** **CO2: Demonstrate the single phase and three-phase power generation by using the phasor diagrams. L3** **CO3: Analyze digital circuits L4** **CO4: Demonstrate the knowledge of Karnaugh maps by simplifying the algebraic equations and design the combinational circuits. L2**

4CSGC1011: ELEMENTS OF COMPUTER ENGINEERING

Course Outcomes:
On successful completion of the course, students will be able to: **CO1:** Demonstrate functioning of different sub-systems, OS and different types of OS. L3 **CO2:** Use different types of data structures, operations and algorithms. L3 **CO3:**Describe the fundamental elements of relational database management systems. L2 **CO4:** Comprehend the layered protocol model & Classification of networks. L3 **CO5:** Demonstrate need for Linux OS and Linux commands. L3

4ENME1011: COMPUTER AIDED ENGINEERING DRAWING
Course Outcomes:
On successful completion of the course, students will be able to: **CO1:** Illustrate competence in basics of orthographic projections of points, lines, planes and solids in three different views. L3 **CO2:** Apply the concepts of orthographic projections for simple objects L3 **CO3:** Develop surfaces of solids of simple objects. L3

CPSHD1011 Design Thinking-1
Course Outcomes: On successful completion of the course, Students will be able to,
O1: Apply teamwork towards building a solution. (Level 3) O2: Apply basic Design Research (Level 3) O3: Apply brainstorming as a way of innovative thinking. (Level 3) O4: Apply story-telling in Design Thinking. (Level 3)

Oral and Written Communication Course Code: CPSHL2041 (SOET) Batch- 2023
Course Outcomes: On successful completion of the course, Students will be able to:
CO1: Identify the Speech sounds and accent of British English and American English. (L1) CO2: Express themselves in different professional setting. (L2) CO3: Use the different methods and classifications of reading. (L3) CO4: Draft letters, E-mails using appropriate tone and structure. (L3) CO5: Construct sentences to improve their Verbal Skills.(L3). (L4)

II SEMESTER

4MATH1021: ENGINEERING MATHEMATICS II	
Course Outcomes:	
On successful completion of the course, students will be able to: **CO1:** Solve first order linear ordinary differential equations L3 **CO2:** Solve higher order differential equations arising through physical processes. **CO3:** Construct a variety of partial differential equations and solve them. **CO4:** Use periodic signals to represent periodic functions in the form of Fourier series. **CO5:** Make use of matrix theory for solving system of linear equations	L3 L4 L3 L3

4CHEM1012: ENGINEERING CHEMISTRY	
Course Outcomes:	
On successful completion of the course, students will be able to: **CO1:** Explain the construction and working of Energy storage devices. **CO2:** Explain corrosion of metals, factors and prevention techniques. **CO3:** Explain the importance of the modern emerging field of nanotechnology. L2 **CO4:** Use instruments which give quick and accurate results for material analysis. **CO5:** Carry out different types of titrations for estimation of concentration of an analyte.	L2 L2 L3 L3

4ENME1022 : ELEMENTS OF MECHANICAL ENGINEERING AND WORKSHOP	
Course Outcomes:	
On successful completion of the course, students will be able to: **CO1** Recognize the impact of energy sources on the environment and sustainability.	L

CO2 Explain the working principles of water, vapour and gas-powered systems.	
CO3 Discuss the working principles of refrigeration systems and IC engines.	2
CO4 Compute various performance parameters of IC engines.	L2
CO5 Demonstrate soldering, brazing and welding of sheet metal & welded joints.	L2
	L3
	L2

4ENCV1011: ELEMENTS OF CIVIL ENGINEERING	
Course Outcomes:	
On successful completion of the course, students will be able to:	
CO1: Explain the basics of Civil Engineering and related fields.	L2
CO2: Develop working models with the laws of mechanics.	L3
CO3: Analyze equilibrium of coplanar, concurrent and non-concurrent forces.	
L4 **CO4:** Determine centroid and moment of inertia of simple geometric figures.	
L3 **CO5:** Apply D'Alembert's principle in any specific application.	
L3	

4CSPL1011: PROBLEM SOLVING USING PYTHON	
Course Outcomes:	
On successful completion of the course, students will be able to:	
CO1: Understand the basis of algorithm problem solving	L2
CO2: Read/Write simple simple python programs	L3
CO3: Develop python programs with conditionals and loops	L4
CO4: Use python functions and python data structures	L3
CO5: Read and write data from/to files in python programs	L3

CPHSD2011 Design Thinking-2
Course Outcomes: On successful completion of the course, Students will be able to:
CO1: Create an appropriate research plan to explore the problem, execute the design research and present findings as a team. (level 5)
CO2: Evaluate research findings, identify insights and brainstorm solutions as a team. (level 4)
CO3: Create a prototype and iterate based on feedback received as a team. (level 5)

CPSSF1011: French –Level-1
Course Outcomes: On successful completion of the course, Students will be able to,

CO1: Introduce themselves and others, and use common French salutations appropriately.(L1,L2)
CO2: Use polite expressions in French appropriately in social interactions. (L2)
CO3: Discuss daily activities with improved fluency and accuracy (L3)
CO4: Identify and use parts of speech correctly in sentences.

CPSSF1021: German – Level-1
Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Introduce themselves and others, and use common German salutations appropriately.(L1,L2)
CO2: Use polite expressions in German appropriately in social interactions. (L2)
CO3: Discuss daily activities with improved fluency and accuracy (L3)
CO4: Identify and use parts of speech correctly in sentences.

CPSSF1041: Spanish –Level-1
Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Introduce themselves and others, and use common Spanish salutations appropriately.(L1,L2)
CO2: Use polite expressions in Spanish appropriately in social interactions. (L2)
CO3: Discuss daily activities with improved fluency and accuracy (L3)
CO4: Identify and use parts of speech correctly in sentences.

FUNCTIONAL ENGLISH **Course Code: CPSAL1111 Batch:2023**
Course Outcomes: On successful completion of the course, Students will be able to:
CO1: Define Social Values and Critical Thinking skills (L1)
CO2: Compare the poetical terms and integrate creative ideas in the English Language. (L2)
CO3: Develop vocabulary and interpret in one academic and professional life.(L2)
CO4: Develop skills of comprehending and analytical to improve their language proficiency. (L3) CO5: Construct sentences to improve their Verbal Skills.(L3)
GPSDR1081: Personal Effectiveness

Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Students will be able to set clear and achievable goals that align with personal objectives. (L3) CO2: Students will be able to make informed decisions based on data, consider multiple options, and evaluate potential outcomes. (L5) CO3: Students will be able to understand and manage one's own emotions, and empathize with and respond to the emotions of others. (L2/L3) CO4: Students will be able to take responsibility for one's actions, and demonstrate integrity and trustworthiness in professional and personal relationships. (L5)

III Semester

4MATH2041-Probability and Statistics (Semester III-Common to CS/IT/DS/ML)
Course Outcomes:
On successful completion of the course, students will be able to: CO1: Apply Binomial and Normal distribution concepts to solve probability problems -L3 CO2: Apply the knowledge of covariance and correlation to solve joint probability problems -L3 CO3: Explain the concept of testing of hypothesis for small and large samples -L2 CO4: Solve continuous and discontinuous piecewise linear functions using linear least square- L3 CO5: Apply least square techniques in solving various engineering problems -L3

4CSPL1121: Programming in C and Data Structures
Course Outcomes:
On successful completion of the course, students will be able to: **CO1:** Explain the basic computer concepts and programming principles of C language L2 **CO2:** Develop C programs to solve simple mathematical, engineering problems using conditionals and looping constructs. L3 **CO3:** Use different types of data structures, operations and algorithms L3 **CO4:** Use different types of data structures, operations and algorithms L3 **CO5:** Implement and utilize stack, queue, linked list, tree, and graph data structures in problem- solving. L3

4ENIT3072: Computer Networks		
Course Outcomes (COs): On successful completion of the course, students will be able to:		
CO1	Interpret the different building blocks of Communication network and its architecture	L2
CO2	Identify and analyze error and flow control mechanisms in data link layer	L3
CO3	Design subnetting and analyze the performance of network layer	L3
CO4	Construct and examine various routing protocols and to find suitable Application layer protocols for specific applications and its respective security mechanisms	L3
CO5	Construct and examine various routing protocols and to compare various congestion control mechanisms and identify appropriate Transport layer protocol for real time applications	L3

4ENIT3011 - Computer Organization and Architecture	
Course Outcomes:	
On successful completion of the course, students will be able to:	
CO1: Illustrate the various functional units of digital computers	L4
CO2: Illustrate different concepts of CPU	L3
CO3: Outline instruction execution using pipeline	L3
CO4: Apply various hardware software concepts on instructions to exploit ILP	L2
CO5: Explain Cache optimization techniques to improve system performance	L2

CKSAM1051: Indian Constitution
Course Outcomes: On successful completion of the course, Students will be able to,
01: Study a particular event in Indian history and trace the impact that can be felt to the present day. (L1)
02: Understand the impact of the way a democracy is structured. (L2)
03: Understand the freedoms that a citizen of India has, and what those mean in daily life. (L2)
04: Understand the duties of an Indian citizen and how they translate to daily life. (L2)
05: Gain an understanding of the workings of the government in their residential locality. (L2)
06: Trace the impact of a single vote from their area of residence to the national scale. (L3)
07: Understand the Indian democratic process and their role in it. (L2)
08: Identify ways in which they can contribute to the progress of the country. (L3)

[CKSAA1033]: Introduction to Philosophical Thought
Course Outcomes: On successful completion of the course, students will be able to:
CO1: Examine various philosophical systems and apply the concepts to actual states of affairs. (L4) CO2: To be able to evaluate the moral acts of individuals belonging to different cultures and societies. (L4) CO3: Analyze, evaluate, and recognize their psychic inclination towards the specific philosophical thought system. (L6)

Preparing for Aptitude Tests [UG- 1/4]
Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Understand how to use calculation techniques for quick calculations and manipulation of numbers. [Level-1] CO2: Understand the number theory to solve problems. [Level-1] CO3: Understand the concepts of percentages and exponents for computing simple and compound interests. [Level-1] CO3: Understand how to solve problems of various arrangements (Circular and Linear). [Level-1] CO4: Understand distributive arrangements that adhere to the given parameters. [Level-1] CO5: Understanding data by analyzing it, grasping its context, and extracting meaningful insights through informed inferences [Level-1]

Career Essentials GPSBD1171
Course Outcomes: On successful completion of the course, Students will be able to:
CO1: Assess personal strengths, weaknesses, and interests to construct a viable career plan. (L5) CO2: Analyse the importance of social and emotional intelligence to facilitate successful relationships. (L4) CO3: Understand the implications of digital footprints on personal and professional life. (L2) CO4: Construct a professional resume and customise it for various job applications / internship applications. (L3) CO5: Build awareness on thoughtfulness, develop honesty, discipline and decisiveness. (L3)

IV Semester

4MATH2051- Discrete Mathematics and Combinatorics (Semester IV-Common to CS/IT/DS/ML)
Course Outcomes:
CO1: Explain the propositional, predicate logic and truth table by evaluating correctness of argument -L2 CO2: Discuss the type of relationship and apply the knowledge using the Hasse diagram -L2 CO3: Demonstrate the knowledge of combinatorics by solving relevant problems.- L2 CO4: Explain the basic concepts of graph theory. L2 O5: Solve linear recurrence relations by recognizing homogeneity, linearity and constant coefficients. L3

4ENIT4021: Design and Analysis of Algorithms
Course Outcomes:
On successful completion of the course, students will be able to: **CO1:** Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands. L4, L6 **CO2:** Understand the basic concepts of data structures along with their applications. L5, L6 **CO3:** Understand the advantages and disadvantages of Divide and Conquer strategy and the application in various fields L2, L5 **CO4:** Understand the concept of Dynamic programming with the help of various examples. L2, L4 **CO5:**Understand backtracking techniques and some branch and bound problems. L2, L3

4ENIT3062: ARTIFICIAL INTELLIGENCE		
Course Outcomes (COs):		
On successful completion of the course, students will be able to:		
CO1	Elucidate the basic concepts of Artificial Intelligence	L2
CO2	Analyze Artificial Intelligence techniques, such as search algorithms, for problem solving	L4
CO3	Apply techniques of Knowledge Representation and Planning	L3
CO4	Apply knowledge of reasoning in the presence of incomplete or uncertain information	L3
CO5	Explain different forms of Learning	L2

4ENIT3052 – Software Engineering		
Course Outcomes:		
On successful completion of the course, students will be able to:		
CO1	Identify the various aspects of software product engineering	L1
CO2	Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design) as well as the managerial aspects (planning, scheduling, and delivery)	L3
CO3	Understand the basics of software testing	L2
CO4	Explain the various software cost estimation models	L2
CO5	Apply quality attributes in software development life cycle	L3

4CSPL2012: WEB DEVELOPMENT USING PYTHON AND DJANGO	
Course Outcomes:	
On successful completion of the course, students will be able to:	
CO1: Create database using SQLite	L6
CO2: Create web client programs using python	L6
CO3: Create web server programs using python	L6
CO4: Create website using Django framework	L6
CO5: Create to-do application using Django and React JS	L6

CPSES1011: MAKING WITH ELECTRONICS	
Course Outcomes:	
On successful completion of the course, students will be able to:	
CO1: Demonstrate the interfacing of basic input and output devices using Arduino.	L2
CO2: Explain the working principles of various sensors and renewable energy sources.	L2
CO3: Apply the understanding of Arduino programming by interfacing sensors and communication devices.	L3
CO4: Analyze and Build a real-time application employing Arduino / Raspberry Pi.	L4
CO5: Demonstrate the project	L3

CKSMM1012 - Critical Inquiry (CIY)
Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Examine their own of thinking and apply critical inquiry in dealing with their day-to day life challenges (L 5)
CO2: Investigate into the origins and sources of their beliefs and knowledge system (Indian and Western doctrines). (L5)
CO3: Evaluate and implement the methods of logical reasoning in their decision making (L5)
CO4: Construct arguments based on the principles of validity and soundness ()(L 6)
CO5: Analyze the value of diverse perspectives and varied interpretation of same information. (L4)

PSBD1191: Career Readiness
Course Outcomes: On successful completion of the course, Students will be able to,
CO1: Students will be able to identify personal values, interests, and skills and connect them to potential career paths. (L3)
CO2: Students will be able to develop effective communication skills and build a network of professional connections. (L5)
CO3: Students will be able apply problem-solving and critical thinking skills, and apply workplace etiquette and professionalism in their workplace. (L3)
CO4: Students will be able to work collaboratively in a team to achieve work-related goals.(L3)

Preparing for Aptitude Tests [UG-2/4]
Course Outcomes: On successful completion of the course, Students will be able to,
O1: Understand the concepts of ratio, proportions, and averages to calculate class/set relationships. [Level-1] O2: Understand the theory of linear and quadratic equations using methods of equation formation. [Level-1] O3: Understand how to solve problems relating to equations, averages, mixtures, and alligations. [Level-1] O4: Understand the sufficiency of data and interpret its specific components by solving problems. [Level-1] O5: Understand the four types of logical statements to solve puzzles based on syllogisms and apply the concepts of Venn diagrams to solve puzzles using set theory. [Level-1]

CURRICULUM GLOSSARY

Credit Distribution: Allocation of credits under lecture (L), tutorials (T), and practical (P) viz. L- T-P-C. Eg. A 4-credit course has a credit distribution as 3-0-1-4 implying 3 credits for lecture and 1 credit for practicals and total of 4 credits

Program Core (Credit Courses):

Each academic programme is divided into mandatory and choice segments, with levels within them. Mandatory segments are those which lay a firm foundation of the knowledge required to complete a programme in the chosen domain, ending with a multifaceted assignment that serves as a culminating academic and intellectual experience for students, typically during their final year. Choice segments are those which a student could opt for to specialize further and / or to improve their interdisciplinary skills. All segments carry credits, and the students are expected to earn the minimum number of credits in their coursework towards program core during their academic programme. The Program Core courses are categorized as follows:

a. **Foundation:** A core course that must be satisfactorily completed in order to complete the requirements of the program. It lays the foundations for higher level courses. A foundation course assures that students are academically and personally ready to progress their degree. The foundation courses are further categorized as follows:

i. **Fundamental:** A required course you have to complete in order to enroll in a more advanced course. The prerequisite course usually teaches the basic information necessary to succeed in the more advanced course. It is the most basic or most important course on which other courses depend.
ii. **Intermediate:** Courses that are suitable for learners with some degree of skill or competence in that particular discipline area of study
iii. **Advanced:** Courses that involve higher and more complex levels of knowledge and understanding than introductory or foundational learning. It means the student has attained a level of knowledge and understanding of a particular area or topic that goes beyond basic terminology and definitions and is ready to be involved in Analysis, Synthesis and Evaluation of information related to a specific topic or area of learning.

b. **Elective:** A course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course. Elective courses can fall either under specialization or general category.

i. **General:** Courses that are designed to develop learners' general knowledge, skills and attitudes, often to prepare students for more advanced education programmes. General courses complement the more specialized learning undertaken in a student's chosen field of study and contributes to the flexibility which graduates are increasingly required to demonstrate.
ii. **Specialization:** A set of related courses which are structures for students to achieve specific learning outcomes. Specializations can be in a single discipline or multi-disciplinary. Specialization courses is a specified sequence of courses that equips one with specialized knowledge in one's discipline

c. **Interdisciplinary:** These are courses that are entirely outside of the program of study. One may take the course from other disciplines, as long as one meets the course requirements (prerequisites)

d. **Mini Project:** A mini project is considered as a special course involving application of knowledge gained from studying a particular discipline or a particular area of the program of study in solving / analyzing /exploring a real-life situation / difficult problem. A process that fosters learners' engagement in studying authentic problems or issues centered on a particular project, theme, or idea. This process is inquiry-based, outcome- oriented, and associated with conducting the curriculum in real-world contexts.

e. **Internship:** An internship is a full-time or part-time work experience during the program study for which one earns course credit and may be paid or considered as volunteer work. Internships allow students to gain real-world experience, determine if they have an interest in a particular career and create a network of professional contacts.

f. **Dissertation:** An elective course designed to acquire special / advanced knowledge, which a student studies on his own with an advisory support by a faculty member. Dissertation is an ordered and critical exposition of existing knowledge in any field or part of a field of study and is expected to provide a good training for the student in R&D work and technical leadership.

g. **Capstone project**: A final course in a sequence of courses that provides an opportunity for students to integrate the knowledge and skills they have acquired. The learning outcomes of the capstone will normally map into the learning outcomes for the program. It is a substantial, compulsory project that consolidates one's learning and demonstrates that one has acquired the necessary skills and knowledge during the program of study. One usually completes it during the final year of your course.

Common Core (Credit Courses):

Students are expected to earn a certain specified number of credits in their coursework towards Common Core, during their academic programme. While some courses are in workshop mode, which can be completed over a few days at a stretch, there are other courses which are offered for a few hours per week throughout a semester. Students take these courses planned for each academic programme, over multiple semesters. Credits range from 1 to 4, which are directly proportional to the number of hours required to complete a course. There are both 'mandatory' and 'choice' courses, with levels within them.

Common Core (Non – Credit): Graduate Requirement:

Engagements under this category do not carry credits but are mandatory for the students to complete them during the academic programme, to be considered eligible to graduate / earn the degree. These could be:

1. **Courses** embedded in the academic programme, where the students must ensure that they attend a minimum of 75% of the classroom hours and meet the assessment criteria, if any.
2. **Community Service activities** under which the students have to log a minimum number of hours in a semester by rendering certain prescribed services to the society

and collect evidence from the concerned authority for having done so. A reflective presentation on the learning and experience gained, together with the impact on the society has to be submitted on completion of the required no. of hours as per the respective program.

Courses under various categories can be further classified as:

- **100 Level Courses**: These courses offer an introduction to a subject area and are designed for students in the first year of study. These courses have no prerequisites and are generally courses defining basic concepts or presenting the terminology of a discipline
- **200 Level Courses**: These courses are built on previous units and are normally taken in the second year or later; they may also be available to students with advanced prior knowledge. They are Courses of intermediate college-level difficulty; courses with 100-level course(s) as prerequisite(s)
- **300 Level Courses**: These courses are usually taken in third year or later, after 200-level study in the area. They may also be available to students with advanced prior knowledge. They are courses of advanced college-level difficulty offered for students clearly interested in the discipline or in any stream of the discipline
- **400 Level Courses**: These units of study are advanced courses and are normally taken in the third year or later as the final elements of a three year or four-year degree or an integrated

degree. The level indicates that the student will be demonstrating coherence and breadth or depth of knowledge and skills. The student may need to have completed a prerequisite course to study a 400-level course.

Prerequisite: A prerequisite to ‘’Course X’’ is a course that must be successfully completed before the student can undertake ‘’Course X’