Department of Computer Science

Sukanta Mahavidyalaya

Dhupguri, Jalpaiguri

Programme Outcomes, Programme Specific Outcomes and Course Outcomes for UG Programme

Programme Name: ***B.Sc Computer Science Honours***

Number of Semesters: 6

Programme Outcomes

The Computer Science Department's Bachelor of Computer Science Honours course must enable students to attain, by the time of graduation:

- With the B.Sc. Computer Science, students will be able to apply for a range of computational and mathematical jobs in the creative industries, business, finance, education, medicine, engineering and science.
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computational systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- Provide students with knowledge, general competence, and analytical skills in Computer Science on an advanced level.
- Prepare them for academics, industry, and research.
- Provide hands-on experience to apply computing skills in all other fields of study like Mathematics, Geography, Bio Sciences, Physics, Chemistry, Linguistics, Music, Medical Sciences etc.

Programme Specific Outcomes

Students will:

- Become technology-oriented with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer systems and technology on people and society as a whole.
- Acquire some development experience within a specific field of Computer Science, through project work.
- Gain ability to apply knowledge of Computer Science to the real-world issues.
- Get familiar with current research trends in various fields of Computer Science.
- Use creativity, critical thinking, analyses and research skills.
- Get prepared for placement by developing personality and soft skills.
- Gain ability to communicate scientific information in a clear and concise manner.
- Build up programming, analytical and logical thinking abilities.
- Know the recent developments in IT, future possibilities and limitations, and understand the value of lifelong learning.
- Get an ability to participate in debates, discussions in the society constructively.

Course Outcomes

SEMESTER—I		
Course Code	**Course Name**	**Course Outcomes**
CC 12	**Programming Fundamentals using C**	Knowledge gained: • Understanding a functional hierarchical code organization. • Ability to define and manage data structures based on problem subject domain. • Ability to work with textual information, characters and strings. • Ability to work with arrays of complex objects. • Understanding a concept of object thinking within the framework of functional model. • Understanding a concept of functional hierarchical code organization. • Understanding a defensive programming concept. Ability to handle possible errors during program execution.

		Skills gained: • Logical thinking • C Programming Competency developed: • Ability to write programs of moderate complexity in C Programming • Developing real world application using C Programming
CC 13	**Computer System Architecture**	Knowledge gained: • Understand the theory and architecture of hardwired and microprogram controlled central processing units
		• Learn the concepts of parallel processing, pipelining and inter-processor communication. • Define different number systems, binary addition and subtraction, 2's complement representation and operations Skills gained: • Analyze some of the design issues in terms of speed, technology, cost, performance • Design a simple CPU with applying the theoretical concepts • Understand the architecture and functionality of central processing unit Competency developed: • Use appropriate tools to design verify and test the CPU architecture. • Exemplify in a better way the I/O and memory organization.
CC 12L	**Programming Fundamentals using C Lab**	Knowledge gained: • This lab work provides hands-on experience for C Programming. • Read, understand and trace the execution of programs written in C language. • Write the C code for a given algorithm. • Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor. • Write programs that perform operations using derived data types Skills gained: • Programming in C Competency developed: • Developing application to solve real world problem using C
CC 13L	**Computer System Architecture Lab**	Knowledge gained: • Analyze the behaviour of logic gates • Understanding the behavior of Logic Gates, Adders, Decoders, Multiplexers, Demultiplexer, Encoder, Decoder and Flip-Flops. • Design combinational circuits for basic components of computer system and applications. • Analyze the operational behaviour and implement various flip-flop, registers, Counters.

Semester II		
Course Code	**Course Name**	**Course Outcomes**
CC 22	**Programming in JAVA**	Knowledge gained: • This lab work provides hands-on for Java. • Java Programming assignments based on class, inheritance, abstraction, encapsulation, dynamic binding, polymorphism, I/O systems, exception handling Skills gained: • Programming in Java Competency developed: • Developing application to solve real world problem using Java • Implement core Java programs to solve simple problems • Implement Client and Server end Java programs Knowledge gained
CC 23	**Discrete Structures**	Knowledge gained: • basics of Combinations and Permutations • relations matrices and graphs. Skills gained: • Mathematical and logical thinking towards a real world problem solving • Mathematical modelling of real world problems • Demonstrate the working of Grammars and Languages Competency developed: • Comprehend and evaluate mathematical arguments revolving around computation • Apply the knowledge on Graphs and Trees to real world applications.
CC 22L	**Programming in JAVA Lab**	Knowledge gained: • This lab work provides hands-on for Java. • Java Programming assignments based on class, inheritance, abstraction, encapsulation, dynamic binding, polymorphism, I/O systems, exception handling

		Skills gained: • Programming in Java Competency developed: • Developing application to solve real world problem using Java • Implement core Java programs to solve simple problems Implement Client and Server end Java programs Knowledge gained.
Semester III		
Course Code	**Course Name**	**Course Outcomes**
CC 31	**Data Structures**	Knowledge gained: • Describe how arrays, records, linked structures, stacks, queues, trees, andgraphs are represented in memory and used by algorithms • Describe common applications for arrays, records, linked structures,stacks, queues, trees, and graphs • Write programs that use arrays, records, linked structures, stacks, queues,trees, and graphs • Demonstrate different methods for traversing trees • Illustrate various technique to for searching, Sorting and hashing • Describe the concept of recursion, give examples of its use, describe howit can be implemented using a stack • Discuss the computational efficiency of the principal algorithms forsorting, searching, and hashing. • Summarize different categories of data Structures Skills gained: • Compare alternative implementations of data structures with respect toperformance • Compare and contrast the benefits of dynamic and static data structuresimplementations • Explain the significance of dynamic memory management Techniques • Identify different parameters to analyze the performance of an algorithm. Competency developed: • Choose appropriate data structures to solve real world problems efficiently. • Design and implement an appropriate hashing function for an application • Design algorithms to perform operations with Linear and Nonlinear data structures
CC 32	**Operating Systems**	Knowledge gained: • To understand Complexity of Operating system as a software • To understand design issues related to process management and various related algorithms • To understand design issues related to memory management and various related algorithms • To understand design issues related to File management and various related algorithms • Allocate Main Memory based on various memory management techniques • Compare Memory allocation using Best fit, Worst fit, and first fit policies • Apply page replacement policies for dynamic memory management

		• Schedule CPU time using scheduling algorithm for processors • Compare various device scheduling algorithms Skills gained: • To evaluate, and compare OS components through instrumentation for performance analysis. • To analyze the various device and resource management techniques for timesharing and distributed systems Competency developed: • To design and understand the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems. • To develop and analyze simple concurrent programs using transactional memory and message passing, and to understand the trade-offs and implementation decisions
CC 33	**Computer Networks**	Knowledge gained: • Basic networking concepts, types of networks, various topologies andapplication of networks • types of addresses, data communication. • wired and wireless networks, its types, functionality of layer • importance of network security and cryptography • concept of networking models, protocols, functionality of each layer Skills gained: • Learn basic networking hardware and tools. • Create hybrid topologies using the existing topologies, and checkefficiency. • Apply different encoding and decoding mechanisms involved in different types of transmission media and to measure the transmission impairments. Competency developed: • Create a new protocol and test its efficiency. • Design various categories of networks and test thetransmission rate.
CC 31L	**Data Structures Lab**	Knowledge gained: • Write programs using structures, unions, dynamic memory allocation functions and command line arguments • Implement code for linear data structures like stacks, queues, linked listsusing static and dynamic allocation and their applications • Implement program for binary search tree using nonlinear data structure. • Write programs using arrays, strings, dynamic memory allocation functions • Implement program for binary search tree and Graphs using nonlinear data structure. Skills gained: • Programming real life application in C/C++ Competency developed: Understand and choose the appropriate data structure for solving realworld problems.

CC 32L	**Operating Systems Lab**	• Understand basic commands of Linux operating system and use them in Linux environment (ubuntu, fedora etc.) • Understand commands related to process control and apply them to manage processes. • Understand the concepts of control structure, loops, case and functions in shell programming and apply them to create shell scripts. • Associate the concepts of arrays with Linux and apply them to create, compile and execute shell script in Linux terminal • Compare different editors (vi, gedit, nano) and use them to create shell script for given problem • To understand the inner workings of UNIX-like operating systems.
CC 33L	**Computer Networks Lab**	• Understand the practical approach to network communication protocols. • Understand network layers, structure/format and role of each network layer. • Able to design and implement various network application such as data transmission between client and server, file transfer, real-time multimedia transmission. • Understand the various Routing Protocols/Algorithms and Internetworking.
SEC 35TL	**E1: Digital Electronics and System Maintenance**	• An ability to understand theory of Digital Design and Computer Organization to provide an insight of how basic computer components are specified. • An ability to understand the functions of various hardware components and their building blocks. • An ability to understand and appreciate Boolean algebraic expressions to digital design • An in depth understanding of realization of different combinational/sequential circuits • An in depth understanding of how different hardware components are related and work in coordination • An ability to understand computer buses and input/output peripherals
	E2: Website Design with HTML and PHP	Knowledge gained: • Learn Core-PHP, Server Side Scripting Language • Learn PHP-Database handling. • Learn different technologies used at client Side Scripting Language • Learn XML, CSS and XML parsers. • One PHP framework for effective design of web application. • Learn JavaScript to program the behavior of web pages. Skills gained: • Design and Develop Web Applications using HTML,CSS, JavaScript, XML, PHP. Competency developed: • Developing application to solve real world problems

	E3: Python Programming	Knowledge gained: • To understand why Python is a useful scripting language for developers. • To learn how to use lists, tuples, and dictionaries in Python programs. • To learn how to identify Python object types. • To learn how to use indexing and slicing to access data in Pythonprograms. • To define the structure and components of a Python program. • To learn how to write loops and decision statements in Python. • To learn how to write functions and pass arguments in Python. • To learn how to build and package Python modules for reusability. • To learn how to read and write files in Python. • To acquire programming skills in core Python. Skills gained: • Learn how to design and program Python applications. Competency developed: • To develop the ability to write database applications in Python • To develop the skill of designing Graphical user Interfaces in Python
Semester IV		
Course Code	**Course Name**	**Course Outcomes**
CC 41	**Design and Analysis of Algorithms**	Knowledge gained: • Analyze the running time and space complexity of algorithms. • Describe, apply and analyze the complexity of divide and conquer strategy. • Describe, apply and analyze the complexity of greedy strategy. • Describe, apply and analyze the complexity of dynamic programming strategy. • Explain and apply backtracking, branch and bound and string matching techniques to deal with some hard problems. • Describe the classes P, NP, and NP Complete and be able to prove that acertain problem is NP-Complete. • Describe analysis techniques for algorithms. • Identify appropriate data structure and design techniques for differentproblems • Identify appropriate algorithm to be applied for the various application likegeometric modeling, robotics, networking, etc. • Appreciate the role of probability and randomization in the analysis ofalgorithm • Differentiate polynomial and non-deterministic polynomial algorithms. Skills gained: • To provide mathematical approach for Analysis of Algorithms • To solve problems using various strategies • To provide mathematical approach for Analysis of Algorithms.

		• To teach advanced data structures. • To solve complex problems in real life applications. Competency developed: • To analyze strategies for solving problems not solvable in polynomial time Analyze various algorithms.
CC 42	**Software Engineering**	Knowledge gained: • Learn the phases of software development • Develop process models and process system models • Gather, understand, analyze and specify requirements • Elicit, analyze and model requirements • Schedule projects, identify risk strategies and manage risks. • Understanding importance of Object Orientation in Software engineering • Understand the components of Unified Modeling Language • Develop architectural diagram, and implement by following coding principles • Estimate software scope feasibility and resources • Identify and apply SQA tasks, goals, and metrics Skills gained: • To develop strategies to calculate risk factors involved in IT projects • To use project management software to control the design, implementation, closure, and evaluation of IT projects • To estimate, plan, calculate, and adjust project variables. Competency developed: • Apply project management practices to launch new programs, initiatives, products, services, and events relative to the needs of stakeholders. • Apply Agile process model for Software Development Apply testing strategies and handle software product maintenanceissues
CC 43	**Database Management Systems**	Knowledge gained: • Types of databases • Detailed architecture, define objects, load data, query data and performance tune databases. • Writing SQL queries for the given problem statement Skills gained: • Establish a basic understanding of the process of Database • Develop ER diagram for representing conceptual data model • Convert ER diagram into a set of relations representing logical data model Competency developed: • Gain ability to handle large volumes of structured, semi-structured, and unstructured data using database technologies. • Appreciate the need for DB approach and understand the components and roles of DBMS • Apply DB system development life cycle to business problems • Implement a set of relations in the chosen DBMS • Development and Administration using MySQL.

		• Analyze and Select storage and recovery techniques of database system. Competency developed: • Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
SEC 45TL	**E1: Android Programming**	Knowledge gained: • Pass data between fragments • To gain knowledge of installing Android Studio and Cross Platform Integrated Development Environment. • An ability to use the techniques, skills, and modern technology. Skills gained: • Debug android apps and create UI fragments • Create database and communicate with mobile apps Competency developed: • Design apps with audio play back. • To develop the different applications that mobile computing offers to people, employees, and businesses To develop high levels of technical competence in the field of mobiletechnology
	E2: Programming in MATLAB	Knowledge gained: • Able to implement loops, branching, control instruction and functions in MATLAB programming environment. • Able to program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems. • Able to understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB. • Able to simulate MATLAB Simulink examples Skill gained: • Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives. • Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors. Competency developed: • Fundamentals of MATLAB tool. • Program curve fitting & solve Linear and Nonlinear Equations. • Demonstrate understanding and use of fundamental data structures (classes). • Create and control simple plot and user-interface graphics objects in MATLAB.
	E3: VB.NET Programming	Knowledge gained: • Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic. • Describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE) • Create applications using Microsoft Windows Forms • Create applications that use ADO. NET

		Skill developed: • Create a rich GUI for web-based application using a rich set of controls • Create secure (authentication and authorization) web applications • Create asynchronous web applications using ASP.NET • Create and use web services • Deploy web applications Competency developed: • Analyze program requirements • Design/develop programs with GUI interfaces • Code programs and develop interface using Visual Basic .Net • Perform tests, resolve defects and revise existing code
Semester V		
Course Code	**CourseCode**	**CourseCode**
CC 51	**Internet Technologies**	Knowledge gained: • Learn Core-PHP, Server Side Scripting Language • Learn PHP-Database handling. • Learn different technologies used at client Side Scripting Language • Learn XML,CSS and XML parsers. • One PHP framework for effective design of web application. • Learn JavaScript to program the behavior of web pages. • Learn AJAX to make our application more dynamic. Skills gained: • Design and Develop Web Applications using Node.js, Express.js,AngularJS • Create and connect MongoDB to web application • Connect Mongoose to MongoDB • Create a MEAN CRUD Module for web application Competency developed: Developing application to solve real world problems
CC 52	**Theory of Computation**	Knowledge gained: • To have an understanding of finite state and pushdown automata. • To have a knowledge of regular languages and context free languages. • Recognize to which class in the Chomsky hierarchy the language described (by a grammar or machine) belongs Skills gained: • Define the various categories of languages and grammars in the Chomsky hierarchy • Define various categories of automata (deterministic and nondeterministic finite state automata, and variants of Turing machines) • Define the notions of computability and decidability • Recognize problems reducible to/from well-known decidable/undecidable problems • Reduce a problem to another (when possible), to develop proofs of decidability/undecidability; • Apply Rice's theorem, when appropriate

		Competency developed: • Derive an appropriate machine description from a grammar, and vice versa; • Design a Turing machine that accomplishes a specific task, using macros when appropriate. • A Infer properties of a language from a grammar or machine description; Infer the equivalence of languages described using different grammars or machines.
DSE 53	**E1: Microprocessor**	Knowledge gained: • Understand the architecture of 8085 and 8086. • Impart the knowledge about the instruction set. • Understand the basic idea about the data transfer schemes and its applications. • Develop skill in simple program writing for 8085 & 8086 and applications. Skill gained: • Develop skill in simple program writing for INTEL 8085 and INTEL 8086. • become familiar with the architecture and the instruction set of Intel microprocessors/ microcontrollers. Competency developed: • Describe the Intel 8085/8086 architecture with explanation of internal organization of some popular microprocessors/microcontrollers. • Construction of a maintainable assembly language program for an algorithm. • Conclude the Intel 8085/8086 real mode memory addressing. • Describe the functioning of different peripheral ICs analyze • Designing of microprocessors/microcontrollers-based systems.
	E2: Information Security	Knowledge gained: • Exhibit knowledge to secure corrupted systems, protect personaldata, and secure computer networks in an Organization. Practice with an expertise in academics to design and implement security solutions. • Understand key terms and concepts in Cryptography, Governanceand Compliance. • Develop cyber security strategies and policies • Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks throughcyber/computer forensics software/tools. Skills gained: • Analyze and evaluate the cyber security needs of an organization. • Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. • Measure the performance and troubleshoot cyber security systems. Competency developed: • Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools. • Comprehend and execute risk management processes, risk treatment

		methods, and key risk and performance indicators • Design and develop security architecture for an organization. • Design operational and strategic cyber security strategies andpolicies.
	E3: Modelling and Simulation	Knowledge gained: • Understand the techniques of modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems through available software. • Learn different types of simulation techniques. • Learn to simulate the models for the purpose of optimum control by using software Skills gained: • Grasp modeling concepts with emphasis on performance analysis. • Build simulation models and their parameterization. • Analyze simulation output data to evaluate performance criteria Competency developed: • Grasping modeling concepts using mean value analysis with some information technology applications. • Grasping how to build appropriate simulation models together with their parameterization and the analysis of simulator output data.
DSE 54	**E1: Operational Research for Computer Science**	Knowledge gained: • Identify and develop operational research models from the verbal description of the real system. • Understand the mathematical tools that are needed to solve optimization problems. • Use mathematical software to solve the proposed models. • Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in computer science. Skills gained: • Building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints. Competency developed: • Enabled the student to understand and analyze managerial and engineering problems to equip him to use the resources such as capitals, materials, productions, controlling, directing, staffing, and machines more effectively.
	E2: Combinatorial Optimization	Knowledge gained: • The student knows the theory of combinatorial optimization problems Skills gained: • The student can formualate a combinatorial optimization problem efficiently model industrial planing problems in terms of combinatorial optimization

		Competency developed: • The student can explain how fast a combinatorial optimization problem can be solved explain the mathematical theory underlying algorithms for combinatorial optimization
	E3: Numerical Methods	Knowledge gained: • Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques. • Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields. • Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems. Skills gained: • Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations. Competency developed: • It is used for solving a system of equations • It has application in all branches of engineering. • To know how to find the roots of transcendental equations. • To learn how to interpolate the given set of values • To understand the curve fitting for various polynomials • To learn numerical solution of differential equations

Semester VI

Course Code	**CourseCode**	**CourseCode**
CC 61	**Artificial Intelligence**	Knowledge gained: • Understand concept of knowledge representation and predicatelogic and transform the real life information in different representation. • Understand state space and its searching strategies. • Understand machine learning concepts and range of problems thatcan be handled by machine learning. • Understand the numerous applications and huge possibilities in thefield of AI

		Skills gained: • To analyze and formalize the problem as a state space, graph,design heuristics • Ability to represent solutions for various real-life problem domainsusing logicbased techniques • Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques • Apply these techniques in applications which involve perception, reasoning and learning • Use different machine learning techniques to design AI machineand enveloping applications for real world problems. • Develop knowledge of decision making and learning methods. Competency developed: • Analyze and design a real world problem for implementation and understand the dynamic behavior of a system • Ability to express the ideas in AI research and programming language related to emerging technology. Apply the machine learning concepts in real life problems.
CC 62	**Computer Graphics**	Knowledge gained: • Learn the concepts of projections, viewing and graphics pipeline Skills gained: • Develop line and circle generation algorithms Competency developed: • Apply 2D and 3D transformations Develop clipping algorithms for point, line and polygons
DSE 63	**E1: Digital Image Processing**	Knowledge gained: • Analyze general terminology of digital image processing. • Describe and explain basic principles of digital image processing. • To study the image fundamentals and mathematical transforms necessary for image processing. • Examine various types of images, intensity transformations andspatial filtering. • Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression. • Evaluate the methodologies for image segmentation, restoration etc. • Learn the signal processing algorithms and techniques in image enhancement and image restoration, and image compression procedures. • Implement image process and analysis algorithms. • Understand the rapid advances in Machine vision. • Learn different causes for image degradation and overview of image restoration techniques. • Learn different feature extraction techniques for image analysis and recognition • Understand and analyze image processing problems • Understand the role of alternative color spaces, and the design requirements leading to choices of color space. Skills gained: • Get broad exposure to and understanding of various applications ofimage processing in industry, medicine, and defence. • Design algorithms to solve image processing problems and meetdesign

		specifications. • Be able to conduct independent study and analysis of image processing problems and techniques. • Apply image processing algorithms in practical applications. • Review the fundamental concepts of a digital image processing system. Competency developed: • Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems. • Design and implement algorithms that perform basic image processing and image analysis • Assess the performance of image processing algorithms and systems. • Interpret Image compression standards, image segmentation and representation techniques.
	E2: Introduction to Data Sciences	Knowledge gained: • Develop in depth understanding of the key technologies in datascience and business analytics: data mining, machine learning, visualization techniques, predictive modelling, and statistics. • Practice problem analysis and decision-making. • Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences. Skills gained: • Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy. • Apply ethical practices in everyday business activities and makewell-reasoned ethical business and data management decisions. • Apply principles of Data Science to the analysis of business problems. • Employ cutting edge tools and technologies to analyze Big Data. • Apply algorithms to build machine intelligence. Competency developed: • Apply quantitative modelling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques. • Demonstrate knowledge of statistical data analysis techniquesutilized in business decision making.
	E3: Data Mining	Knowledge gained: • Develop in depth understanding of the key technologies in datascience and business analytics: data mining, machine learning, visualization techniques, predictive modelling, and statistics. • Practice problem analysis and decision-making. • Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences. Skills gained: • Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy. • Apply ethical practices in everyday business activities and makewell-reasoned ethical business and data management decisions.

		• Apply principles of Data Science to the analysis of business problems. • Employ cutting edge tools and technologies to analyze Big Data. • Apply algorithms to build machine intelligence. Competency developed: • Apply quantitative modelling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques. • Demonstrate knowledge of statistical data analysis techniquesutilized in business decision making. • Use data mining software to solve real-world problems.
CC 61L	**Artificial Intelligence Lab**	• Apply various pre-processing techniques on different datasets. • Construct Machine learning programs for Supervised, Unsupervised and Semi supervised learning models. • Develop Deep learning programs for Supervised & Unsupervised learning models. • Identify and Apply Artificial Intelligence concepts to solve real world problems.
CC 62L	**Computer Graphics Lab**	• Programming User-interface issues • Concepts of 2D & 3D object representation • Implementation of various scan & clipping algorithms • 2D modeling • Implementation of illumination model for rendering 3D objects. • Visibility detection & 3D viewing • Implementation of a project based on learned concepts.
DSE 63L	**E1: Digital Image Processing Lab**	Knowledge gained: • To implement basic and advanced image processing algorithms • To learn about compression and coding schemes. Skills gained: • Programming for different operations on image Competency developed: Programming related to image operations
	E2: Introduction to Data Sciences Lab	• Students will develop relevant programming abilities. • Students will demonstrate proficiency with statistical analysis of data. • Students will develop the ability to build and assess data-based models. • Students will execute statistical analyses with professional statistical software. • Students will demonstrate skill in data management. • Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively
	E3: Data Mining Lab	Knowledge gained: • Practical exposure on implementation of well known data mining tasks. • Exposure to real life data sets for analysis and prediction. • Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting. • Handling a small data mining project for a given practical domain Skills gained: • The data mining process and important issues around data cleaning, pre-processing and integration. Competency developed: • The principle algorithms and techniques used in data mining, such as clustering, association

		mining, classification and prediction.
DSE 64	**E1: Machine Learning**	Knowledge gained: • To understand the basic theory underlying machine learning. • To be able to formulate machine learning problems corresponding to different applications. • To understand a range of machine learning algorithms along with their strengths and weaknesses. • To be able to apply machine learning algorithms to solve problems of moderate complexity. • To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models. Competency developed: • Appreciate the importance of visualization in the data analytics solution • Apply structured thinking to unstructured problems • Understand a very broad collection of machine learning algorithms and problems • Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory • Develop an appreciation for what is involved in learning from data.
	E2: System Programming	Knowledge gained: • Interpret the mathematical results in physical and other forms. • Identify, formulate and solve the Linear Differential Equations. • Classify and solve the contour integration of complex functions. Competency developed: • To understand the basics of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger. • Describe the various concepts of assemblers and macro-processors. To understand the various phases of compiler and compare its working with assembler. • To understand how linker and loader create an executable program from an object module created by assembler and compiler. • To know various editors and debugging techniques.
	E3: Cloud Computing	Knowledge gained: • the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges; • The basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations; • Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software

		Defined Networks (SDN) and Software Defined Storage (SDS); • Cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage; • The variety of programming models and develop working experience in several of them. Skills gained: • Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient.
DSE 64L	**E1: Machine Learning Lab**	• Develop an appreciation for what is involved in Learning models from data • Understand a wide variety of learning algorithms • Understand how to evaluate models generated from data • Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models
	E2: System Programming Lab	• Build low level system programs using the OS kernel functions, APIs, C programming languages, and utility tools. • Practice basic knowledge of writing device, file system and filter drivers
	E3: Cloud Computing Lab	• Use the grid and cloud tool kits. • Design and implement applications on the Grid. • Design and Implement applications on the Cloud • To understand the basic concepts Cloud Computing & its Services • To understand the taxonomy and types of Cloud Computing • To understand different hypervisors of Clouds for the Virtualization • To understand how to secure the Cloud & how to Demystify the Cloud
	DSE 64P : Project	Knowledge gained: • Identify and define the problem statement • Define and justify scope of the proposed problem • Gather and analyze system requirements • Propose an optimized solution among the existing solutions • Practice software analysis and design techniques • Develop a functional application based on the software design • Apply coding, debugging and testing tools to enhance the quality ofthe software • Construct new software system based on the theory and practicegained through this exercise • Prepare the proper documentation of software projects following the standard guidelines • Develop technical report writing and oral presentation Skills gained: • Software Project Development Competency developed: • Professional Software Developer