

# Department of Computer Science

## Programme Specific Outcome

- PSO1 Challenging and varied subjects aligned with the current trend with the introduction of Machine Intelligence specific subjects.
- PSO2 Understand Data Management Skills.
- PSO3 Learn the skills of Image processing.
- PSO4 Introduction of the physical world through Architecting of IoT and Wireless Sensor Networks and Mobile Communication.
- PSO5 Security domain is also evolved by the introduction of Ethical Hacking, Cyber Forensic and Information and Network Security.
- PSO6 Get the hands on experience Linux Server Administration and Web Services topics are included.

## Course Outcomes

### Class: F.Y.B. Sc. Computer Science

#### Semester I

#### Course (Paper) Name and No.: Computer Organization and Design (P I)

- CO1 To learn about how computer systems work and underlying principles
- CO2 To understand the basics of digital electronics needed for computers
- CO3 To understand the basics of instruction set architecture for reduced and complex instruction sets
- CO4 To understand the basics of processor structure and operation
- CO5 To understand how data is transferred between the processor and I/O devices

#### Course (Paper) Name and No.: Programming with Python-I (P-II)

- CO1 Students should be able to understand the concepts of programming before actually starting to write programs.
- CO2 Students should be able to develop logic for Problem solving with conditions, loops and functions
- CO3 Students should be able to apply the problem solving skills using syntactically simple language
- CO4 Students learned about object-oriented features and dictionary concepts.

#### Course (Paper) Name and No.: Programming with C (P –III)

- CO1 Implement programs involving decision structures, loops and functions.
- CO2 Implement pointers, arrays.
- CO3 Implement different data structures and create/update basic data files.

- CO4 Implement all the operators in C programming language.
- CO5 Implement string functions and applications of string functions.

### **Course (Paper) Name and No.: Free and Open Source System (P-IV)**

- CO1 Students will get exposure to a free open source software environment.
- CO2 This course will introduce them to use open source packages so Learners get to know how FOSS technologies work.
- CO3 Learners will be able to choose an appropriate license for open source things in general and to explain what can and cannot be done with software that has a specific license common open source licenses and the impact of choosing a license.
- CO4 This course gives practical knowledge of free and open source technologies which inculcate the ability to contribute to software and interact with Free and Open Source Software development projects.
- CO5 Learners will be able to install and run open-source operating systems.
- CO6 Gives Learners the ability to gather information about Free and Open Source Software projects from software releases and from sites on the internet.
- CO7 Students will Understand the kernel configuration and virtual environment
- CO8 By learning Open Source Ecosystem, it Increases engagement and social entrepreneurship in students

### **Course (Paper) Name and No.: Discrete Mathematics (P-V)**

- CO1 To provide overview of theory of discrete objects, starting with relations and partially ordered sets and study about recurrence relations, generating function and operations on them.
- CO2 Students be able to understand permutations, combinations and counting principles.
- CO3 Give an understanding of graphs and trees which are widely used in software

### **Course (Paper) Name and No.: Descriptive statistics and introduction to probability (P-VI)**

- CO1 Enable learners to know descriptive statistical concepts
- CO2 Enable to study Measures of skewness and Kurtosis and correlation and regression.
- CO3 Enable study of probability concept required for Computer learners
- CO4 Knowledge of various types of data, their organisation and evaluation of summary measures such as measures of central tendency and dispersion etc.

### **Course (Paper) Name and No.: Soft Skill Development (P VII)**

- CO1 To know about various aspects of soft skills and learn ways to develop personality
- CO2 Understand the importance and type of communication in personal and professional environment.
- CO3 To provide insight into much needed technical and non-technical qualities in career planning.
- CO4 Learn about Leadership, team building, decision making and stress management

## **Semester II**

### **Course (Paper) Name and No.: Database System (P-I)**

- CO1 Students learn to evaluate business information problems and find the requirements of a problem in terms of data.
- CO2 Students will learn to design ER-models to represent simple database application scenarios and then convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.
- CO3 Learners will be able to describe the fundamental elements of relational database management systems.
- CO4 Learners will get the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- CO5 Learners will get to know how to Improve the database design by normalization.

CO6 Learners will be able to design and build a simple database system with appropriate data-types for storage of data and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

### **Course (Paper) Name and No.: Programming with Python II (P-II)**

- CO1 Students should be able to understand how to read/write to files using python.
- CO2 Students able to catch their own errors that happen during execution of programs.
- CO3 Students should get an introduction to the concept of pattern matching.
- CO4 Students will be familiar with the concepts of GUI controls & designing GUI applications.
- CO5 Students should connect to the database to move the data to/from the application.
- CO6 Students should know how to connect to computers read from URL and send email

### **Course (Paper) Name and No.: Linux (P-III)**

- CO1 Upon completion of this course, learners should have a good working knowledge of Linux, from both a graphical and command line perspective, allowing them to easily use any Linux distribution.
- CO2 This course shall help learner to learn advanced subjects in computer science practically.
- CO3 This course shall help learner to acquire knowledge of networking in Linux
- CO4 Student shall be able to progress as a Developer or Linux System Administrator using the acquired skill set.
- CO5 Students will be able to understand the basic commands of Linux operating system and can write shell scripts

### **Course (Paper) Name and No.: Data Structure (P-IV)**

- CO1 Learn about Data structures, its types and significance in computing.

- CO2 Explore about Abstract Data types and its implementation.
- CO3 Ability to program various applications using different data structure in Python.
  
- CO4 Learn applications and implementations of stack, queue, heap, tree etc in python.
- CO5 Explore sorting and searching techniques and its implementation.

**Course (Paper) Name and No.: Statistical Methods & Testing of Hypothesis (P-VI)**

- CO1 Enable learners to know descriptive statistical concepts
- CO2 Enable study of probability concept required for Computer learners
- CO3 Enable to study the concept of hypothesis testing.
- CO4 An idea of conducting the sample surveys and selecting appropriate sampling techniques

**Course (Paper) Name and No.: Green Technology (P-VII)**

- CO1 Students should be able to understand the concept of green technology concept.
- CO2 Students should be able to understand green server, green data centre, green server farm.
- CO3 Aware good and dangerous activity to environment.
  
- CO4 Understand the strategies, frameworks, processes and management of green IT

## **Class: S.Y.B. Sc. Computer Science**

### **Semester III**

#### **Course (Paper) Name and No.: Theory of Computation (P-I)**

- CO1 Understand Automata theory and Languages
- CO2 Understand and design Grammar and its application in Language design
- CO3 Design and implement Turing Machines and Pushdown Automata
- CO4 Design and implement Linear Bounded Automata and its applications
- CO5 Solve various problems of applying normal form techniques

#### **Course (Paper) Name and No.: Core Java (P-II)**

- CO1 Object oriented programming concepts using Java
- CO2 Knowledge of input, its processing and getting suitable output
- CO3 Understand, design, implement and evaluate classes and applets
- CO4 Knowledge and implementation of AWT package

#### **Course (Paper) Name and No.: Operating System (P-III)**

- CO1 To provide a understanding of operating system, its structures and functioning
- CO2 Develop and master understanding of algorithms used by operating systems for various purposes.
- CO3 Describe and analyse the memory management and its allocation policies.
  
- CO4 To provide a sound understanding of Computer operating system, its structures, functioning and algorithms.

#### **Course (Paper) Name and No.: Database Management System (P-IV)**

- CO1 Master concepts of stored procedure and triggers and its use.

- CO2 Learn about using PL/SQL for data management.
- CO3 Understand concepts and implementations of transaction management and crash recovery
- CO4 Execute various advanced SQL queries related to Transaction Processing & Locking using concept of Concurrency control.

### **Course (Paper) Name and No.: Combinatorics and Graph Theory (P-V)**

- CO1 Appreciate the beauty of combinatorics and how combinatorial problems naturally arise in many settings.
- CO2 Understanding the combinatorial features in real world situations and Computer Science applications.
- CO3 Apply combinatorial and graph theoretical concepts to understand computer science concepts and apply them to solve problems.
- CO4 Learners will be able to analyze combinatorial objects satisfying certain properties and answer questions related to existence (proving the existence or non-existence of such objects), construction (describing how to create such objects in the case they exist), enumeration (computing the number of such objects), and optimization (determining which objects satisfy a certain extremal property).

### **Course (Paper) Name and No.: Physical Computing and IOT Programming (P VI)**

- CO1 Enable learners to understand System On Chip Architectures
- CO2 Introduction and preparing Raspberry Pi with hardware and installation
- CO3 Learn physical interfaces and electronics of Raspberry Pi and program them using practical's
- CO4 Learn how to make consumer grade IoT safe and secure with proper use of protocols

### **Course (Paper) Name and No.: Web Programming (P-VII)**



- CO1 To design valid, well-formed, scalable, and meaningful pages using emerging technologies
- CO2 Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites
- CO3 To develop and implement client-side and server-side scripting language programs.
- CO4 To develop and implement Database Driven Websites.
- CO5 Design and apply XML to create a mark-up language for data and document centric applications

## Semester IV

### Course (Paper) Name and No.: Fundamentals of Algorithm (P-I)

- CO1 Understand the concepts, different algorithm techniques and its approaches.
- CO2 Improve logical skills by implementing algorithms
- CO3 Build a strong foundation on fundamentals and exposure to advanced techniques.
- CO4 Build research skills and improve project based learning.

### Course (Paper) Name and No.: Advanced Java (P-II)

- CO1 Understand the concepts related to Java Technology
- CO2 Explore the use of Java Server Programming
- CO3 Understand the fundamentals of JSON
- CO4 Explore the use of Struts and Java Bean

### Course (Paper) Name and No.: Computer Network (P III)

- CO1 Learner will be able to understand the concepts of networking, which are important for them to be known as a '*networking professionals*'
- CO2 Useful to proceed with industrial requirements and International vendor certifications
- CO3 Learners will be able to understand the services provided by each layer of network models
- CO4 Learner will acquire knowledge that will help them in Advanced courses and certifications in computer networking

### Course (Paper) Name and No.: Software Engineering, Paper IV

- CO1 Understand the concepts of process model, metrics and how to apply in organization
- CO2 Implement the techniques like project scheduling, risk management in organization.
- CO3 Draw useful diagrams associated with the system.
- CO4 Development of Software with help of SDLC phases.

### **Course (Paper) Name and No.: Linear Algebra using Python (PV)**

- CO1 Appreciate the relevance of linear algebra in the field of computer science.
- CO2 Understand the concepts through program implementation.
- CO3 Install computational thinking while learning linear algebra.
- CO4 Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.

### **Course (Paper) Name and No.: .NET Technologies (P-VI)**

- CO1 Understand the .NET framework
- CO2 Develop a proficiency in the C# programming language
- CO3 Proficiently develop ASP.NET web applications using C#
- CO4 Use ADO.NET for data persistence in a web application

### **Course (Paper) Name and No.: Android (PVII)**

- CO1 At the end of the course student will able to understand the requirements of Mobile programming environment.
- CO2 At the end of the course student Learn about basic methods, tools and techniques for developing Apps
- CO3 Explore and practice App development on Android Platform
- CO4 Develop working prototypes of working systems for various uses in daily lives.

## **Class: T.Y.B. Sc. Computer Science**

### **Semester V**

#### **Course (Paper) Name and No.: Artificial Intelligence (Elective-I-P-I)**

- CO1 Understanding the various search techniques, constraint satisfaction problem, game playing techniques
- CO2 Acquire knowledge of real world knowledge representation.
- CO3 Analyse and design real world problems for implementation and understanding the dynamic behaviour of the system.
- CO4 Apply the basic principles, models, and algorithms of Artificial Intelligence to recognize, model, and solve problems in the analysis and design of information systems.

#### **Course (Paper) Name and No.: ST&QA (Elective-I-P-II)**

- CO1 Learners will understand software testing and quality assurance as a fundamental component of software life cycle
- CO2 The students will understand the process of applying tests to software and the fundamental components of a test case.
- CO3 Understand various software testing methods and strategies.
- CO4 Understand a variety of software metrics, and identify defects and manage those defects for improvement in quality for given software.
- CO5 Design SQA activities, SQA strategy, formal technical review report for software quality control and assurance.
- CO6 The students will understand the process of applying tests to software and the fundamental components of a test case.

**Course (Paper) Name and No.: PIII Information & Network Security (Elective-II-P-I)**

- CO1 Understand the principles and practices of cryptographic techniques.
- CO2 Understand a variety of generic security threats and vulnerabilities.
- CO3 Understand various protocols for network security to protect against the threats in a network
- CO4 Identify & analyze particular security problems for a given application and actual implementation using practicals.

### **Course (Paper) Name and No.: Web Service (Elective-II-P-III)**

- CO1 Design SOAP based web services that associated with standards such as WSDL and UDDI
- CO2 Design Restful Web Services with JAX-WS and JAX-RS
- CO3 Design WCF services and deal with QoS issues of Web Services
- CO4 Design and Implement secure Web Services

### **Course (Paper) Name and No.: Game Programming (P-V)**

- CO1 Study Graphics and gaming concepts with present working style of developers where everything remains on internet
- CO2 Study and review Unity community
- CO3 Understand and be a part of Unity community
- CO4 Design small games using logical skill

## **Semester VI**

### **Course (Paper) Name and No.: Cloud Computing (Elective-I P-I)**

- CO1 Learners get exposed to areas of Cloud Computing, and encouragement for further study and research.
- CO2 Students learn to articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing using open source technology.
- CO3 Students get the ability to identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- CO4 Students learn to identify the core issues of cloud computing such as security, privacy, and interoperability

### **Course (Paper) Name and No.: Cyber Forensics (Elective-I P-III)**

- CO1 The student will be able to plan and prepare for all stages of an investigation - detection, initial response and management interaction.
- CO2 Investigate various media to collect evidence.
- CO3 Learn investigation of network and host system intrusions, analysis and documentation of information gathered.
- CO4 Report various investigations in a way that would be acceptable in the court of law.

### **Course (Paper) Name and No.: Information Retrieval (Elective-II-P-I)**

- CO1 Learners Should be able to understand the field of Information retrieval
- CO2 Learners should be able to design information retrieval model
- CO3 It will give the learner an understanding to apply information retrieval model
- CO4 After completion of this course, learners should get an understanding of the field of information retrieval and its relationship to search engines.

### **Course (Paper) Name and No.: Data Science (Elective-II-P-III)**

- CO1 After completion of this course, the learners should be able to understand & comprehend the problem.
- CO2 Learners should be able to define suitable statistical methods to be adopted.
- CO3 Learner should be able to understand data management, data curation techniques
- CO4 Learners will demonstrate proficiency with statistical analysis of data and will develop the ability to build and assess data based models.

## **Course (Paper) Name and No.: Ethical Hacking (P-V)**

- CO1 To identify security vulnerabilities and weaknesses in the target applications
- CO2 Learn to test and exploit systems using various tools
- CO3 Understand the impact of hacking in real time machines
- CO4 Learn to protect from malwares such as viruses, worms



# Department of Computer Science

## Programme Specific Outcome

- PSO1 Learners will be able to communicate computer science concepts, designs, and solutions effectively and professionally.
- PSO2 Able to Identify, analyse and synthesize scholarly literature relating to the field of computer science.
- PSO3 Gain knowledge of computing to produce effective designs and solutions for specific problems.
- PSO4 Promotes research oriented activity through different subjects.

## Course Outcomes

### Class: M.Sc. I (Computer Science)

#### Semester I

#### Course (Paper) Name and No.: P-I, Analysis of Algorithms and Researching Computing

- CO1 Understand the concepts of different algorithm techniques like maximum subarray problem, randomized algorithm.
- CO2 Implement the Graph, Tree representation.
- CO3 Implement elementary number notations, overview of research process and elementary graph algorithms.
- CO4 Understand the quantitative data analysis concepts.
- CO5 Learn about the research area, its importance, ethics and need to the society.
- CO6 Implement dynamic programming algorithms.

#### Course (Paper) Name and No.: P-II, Advanced Networking Concepts

- CO1 1) Learner will be able to understand the concepts of Advanced networking, which are important for them to be known as a '*networking professionals*'
- CO2 2) Useful to proceed with industrial requirements and International vendor certifications
- CO3 3) Learner will be able to understand the concepts of wireless networks and Adhoc networks
- CO4 4) Learners understands the working of Wireless Sensor Networks

#### Course (Paper) Name and No.: P III, Advanced Database Systems

- CO1 Understood the architecture, design, features of distributed systems.
- CO2 Understood how transactions processing occurs in distributed and parallel systems.

- CO3 Understood object oriented, temporal, spatial databases in detail.
- CO4 Understood concepts of deductive, active, multimedia, XML dB in detail

### **Course (Paper) Name and No.: P-IV, Robotics and Artificial Intelligence**

- CO1 Apply and evaluate concepts of gear, sensors and motors
- CO2 Apply and evaluate the concepts of vision, feedback control and trajectory planning
- CO3 Plan, design and implement robotics systems and algorithms.
- CO4 Analyse and formalize the problem as a state space, graph and select amongst different search

## **Semester II**

### **Course (Paper) Name and No.: P-I, Advanced Operating system**

- CO1 Students demonstrate an ability to analyse a problem and identify and define the computing requirements appropriate to its solution.
- CO2 Students demonstrate an ability to design, implement process and components for distributing systems.
- CO3 Students demonstrate an ability to evaluate a computer-based system or program to meet desired needs.

CO4 Develop and master understanding of algorithms used by operating systems for various purposes.

### **Course (Paper) Name and No.: P-II Design and Implementation of Modern Compiler**

- CO1 Students demonstrate an ability to analyse phases of compilation processes.
- CO2 Students demonstrate an ability to implement a compiler for a small programming language.
- CO3 Learns the optimization techniques
- CO4 Learns dataflow analysis

### **Course (Paper) Name and No.: Elective I - Track A Cloud Computing-I**

- CO1 To develop application using cloud computing environments
- CO2 To present a survey on cloud building blocks and technologies
- CO3 To perform cloud computing admin and programming using open source tools
- CO4 Identify the issues of cloud computing such as security, privacy, and interoperability

### **Course (Paper) Name and No.: Elective I-Track B: Cyber and Information Security (Network and Communication Security)**

- CO1 Understand a variety of generic security threats and vulnerabilities
- CO2 Learn data recovery techniques and protocols
- CO3 Understand various protocols for network security to protect against the threats in a network
- CO4 Identify & analyze particular security problems for a given application and actual implementation using practicals

### **Course (Paper) Name and No.: Elective II - Track C: Business Intelligence and Big Data Analytics (Business Intelligence)**

- CO1 Create Data cubes in Sql Server .
- CO2 Apply star schema, snowflake schema, parent child schema in the application.
- CO3 Perform operations like drill down, roll up on the data cube.
- CO4 Apply association rule in real life examples

### **Course (Paper) Name and No.: Elective II- Track D: Machine Intelligence**

- CO1 Gain knowledge about basic concepts of Machine Learning
- CO2 Identify machine learning techniques suitable for a given problem
- CO3 Generate optimized models using various machine learning techniques
- CO4 Apply Dimensionality reduction techniques for attribute reduction

## **Class: M.Sc. II (Computer Science)**

### **Semester III**

#### **Course (Paper) Name and No.: P-I, Ubiquitous Computing**

- CO1 Describe the characteristics of pervasive computing applications including the basic
- CO2 Computing application problems, performance objectives and quality of services, major system components and architectures of the systems.
- CO3 Analyze the strengths, problems and limitations of the current tools, devices and
- CO4 Communications for pervasive computing systems.
- CO5 Recognize the different ways that humans will interact with systems in a ubiquitous environment and account for these accordingly.
- CO6 List and exemplify the key technologies involved in the development of Ubicomp systems.

#### **Course (Paper) Name and No.: P-II, Social Network Analysis**

- CO1 Analyze the area of social network concepts, relationship analysis and relationships using algorithm.
- CO2 Apprehend how network analysis can contribute to increasing knowledge about diverse aspects of society using local and global centrality, Approaches and google page rank algorithm.
- CO3 Use a relational algorithm like Dijkstra's algorithm using top-down and bottom up approaches.
- CO4 Analyze social network data using various software packages and similarity and structural equivalences.
- CO5 Ascertaining mode networks, Bi-partite data structure and SVD analysis.
- CO6 Compare different Similarity and dissimilarity distance measuring approaches



### **Course (Paper) Name and No.: Elective I- Track A: Cloud Computing -II**

- CO1 Learners will be able to define Cloud Computing and memorize the different Cloud service and deployment models. Learners can analyse and describe importance of virtualization along with their technologies.
- CO2 Learners will be able to identify different cloud computing platforms.
- CO3 Learners will get sound knowledge of cloud technologies and how to use them.
- CO4 Learners will learn the variety of Software Architecture models for cloud computing and develop working experience in several of them.

### **Course (Paper) Name and No.: Elective I- Track B: Cyber and Information Security II**

- CO1 Understand the definition of computer forensics fundamentals.
- CO2 Describe the types of computer forensic technology.
- CO3 Learn Mobile Forensics and its tools to analyze mobile data
- CO4 Illustrate the methods for data recovery, evidence collection and data seizure
- CO5 Summarize duplication and preservation of digital evidence

### **Course (Paper) Name and No.: Elective II- Track C: Business Intelligence and Big Data Analytics –II (Mining Massive Data sets)**

- CO1 To optimize business decisions and create competitive advantage with Big Data analytics
- CO2 To learn to use various algorithms of map reduce.
- CO3 To understand the various search methods and visualization techniques, Methods for high degrees of similarity.
- CO4 To learn data mining streams and its architecture.

### **Course (Paper) Name and No.: Elective II - Track D, Machine Learning –II**

- CO1 Gain knowledge about advance concepts of Machine Learning
- CO2 Identify probability distribution techniques suitable for a given problem
- CO3 Design of applications using various graphical models
- CO4 Understand the strengths and weaknesses of different Machine Learning approaches

## **Semester IV**

### **Course (Paper) Name and No.: P-I, Simulation and Modelling**

- CO1 Students should be able to understand the concepts related to simulation and conceptual modelling.
- CO2 Students should be able to understand conceptual and simulation models verification and validation.
- CO3 Students can understand different methods for simulation modelling.
- CO4 Students can understand how designing of models is done and how models behave in different external environments

### **Course (Paper) Name and No.: Elective I Track B: Cyber and Information Security-II (Cryptography and Crypt Analysis)**

- CO1 Understand the significance of cryptography to the modern world and the internet.
- CO2 Solve elementary problems in number theory relating to cryptography.
- CO3 Build on number theoretic basics to further their knowledge of advanced methods of cryptography.
- CO4 Understand the computer security including network security and cryptography. Integrate cryptographic algorithms into software projects.



**Course (Paper) Name and No.: Elective II Track C: Business Intelligence and Big Data Analytics-III (Intelligent Data Analysis)**

- CO1 Implement clustering algorithms like k-means, partitioning algorithms.
- CO2 Explore the concepts of Bayesian classification, Document classification, Bayesian Networks on real data.
- CO3 Implement Principal Component Analysis and decomposition techniques.
- CO4 Implement the concept of Collaborative Filtering, Dimensionality Reduction, link analysis
- CO5 Explore the concept of Recommendation System