Preamble

1) Introduction

Master of Science (Information Technology) is a Programme designed to meet the needs of the market for expertise in Information Technology (IT). The Programme is intended to address the increasing demand in the work-place for IT professionals with a broad and sound knowledge of both technical and managerial skills. A master degree is granted to individuals who have undergone study demonstrating a mastery or high-order overview of a specific area.

2) Aims and Objectives

1. To equip postgraduate students with an integrated set of skills that will allow them to develop their professional careers in Information Technology.
2. To equip students with the theoretical and practical knowledge that is necessary to enable them to understand the design of complex computer applications/science.
3. The programme also prepares students to embrace future developments in the field and has a demonstrated professional relevance.
4. The programme helps students to acquire the latest skills and build their future capabilities using world-class technology. At the end of this programme, a student will possess a strong foundation of computer systems and information technology.
5. Dexterity in advanced programming languages; power to build sophisticated software for wide area of applications.
6. Skills to work with higher end applications in internet technologies; also managerial ability to analyze, design, develop and to maintain software development.

3) Learning Outcomes

1. Apply the knowledge of mathematics, science and computing in the core information technologies.

2. Identify, design, and analyze complex computer systems and implement and interpret the results from those systems.

3. Design, implement and evaluate a computer-based system, or process component, to meet the desired needs within the realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

4. Review literature and indulge in research using research based knowledge and methods to design new experiments, analyze, and interpret data to draw valid conclusions.

5. Select and apply current techniques, skills, and tools necessary for computing practice and integrate IT-based solutions into the user environment effectively.

6. Apply contextual knowledge to assess professional, legal, health, social and cultural issues during profession practice.

7. Analyze the local and global impact of computing on individuals, organizations, and society.

8. Apply ethical principles and responsibilities during professional practice.

9. Function effectively as a team member or a leader to accomplish a common goal in a multidisciplinary team.

10. Communicate effectively with a range of audiences using a range of modalities including written, oral and graphical.

11. Apply the knowledge of engineering and management principles to manage projects effectively in diverse environments as a member or a leader in the team.

12. Engage in independent and life-long learning for continued professional development

Semester I

Programme Code : _____ **Programme Name:** <u>M. Sc (Information Technology)</u>

Course Code:501	**Course Name:** Data Science
Total Credits: 04 (60 Lecture Hrs)	**Total Marks:** 100 marks
University assessment: 50 marks	**College/Department assessment:** 50 marks

Pre requisite:

Basic understanding of statistics

Course Objectives (COs)

To enable the students to:

CO1 : Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.

CO2 : Practice problem analysis and decision-making.

CO3 : Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences.

Course Outcomes(OCs)

Upon completing this course, the student will be able to:

1. Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
2. Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.
3. Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.
4. Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
5. Apply principles of Data Science to the analysis of business problems.
6. Use data mining software to solve real-world problems.
7. Employ cutting edge tools and technologies to analyze Big Data.
8. Apply algorithms to build machine intelligence.
9. Demonstrate use of team work, leadership skills, decision making and organization theory.

Course Code:502 **Total Credits:** 02 (60 Lecture Hrs) **University assessment:** 25 marks	**Course Name:** Data Science Practical **Total Marks:** 50 marks **College/Department assessment:** 25 marks

Pre requisites:

Basic understanding of statistics and basic programming logic

Course Objectives (OCs)

To enable the students to:

CO1 To Develop statistical and analytical modelling using data science concepts

CO2 To develop data visualization

CO3 To Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences

Course Outcomes(OCs)

Upon completing this course, the student will be able to:

OC 1. Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.

OC 2. Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.

OC 3. Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.

OC 4. Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.

OC 5. Apply principles of Data Science to the analysis of business problems.

OC 6. Use data mining software to solve real-world problems.

OC 7. Employ cutting edge tools and technologies to analyze Big Data.

OC 8. Apply algorithms to build machine intelligence.

OC 9. Demonstrate use of team work, leadership skills, decision making and organization theory.

Course Code: 503	**Course Name:** Soft Computing Techniques
Total Credits: 04 (60 Lecture Hrs)	**Total Marks:** 100 marks
University assessment: 50 marks	**College/Department assessment:** 50 marks

Pre-requisite: Basic **Knowledge** on AI
 Course Objectives (COs):
 To enable the students to:
- **CO1:** Soft computing concepts like fuzzy logic, neural networks and genetic algorithm, where Artificial Intelligence is mother branch of all.
- **CO2** All these techniques will be more effective to solve the problem efficiently **:**

Course Outcomes(OCs)

Upon completing this course, the student will be able to:

OC1 Gain a solid understanding of the fundamental concepts underlying soft computing, including the differences between soft computing and traditional hard computing methods.

OC2 Familiarize with a variety of soft computing techniques such as fuzzy logic, neural networks, genetic algorithms, swarm intelligence, and probabilistic reasoning.

OC3 Apply soft computing techniques to solve real-world problems from various domains such as engineering, finance, healthcare, and more.

OC4 Formulate problems in a way that lends itself to the application of soft computing techniques, taking into account the uncertainties and imprecisions present in real-world data.

OC5 Understand of how fuzzy logic works and its applications in modeling and decision-making under uncertainty.

OC6 Gain knowledge of neural network architectures, training algorithms, and their applications in pattern recognition, regression, and classification tasks.

OC7 Understand genetic algorithms, their components, and their use in optimization problems and search spaces.

OC8 Familiarize with swarm intelligence algorithms such as ant colony optimization and particle swarm optimization, and their applications in optimization and search problems.

Course Code: 504	**Course Name:** Soft Computing Techniques
Total Credits: 02 (60 Lecture Hrs)	Practical
University assessment: 25 marks	**Total Marks:** 50 marks
	College/Department assessment: 25 marks

Pre requisites:

Basic understanding of statistics and basic programming logic with AI basics

Course Objectives (COs)

CO1. Hands-On Implementation
CO2. Algorithm Understanding
CO3. Real-World Applications

Course Outcomes(COs)

Upon completing this course, the student will be able to:

OC 1: Identify and describe soft computing techniques and their roles in building intelligent machines

OC 2: Recognize the feasibility of applying a soft computing methodology for a particular problem

OC 3: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

OC 4: Apply genetic algorithms to combinatorial optimization problems

OC 5: Apply neural networks for classification and regression problems

OC 6: Effectively use existing software tools to solve real problems using a soft computing approach

OC 7: Evaluate and compare solutions by various soft computing approaches for a given problem.

Course Code: 505	Course Name: Cloud Computing
Total Credits: 04 (60 Lecture Hrs)	Total Marks: 100 marks
University assessment: 50 marks	College/Department assessment: 50 marks

Pre requisite: Basic knowledge of Computer Networks, Operating Systems
Course Objectives(COs)

CO1. To learn how to use Cloud Services.

CO2. To implement Virtualization.

CO3. To implement Task Scheduling algorithms.

CO4. Apply Map-Reduce concept to applications.

CO5. To build Private Cloud.

CO6. Broadly educate to know the impact of engineering on legal and societal issues

involved.

Course Outcomes(COs)

Upon completing this course, the student will be able to:

OC1	Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.
OC2	Design different workflows according to requirements and apply map reduce programming model.
OC3	Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
OC4	Create combinatorial auctions for cloud resources and design scheduling algorithms for computing cloud.
OC5	Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application
OC6	Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.

Course Code: 506a Total Credits: 04 (120 Lecture Hrs) University assessment: 50 marks	Course Name: Security Breaches and Countermeasures Practical Total Marks: 100 marks College/Department assessment: 50 marks

Prerequisite:

Basic Networking and Security concepts

Course Objectives(COs):

- To get the insight of the security loopholes in every aspect of computing.
- To understand the threats and different types of attacks that can be launched on computing systems.
- To know the countermeasures that can be taken to prevent attacks on computing systems.
- To test the software against attacks.

Course Outcome(OCs)

Upon completing this course, the student will be able to:

OC 1: The student should be able to identify the different security breaches that can occur. The student should be able to evaluate the security of an organization and identify the loopholes. The student should be able to perform enumeration and network scanning.

OC 2: The student should be able to identify the vulnerability in the systems, breach the security of the system, identify the threats due to malware and sniff the network. The student should be able to do the penetration testing to check the vulnerability of the system towards malware and network sniffing.

OC 3: The student should be able to perform social engineering and educate people to be careful from attacks due to social engineering, understand and launch DoS and DDoS attacks, hijack and active session and evade IDS and Firewalls. This should help the students to make the organization understand the threats in their systems and build robust systems.

OC 4: The student should be able to identify the vulnerabilities in the Web Servers, Web Applications, perform SQL injection and get into the wireless networks. The student should be able to help the organization aware about these vulnerabilities in their systems.

OC 5: The student should be able to identify the vulnerabilities in the newer technologies like mobiles, IoT and cloud computing. The student should be able to use different methods of cryptography.

Course Code: 506b	**Course Name:** Data Center Virtualization
Total Credits: 04 (60 Lecture Hrs)	**Total Marks:** 100 marks
University assessment: 50 marks	**College/Department assessment:** 50 marks

Pre requisites:

Basic knowledge of Computer Networks and Cloud Computing

Course Objectives(COs):

- Identify important requirements to design and support a data center.
- Determine a data center environment's requirement including systems and network architecture as well as services.
- Evaluate options for server farms, network designs, high availability, load balancing, data center services, and trends that might affect data center designs.
- Assess threats, vulnerabilities and common attacks, and network security devices available to protect data centers.
- Design a data center infrastructure integrating features that address security, performance, and availability.
- Measure data center traffic patterns and performance metrics.

Course Outcomes(OCs):

After completion of the course, a student should be able to:

OC 1: Understand basic concepts in Virtualization.
OC 2: Use concepts of Load Balancing and Aggregation /virtual switching
OC 3: Configure Data center Migration and Fabric Building
OC 4: Understand various Changes in Server Architecture
OC 5: Use the concepts of Cloud computing and how to move towards a cloud computing technology.

Course Code: 506c	Course Name: Image Processing
Total Credits: 04 (60 Lecture Hrs)	Total Marks: 100 marks
University assessment: 50 marks	College/Department assessment: 50 marks

Prerequisites:
Fundamental knowledge of graphics and Mathematics
Course Objectives(COs):

CO1.   Review the fundamental concepts of a digital image processing system.
CO2.   Analyze images in the frequency domain using various transforms.
CO3.   Evaluate the techniques for image enhancement and image restoration.
CO4.   Categorize various compression techniques.
CO5.   Interpret Image compression standards.
CO6.   Interpret image segmentation and representation techniques.

COURSE OUTCOMES

OC 1: Understand the relevant aspects of digital image representation and their practical implications.

OC 2: Have the ability to design pointwise intensity transformations to meet stated specifications.

OC 3: Understand 2-D convolution, the 2-D DFT, and have the abitilty to design systems using these concepts.

OC 4: Have a command of basic image restoration techniques.

OC 5: Understand the role of alternative color spaces, and the design requirements leading to choices of color space.

OC 6: Appreciate the utility of wavelet decompositions and their role in image processing systems.

OC 7: Have an understanding of the underlying mechanisms of image compression, and the ability to design systems using standard algorithms to meet design specifications.

Course Code: 507 **Total Credits:** 04 (60 Lecture Hrs) **University assessment:** 50 marks	**Course Name:** Research Methodology **Total Marks:** 100 marks **College/Department assessment:** 50 marks

Pre requisites	Basic knowledge of statistical methods. Analytical and logical thinking.

Course Objectives(COs)

CO1. To be able to conduct business research with an understanding of all the latest theories.

CO2. To develop the ability to explore research techniques used for solving any real world or innovate problem.

Course Outcomes(OCs)

 A learner will be able to:

OC 1: solve real world problems with scientific approach.

OC 2: develop analytical skills by applying scientific methods.

OC 3: recognize, understand and apply the language, theory and models of the field of business analytics

OC 4: foster an ability to critically analyze, synthesize and solve complex unstructured business problems

OC 5: understand and critically apply the concepts and methods of business analytics

OC 6: identify, model and solve decision problems in different settings

OC 7: interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity

OC 8: create viable solutions to decision making problems

SEMESTER II

Course Code: 511 Total Credits: 04 (60 Lecture Hrs) University assessment: 50 marks	Course Name: Big Data Analytics Total Marks: 100 marks College/Department assessment: 50 marks

Prerequistes:

Fundamental knowledge of Databases

Course Objectives:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

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Course Outcomes(OCs)

Upon completion of this course the Students will be able to:

OC1   Understand Big Data Concepts

OC2   Do Data Collection and Integration

OC3   Develop Data Storage and Management

OC4   Perform Data Preprocessing and Cleaning

OC5   Understand Data Transformation and Feature Engineering

OC6   Perform Exploratory Data Analysis (EDA)

OC7   Use Big Data Analytics Tools

Course Code: 512	**Course Name:** Big Data Analytics Practical
Total Credits: 02 (60 Lecture Hrs)	**Total Marks:** 50 marks
University assessment: 25 marks	**College/Department assessment:** 25 marks

Prerequisites: Conceptual understanding of Big Data and DBMS
Course Objectives:
To teach the students the implementation of Big data analytic as per the concepts learnt

OC 1: Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

OC 2: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

OC 3: Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

OC 4: Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Course Code: 513	**Course Name:** Modern Networking
Total Credits: 02 (60 Lecture Hrs)	**Total Marks:** 100 marks
University assessment: 50 marks	**College/Department assessment:** 50 marks

Pre requisites	Fundamentals of Networking

Course Objectives(COs)

CO1. To understand the state-of-the-art in network protocols, architectures and applications.
CO2. Analyze existing network protocols and networks.
CO3. Develop new protocols in networking
CO4. To understand how networking research is done
CO5. To investigate novel ideas in the area of Networking via term-long research projects.

Course Outcomes(OCs)

OC1 Understand the modern networking concepts and implement

Course Code: 514	**Course Name:** Modern Networking Practical
Total Credits: 02 (60 Lecture Hrs)	**Total Marks:** 50 marks
University assessment: 25 marks	**College/Department assessment:** 25 marks

Prerequisite: Concepts of Modern Networking

Course Objectives: To gain practical knowledge in Modern networking
All practical are expected to be performed on GNS3/EVE-Ng network Emulator/MININET

OC 1: Demonstrate in-depth knowledge in the area of Computer Networking.

OC 2: To demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to Computer Networks

OC 3: Prepare a technical document for the identified Networking System Conducting experiments to analyze the identified research work in building Computer Networks

Course Code: 515 **Total Credits:** 02 (30 Lecture Hrs) **University assessment:** 25 marks	**Course Name:** Microservices Architecture **Total Marks:** 50 marks **College/Department assessment:** 25 marks

Prerequisites: Networking, cloud concepts

Course Objectives(COs)

CO1.   Gain a thorough understanding of the philosophy and architecture of Web applications using ASP.NET Core MVC;

CO2.   Gain a practical understanding of.NET Core;

CO3.   Acquire a working knowledge of Web application development using ASP.NET Core MVC 6 and Visual Studio

CO4.   Persist data with XML Serialization and ADO.NET with SQL Server

CO5.   Create HTTP services using ASP.NET Core Web API;

CO6. Deploy ASP.NET Core MVC applications to the Windows Azure cloud.

Course Outcomes:

OC 1: Develop web applications using Model View Controller.

OC 2: Think and apply the microservices way to software development.

Course Code: 516a	Course Name: Malware Analysis Practical
Total Credits: 04	Total Marks: 100 marks
University assessment: 50 marks	College/Department assessment: 50 marks

Prerequisites:

Basic security concepts

Course Objectives(COs)

CO1. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.

CO2. Have an intimate understanding of executable formats, Windows internals and API, and analysis techniques.

CO3. Extract investigative leads from host and network-based indicators associated with a malicious program.

CO4. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti•analysis techniques in future malware samples.

CO5. Achieve proficiency with industry standard tools including IDA Pro, OllyDbg, WinDBG, PE Explorer, ProcMon etc.

Course Outcomes:

After completion of the course, a student should be able to:

OC 1: Understand various introductory techniques of malware analysis and creating the testing environment

OC 2: Perform advanced dynamic analysis and recognize constructs in assembly code.

OC 3: Perform Reverse Engineering using OLLYDBG and WINDBG and study the behaviours and functions of malware

OC 4: Understand data encoding, various techniques for anti-disassembly and anti-debugging

OC 5: Understand various anti virtual machine techniques and perform shellcode analysis of various languages along with x64 architecture.

Course Code: 516b	Course Name: Cloud Management Practical
Total Credits: 04 (120 Lecture Hrs)	Total Marks: 100 marks
University assessment: 50 marks	College/Department assessment: 50 marks

Prerequistes: Basic cloud knowledge
Course Objectives:

- Understand System Center 2019 and its different components.
  Each unit of 30 hrs duration

Course Outcomes:
After completion of the course, a student should be able to:

OC 1: Understand the concepts of VMM, SDN, NAS , HyperV etc.
OC 2: Understand and use of Service manager with various deployments that can be performed using it.
OC 3: Understand and use SCCM and Demonstrate the use of Configuration Manager
OC 4: Use automation with runbooks and demonstrate the use of Windows Orchestrator
OC 5: Use Data Protection Manager

Course Code: 516c **Total Credits:** 04 (120 Lecture Hrs) **University assessment:** 50 marks	**Course Name:** Computer Vision Practical **Total Marks:** 100 marks **College/Department assessment:** 50 marks

Prerequisites: Knowledge of Digital Image Processing

Course Objectives:

CO1. To develop the student's understanding of the issues involved in trying to define and simulate perception.

CO2. To familiarize the student with specific, well known computer vision methods, algorithms and results.

Each Unit of 30 hrs duration

Course Outcomes:

After completion of the course, a student should be able to:

OC 1: Understand the basics of computer vision

OC 2: Understand and analyse various structure form motion and various estimates of Dense Motion

OC 3: Apply various motion models to images and understand computation photography techniques

OC 4: Apply Epipolar geometry , Rectification and various other 3D correspondence and Stereo reconstruction techniques

OC 5: Understand image-based rendering and reconstruction.

(to be implemented in a cloud environment.)