M.Sc.

INFORMATION TECHNOLOGY

SYLLABUS

THOSE WHO JOINED FROM THE ACADEMIC YEAR
2023 - 2024

MANONMANIAM SUNDARANAR UNIVERSITY
THIRUNELVELI – 627 012

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI
PG PROGRAMME – AFFILIATED COLLEGES
M.Sc. INFORMATION TECHNOLOGY
(Choice Based Credit System)
(with effect from the academic year 2023-2024)

PREAMBLE

The Learning Outcome-based Curriculum Framework (LOCF) approach has been adopted in M.Sc Information Technology Programme to create and disseminate knowledge to the students on the latest technologies by imparting the technical skills to meet industrial needs and inculcate the skills for employability at the point of graduation.

Vision

Empowering students with computing knowledge to stay in forefront of state-of-art technologies for rendering the need based services to the society.

Mission

- To impart quality based education by inculcating technical, entrepreneurship and leadership skills to meet global challenges.
- To enable the students acquire the skill of employability and entrepreneurship.

Programme Educational Objectives (PEOs):

PEO 1: To equip students with the advanced concepts of Information Technology.

PEO 2: To help students in getting employment by mastering their skills.

PEO 3: To nurture creative thinking and make the students capable of undertaking innovative practices.

PEO 4: To develop environmental awareness, empowerment of humanity and civic consciousness.

PEO 5: To build the ability to cope with the changing environment

PEO 6: To mould them as responsible citizens by imparting value based education.

Program Outcomes (POs):

On successful completion of the M .Sc. Information Technology program, the

graduates will be:

PO 1: Knowledge: Gain in-depth knowledge of software and hardware techniques

PO 2: Problem solving: Ability to critically analyze and provide software solutions for problems

PO 3: Environment and sustainability: Understand the impact of software solutions in environmental and societal context and strive for sustainable development.

PO 4: Team Work: Work in teams to accomplish the objective.

PO 5: Communication Skills: Able to communicate effectively.

Programme Specific Outcomes (PSOs):

PSO 1: Understand and analyze the advanced knowledge in the Information Technology domain.

PSO 2: Enhance the logical and analytical thinking to understand the computational systems.

PSO 3: Ability to comprehend the development methodologies of software systems and to design the software solutions.

PSO 4: Explore the developing areas in the Information Technology sector and to enrich themselves to be skillful to meet the diverse expectations of the industry.

PSO 5: Equipped to be competent in providing optimal and ethical solutions to the technological challenges laid by the professional societies.

	PO 1	PO 2	PO 3	PO 4	PO 5
PSO 1	S	S	L	S	S
PSO 2	S	S	S	S	S
PSO 3	M	S	M	S	M
PSO 4	S	S	S	S	S
PSO 5	L	S	S	S	S

S – Strong, M- Medium, L- Low

REGULATIONS/ PROGRAMME SPECIFIC REQUIREMENTS

Duration of the Course:

M.Sc. Information Technology is a 2 years full time programme spread over four semesters.

Eligibility for Admission to the Programme

Candidates who have studied Bachelor's degree in relevant disciplines like B.Sc. in IT/CS, BCA, BE/BTech in IT or CS from recognized university are eligible for this programme (as specified in the admission guidelines given by the Directorate of Collegiate Education 2023-'2024 www.tndce.tn.gov.in)

SEMESTER WISE COURSE LIST
SECOND YEAR
Semester – III

Specification	Courses	Credits	No. of Hours
Core – X	R Programming	4	5
Core – XI	Research Methodology	4	4
Core – X1I	Artificial Neural Network	4	4
Core – XIII [LAB]	Data Analytics using R - Practical	3	4
Core – XIV [PRJ]	Mini Project	6	6
Elective – V	Cryptography & Network Security / Big Data Analytics / Virtual and Augmented Reality	3	4
Skill Enhancement Course – II	Soft Computing	2	3
	Internship	2	-
		28	**30**

Semester-IV

Specification	Courses	Credits	No. of Hours
Core – XV	Project with Viva Voce	20	30
	Extension Activity	1	-
		21	**30**

Total Credits : 91

Scheme of Evaluation (THEORY): Core/ Elective/ Skill Enhancement Courses

Total Marks:100 (Internal:25 Marks, External:75Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Average of best two tests from three: 15 Marks ii. Assignment: 05 Marks iii. Seminar: 05 Marks	End Semester Examination
Total: 25 Marks	Total: 75 Marks
Minimum Passing 50% i.e. 38marks	

Scheme of Evaluation (PRACTICAL): Core / Skill Enhancement Course

Total Marks:100 (Internal:50 Marks, External:50 Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Completion of Practical in time : 20 Marks ii. Model Practical Test : 20 Marks iii. Completion of Record work: 10 Marks	End Semester Practical Examination
Total: 50 Marks	Total: 50 Marks
Minimum Passing 50% i.e. 38 marks	

Scheme of Evaluation (PROJECT)

Total Marks:100 (Internal:50 Marks, External:50 Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Completion of Project in time : 10 Marks ii. Review marks(3 reviews) : 30 Marks iii. Completion of Report work: 10 Marks	End of IV Semester Project Submission and Viva-voce Examination
Total: 50 Marks	Total: 50 Marks
Minimum Passing 50% i.e. 38marks	

Project : Individual Project report should be submitted at the end of IV semester for external evaluation. Internal – 50 Marks, External – 50 Marks (Total 100 Marks). The internal marks should be given based on the presentation of three reviews(0th review -10 Marks, 1st review – 10 Marks, 2nd review – 10 Marks) and the performance assessment of the guide (Project completion in time 10 Marks and Report 10 Marks).

External (End Semester) Examination Question Pattern

Time: 3 hours   Max. Marks: 75

Part– A   (15 x 1 = 15)

Answer all the questions

Ten Questions, three objective type questions from each unit.

Part–B (5 x 4 = 20)

Answer all the questions

Five Questions, two short answer type questions from each unit with

internal choice (Either ... Or ...type)

Part–C   (5 x 8 = 40)

Answer all the questions

Five Questions, two descriptive/Analytical type questions from each unit with

internal choice (Either... Or …type)

Internship/Industrial visit/Field visit/Research Knowledge Updation Activity:
- A report should be submitted at the end of III semester and evaluated by external examiners.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)
- Internship students should submit certificate of attendance from the industry along with report.

Extension Activity :
- Outreach Activities / Conducting Virtual Presentations
  - Outreach Activities
    - Creating awareness of the usage of Computers in remote places
    - Performing any computer exhibition in a village
    - Conducting any type of awareness programmes using computers/ software

- o Conducting Virtual Presentations
  - Encourage the school students through some presentations
  - Conducting higher education awareness among school students using computers
- External examination will be conducted at the end of IV semester.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)

Title of the Course				R PROGRAMMING						
Category		CORE		**Paper Number**			CORE X			

Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	5	0	0	II	IIII	4	5	25	75	100

Pre-requisite	Basic idea about any programming language
Objectives of the Course	To impart knowledge about Big-data To study the control structures and vectors. To study about the lists To study the factors and tables To study about the object oriented programming
Course Outline	
	UNIT I: INTRODUCTION Evolution of Big Data - Best Practices for Big Data Analytics - Big Data Characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases - Characteristics of Big Data Applications - Perception and Quantification of Value - Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - MapReduce Programming Model

	UNIT II: CONTROL STRUCTURES AND VECTORS
	Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, DataFrames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations
	UNIT III: LISTS
	Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DataFrames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations
	UNIT IV: FACTORS AND TABLES
	Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING
	UNIT V: OBJECT-ORIENTED PROGRAMMING
	S Classes, Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Roger D. Peng, "R Programming for Data Science", 2012. 2. Norman Matloff, "The Art of R Programming - A Tour of Statistical Software Design", 2011.

Reference Books	1. Garrett Grolemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014
	2. Venables, W.N., and Ripley, "S Programming", Springer, 2000.
Website and e-Learning Source	1. https://www.simplilearn.com
	2. https://www.tutorialspoint.com/data-analytics-using-r-programming/index.asp
	3. https://www.javatpoint.com/r-tutorial

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding the fundamentals of Big Data
CLO2	Study about control structures and vectors
CLO3	Get the knowledge about Lists
CLO4	Get the information about the factors and tables
CLO5	Object oriented Programming

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	2	3	2	2
CLO2	3	2	2	3	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to each PSO	15	11	11	13	14	13

Title of the Course	RESEARCH METHODOLOGY								
Category	CORE			**Paper Number**		CORE XI			

Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	II	IIII	4	4	25	75	100

Pre-requisite	Basic critical and writing skills
Objectives of the Course	To impart knowledge and skills required for research problem formulation, analysis, solutions, technical paper writing and drafting and filing patents.
Course Outline	
	UNIT-I : **Research Methodology:** Objectives and motivation of research - Types of research - Research approaches - Significance of research - Research methods verses methodology - Research and scientific method - Importance of research methodology - Research process - Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations- Criteria of good research. Defining the research problem: Definition of research problem - Problem formulation - Necessity of defining the problem - Technique involved in defininga problem.
	UNIT-II : **Literature Survey and Data Collection:** Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Effective literature studies approaches, analysis, plagiarism, and research ethics. Data - Preparing, Exploring, examining and displaying.
	UNIT-III : **Research Analysis and Design:** Meaning of research design - Need of research design - Different research designs - Basic principles of experimental design - Developing a research plan - Design of experimental set-up - Use of standards and codes. Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

	UNIT-IV : **Intellectual Property Rights:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright- Process of Patenting and Development: technological research, innovation, patenting, development- Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.
	UNIT-V: **Patent Rights:** Scope of Patent Rights- Licensing and transfer of technology- Patent information and databases- Geographical Indications - New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs -Licenses, Licensing of related patents, patent agents, Registration of patent agents.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	3. R. Ganesan, "Research Methodology for Engineers", MIP Publishers, Chennai, 2011. 4. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
Reference Books	3. Peter S. Menell ,Mark A. Lemley, Robert P. Merges, "Intellectual Property in the New Technological "Vol. I Perspectives, 2021. 4. Laura R. Ford,"The Intellectual Property of Nations: Sociological and Historical Perspectives on a 5. RatanKhananabis and SuvasisSaha, "Research Methodology", Universities Press, Hyderabad, 2015. 6. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007. 7. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010

Website and e-Learning Source	1. https://www.coursera.org/courses?query=research%20methodology
	2. https://www.researchgate.net/topic/Research-Methodology
	3. https://www.wto.org/english/tratop_e/trips_e/intel1_e.htm
	4. https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf
	5. https://mrcet.com/downloads/digital_notes/CSE/Mtech/I%20Year/RESEARCH%20METHODLOGY.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding of research, IPR and patent fundamentals
CLO2	Identify the issues involved in research, IPR and patent filing
CLO3	Apply suitable instrumentation and sampling techniques for the research studies and recognize the framework for protecting IPR and process for obtaining patents
CLO4	Analyze data, and interpret research findings using appropriate methods and importance of IPR and patent protection in promoting research and development
CLO5	Design and develop research reports, research proposals, academic papers and patents

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	1	2	3	2	2
CLO2	3	2	2	3	3	2
CLO3	3	2	2	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to each PSO	15	11	11	13	14	13

Title of the Course				**ARTIFICIAL NEURAL NETWORKS**						
Category		CORE		**Paper Number**			CORE XII			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	II	III	4	4	25	75	100

Pre-requisite	Able to know the fundamentals of computer networks
Objectives of the Course	The main objectives of this course are to: • To understand the basics of artificial neural networks • To understand the Activation and Synaptic Dynamics. • To understand the Functional Units Of Ann For Pattern Recognition Tasks • To understand the Feedback Neural Networks • To understand the Applications Of Neural Systems
Course Outline	**UNIT – I** Basics of Artificial Neural Networks: Characteristics of Neural Networks – Historical development of Neural Network principles – Artificial Neural Networks: Terminology – Models of Neuron – Topology – Basic Learning Laws
	UNIT – II Activation and Synaptic Dynamics: Introduction – Activation Dynamic Models – Synaptic Dynamic Model – Learning Models –Learning Methods.
	UNIT – III Functional Units Of Ann For Pattern Recognition Tasks: Pattern Recognition Problem – Basic Functional Units – Pattern Recognition Tasks by The Functional Units – FEED FORWARD NEURAL NETWORKS: Introduction – Analysis of Pattern Association Networks – Analysis of Pattern Classification Networks – Analysis of Pattern Mapping Networks.
	UNIT – IV Feedback Neural Networks: Introduction – Analysis of Linear Auto Associative FF Networks – Analysis of Pattern Storage Networks. Competitive Learning Neural Networks: Introduction – Components of a Competitive Learning Network – Analysis of Feed Back Layer for Different Output Functions – Analysis of Pattern Clustering Networks – Analysis of Feed Mapping Network
	UNIT – V Applications Of Neural Systems: Applications of Neural Algorithms And Systems Character Recognition – Expert System Applications – Neural Network Control Applications, Spatio – Temporal Pattern Recognition – Neocognitron and other Applications

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Acquire the knowledge about Artificial Neural Network
Recommended Text	1. For Units I to IV : "ARTIFICIAL NEURAL NETWORKS", B.YEGNANARAYANAN, Eastern Economy edition – Chapter 1,2, (2.1, 2.2, 2.3, 2.4 only), 3, 4, 5 (5, 5.1, 5.2, 5.3 only) & 6. 2. For Unit – V : "INTRODUCTION TO ARTIFICIAL NEURAL SYSTEMS", JACEK M.ZURADA – Jaico Publishing House (1994).
Reference Texts	"Introduction to the theory of Neural Computation"- J.Hertz, A.Krogh and R.G.Palmer, Addison – Wesley 1991.

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	understand the principles of Neural Networks L2
CO2	Identify different types of models of artificial neural networks L3.
CO3	Analyse the feed-forward neural networks. L4
CO4	Analyse the feedback neural networks. L4
CO5	Compare different applications of artificial neural networks. L4

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed To each PSO	15	13	14	12	14	13

Title of the Course	DATA ANALYTICS USING R - PRACTICAL		
Category	CORE	**Paper Number**	CORE IV

Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	4	II	III	3	4	50	50	100

Pre-requisite	Basic understanding of C, C++ and Java programming languages
Objectives of the Course	This course gives practical experience in R Programming basics and different applications in data analytics
Course Outline	1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R. 2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R. 3. To get the input matrix from user and perform Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in R. 4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R. 5. To perform data pre-processing operations i) Handling Missing data ii) MinMax normalization 6. To perform dimensionality reduction operation using PCA for Houses DataSet 7. To perform Simple Linear Regression with R. 8. To perform K-Means clustering operation and visualize for iris data set 9. Write R script to diagnose any disease using KNN classification and plot the results. 10. To perform market basket analysis using Association Rules (Apriori)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Programming knowledge in R Programming
Recommended Text	1. Roger D. Peng, "R Programming for Data Science", 2012. 2. Norman Matloff, "The Art of R Programming - A Tour of Statistical Software Design", 2011.

Reference Books	1. Garrett Grolemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014
	2. Venables, W.N., and Ripley, "S Programming", Springer, 2000.
Website and e-Learning Source	1. https://www.simplilearn.com
	2. https://www.tutorialspoint.com/data-analytics-using-r-programming/index.asp
	3. https://www.javatpoint.com/r-tutorial

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand the significance of control statements, loops and functions in creating simple programs.
CLO2	Apply the core data structures available in python to store, process and sort the data
CLO3	Analyze the real time problem using suitable python concepts
CLO4	Assess the complex problems using appropriate concepts in python
CLO5	Develop the real time applications using python programming language.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	2	2
CLO2	3	3	3	3	3	2
CLO3	3	2	3	3	3	3
CLO4	3	3	3	3	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to each PSO	15	13	15	15	13	15

Title of the Course				MINI PROJECT						
Category		CORE		**Paper Number**			CORE XIV			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	0	0	6	II	III	6	6	50	50	100
Pre-requisite			UG Level Programming knowledge							

Title of the Course				Cryptography and Network Security						
Category		Elective		**Paper Number**			ELECTIVE V A			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	II	III	3	4	25	75	100
Pre-requisite		The Prerequisites of Cryptography and information security is to understand the principles and practices of cryptographic techniques								
Objectives of the Course		the students will be able to ➢ Understand a variety of generic security threats and vulnerabilities, and identify.(K1) ➢ Appreciate the application of security techniques and technologies in solving real life security problems in practical systems.(K2) ➢ Apply appropriate security techniques to solve security problem(K3,K4) ➢ Design security protocols and methods to solve the specific security problems. K5,K6)								
Course Outline		**UNIT-I :**Fundamentals and Mathematics of Cryptography Overview - Classical Crypto Systems – Substitution Ciphers – Transposition Ciphers- Stream and Block Ciphers – Introduction to Number Theory – Congruences – Chinese Remainder theorem – Modular Arithmetic - Modular Exponentiation – Fermats and Eulers Theorem - FiniteFields – GF(2n) Fields.								
		UNIT-II : Encryption Techniques Symmetric Encryption Techniques – DES – AES - Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service - differential cryptanalysis - linear cryptanalysis - side channel attack - lattice reduction attack - MerkleHellman knapsack attack - Hellman's time-memory tradeoff (TMTO) attack.								
		UNIT-III : Hash Functions and Signatures Message Authentication and Hash Functions – Description of MD Hash Family – Secure Hash Algorithms – SHA 512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Process, Services, Attacks on Digital Signature- Digital Signature Schemes.								

	UNIT-IV : Security Practices Vulnerability Analysis - Flaw Hypothesis Methodology, NRL taxonomy and Aslam's model - Auditing - Anatomy of an Auditing System - Design of Auditing Systems - Posteriori Design - Auditing mechanisms - Risk Analysis and Management - Disaster Recovery Planning/Incident Response Planning - Intrusion Detection System
	UNIT-V: Secure Development Secure Coding - OWASP/SANS Top Vulnerabilities - Buffer Overflows - Incomplete mediation - XSS - Anti Cross Site Scripting Libraries - Canonical Data Format - Command Injection - Redirection - Inference – Application Controls - Secure Software Development Life Cycle - Testing, Maintenance and Operation - Evaluation of Security Systems.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. William Stallings, "Cryptography And Network Security – Principles And Practices", PearsonEducation, Fourth Edition, 2006.
Reference Books	1. Wade Trappe And Lawrence C. Washington, "Introduction To Cryptography With Coding Theory" Second Edition, Pearson Education, 2007. 2. Mark Stamp, "Information Security: Principles And Practice", Wiley Inter Science, 2011.
Website and e-Learning Source	1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep Mukhopadhyay IIT Kharagpur 2. https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-033-computer-system-engineering-spring2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

CLO1: To provide students with contemporary knowledge in Cryptography and Security.
CLO 2: To understand how cryptography can be used as an effective tool in providing assurance concerning privacy and integrity of information
CLO 3: To provide skills to design security protocols for security problems.
CLO 4: Analyze particular security problems for given application
CLO 5: Familiar with current research issues and directions of security

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

Title of the Course			BIG DATA ANALYTICS				

Category		Elective	**Paper Number**		ELECTIVE V B		

Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	CIA	External	Total
								Marks		
	4	0	0	II	III	3	4	25	75	100

Pre-requisite	This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies.
Objectives of the Course	By the end of the course the students will be able to ➢ Identify and distinguish big data analytics applications. ➢ Describe big data analytics tools. ➢ Present cases involving big data analytics in solving practical problems.
Course Outline	**UNIT-I :** **Overview of Big Data and Data Analytics** Overview of Big Data: Characteristics of Big Data-Big Data Sources-Challenges in Big Data processing-Scalability issues; Business Intelligence v/s Data Analytics-Need of Data Analytics- Data Analytics in Industries- Role of the Data Scientist. The Design of HDFS- HDFS Concepts- Blocks – Name nodes and Data nodes; The Command- Line Interface: Basic File system Operations; Hadoop File systems: Interfaces-The Java Interface-Data Flow; Hadoop **I/O:** Data Integrity-Compression-Serialization-File-based data structures**.**
	UNIT-II : **MapReduce and its application** Analyzing the Data with Unix Tools- Analyzing the Data with Hadoop- Map and Reduce- Java Map Reduce; Data Flow- Combiner Functions- Running a Distributed Map Reduce Job; Hadoop Streaming; Hadoop Pipes.

	UNIT-III : **Application development using MapReduce framework** The Configuration API- Configuring the Development Environment- Writing a Unit Test- Running Locally on Test Data- Running on a Cluster- Tuning a Job- MapReduce Workflows.
	UNIT – IV : **Working of MapReduce** Mining Data Streams: The Stream Data Model- Sampling data in a stream- Filtering Streams- The Bloom filter; Counting distinct elements in a stream-The Flajolet-Martin Algorithm. How stream works-Streams Processing Language; Apache Spark - Introduction- Features of Apache Spark-Components of Spark- Resilient Distributed Datasets- Data Sharing using Spark RDD-Spark Streaming.
	UNIT-V: **Analytics for Big Data in motion** Mining Data Streams: The Stream Data Model- Sampling data in a stream- Filtering Streams- Mining Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank; Sentimentanalysis- Document sentiment classification- Rules of Sentiment Composition- Sentiment analysis using Twitter data.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, UK, 2011.
Reference Books	1. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2012. 2. Liu, Bing. "Sentiment analysis and opinion mining." Synthesis lectures on human language technologies, Cambridge University Press, 2015. 3. Holden Karau, Andy Konwinski, Patrick Wendell, MateiZaharia, " Learning Spark: Lightning- Fast Big Data Analysis", O'Reilly Media, 2015. 4. David Loshin, Morgan, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph", Kaufman Publishers, 2013.

Website and e-Learning Source	https://nptel.ac.in/courses/106/105/106105166/ https://onlinecourses.nptel.ac.in/noc21_ee85/preview	

CLO1: To understand the basic knowledge of big data analytics.
CLO 2: To learn the techniques and tools for big data analytics.
CLO 3: To conduct application case studies to show the usage of big data analytics.
CLO 4: Design and develop program to big data analytics techniques.
CLO 5: Conduct big data analytics using system tools.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

Title of the Course			VIRTUAL AND AUGMENTED REALITY							
Category		Elective		**Paper Number**			ELECTIVE V C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	II	III	3	4	25	75	100
Pre-requisite			Basic knowledge of computer graphics							
Objectives of the Course			To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.							
Course Outline										

	UNIT-I : **Virtual Reality**: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –**Input Devices:** Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces
	UNIT-II : **Output Devices:** Graphics Displays – Sound Displays – Haptic Feedback - **Computer Architecture for VR:** The Rendering Pipeline- PC Graphics Architecture - **VR Programming:** Toolkits and Scene Graphs – Traditional and Emerging Applications of VR
	UNIT-III : **Augmented Reality**: Introduction – **Augmented Reality Concepts:** Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience
	UNIT-IV : Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies
	UNIT-V: **Augmented Reality Content:** Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - **Mobile Augmented Reality:** Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9) 2. Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8) 3. Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books	1. Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers) 2. Paul Mealy (2018), "Virtual and Augmented Reality",Wiley 3. Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley
Website and e-Learning Source	1. Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013 2. Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q 3. http://msl.cs.uiuc.edu/vr/ 4. http://www.britannica.com/technology/virtual reality/Living-in - virtual-worlds 5. https://mobidev.biz/blog/augmented-reality-development-guide

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic terminologies, techniques and applications of VR and AR
CLO2	Describe different architectures and principles of VR and AR systems
CLO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CLO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CLO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6
CLO1	3	1	1	2	2	2
CLO2	3	2	2	2	2	2
CLO3	3	2	2	3	3	3
CLO4	3	2	2	3	3	2
CLO5	3	2	3	3	3	3
Weightage of course contribute to each PSO	15	9	10	13	13	12

Title of the Course	SOFT COMPUTING								
Category	SKILL		**Paper Number**			SKILL II			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	3	0	0	II	III	2	3	25	75	100

Pre-requisite	Able to know the fundamentals of networks.
Objectives of the Course	The main objectives of this course are to: • To explore the benefits computing methodologies like neural netwoks, fuzzy logic and genetic algorithms • To enable the students to develop hybrid systems for the industrial problems
Course Outline	**UNIT - I NEURAL NETWORKS FUNDAMENTALS** Artificial Neural Network : Basic Concepts of Neural networks - Evolution of Neural networks - Basic Models of Artificial neural network - Terminologies of ANN- McCulloch - Pitts Neuron - Linear separability - Hebb Network - Applications of Neural networks. Supervised learning Network : Introduction – Perceptron Networks – Adaptive Linear Neuron – Multiple Adaptive Linear Neurons – Back propagation Network.

	UNIT – II CATEGORIES OF NEURAL NETWORKS Associative Memory Networks : Introduction – Training algorithms for pattern association – Auto associative Memory Network – Bidirectional Associative Memory – Hopfield Networks. Unsupervised Learning networks: Introduction – Fixed Weight Competitive Nets - Kohonen Self-Organizing Maps – Learning Vector Quantization – Adaptive Resonance Theory Network.
	UNIT – III BASIC CONCEPTS OF FUZZY SET Introduction to Classical Sets and Fuzzy Sets : Introduction - Classical sets - Fuzzy Sets. Classical Relation and Fuzzy Relations :- Introduction - Cartesian product of a relation - Classical Relation - Fuzzy Relations. Membership Functions : Introduction - Features of Membership Functions – Fuzzification - Methods of Membership Value Assignments. Defuzzification : Introduction - Lambda-Cuts for Fuzzy Sets - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods.
	UNIT - IV FUZZY ARITHMETIC AND DECISION MAKING Fuzzy Arithmetic and Fuzzy Measures : Introduction - Fuzzy Arithmetic - Extension principles – Fuzzy measures. Fuzzy Rule Base and Approximate Reasoning : Introduction- Truth values and Tables in fuzzy logic - Fuzzy properties - Formation of rules- Decomposition of rules - Aggregation of Fuzzy rules - Fuzzy reasoning - Fuzzy Inference Systems. Fuzzy Decision Making : Individual Decision Making - Multiperson Decision Making - Multiobjective Decision Making - Multiattribute Decision Making. Fuzzy Logic Control Systems : Introduction - Control System Design - Architecture and Operation of FLC System.
	UNIT - V GENETIC ALGORITHMS Genetic Algorithms : Introduction - Basic Operators and Terminologies in GAs - Traditional Algorithm vs. Genetic Algorithm - Simple GA - General Genetic algorithm - The Schema Theorem - Classification of Genetic Algorithm - Applications of Genetic Algorithm. Applications of Soft Computing : Introduction - A Fusion approach of Multispectral Images with SAR Image for Flood area Analysis - Optimization of TSP using Genetic Algorithm Approach

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency.
Recommended Text	1. S.N Sivanandam and S.N Deepa, "Principles of Soft Computing", Wiley – India, 2007. 2. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2004.
Reference Texts	1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI,Pearson Education 2004. 2. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007. 3. Timothy J.Ross, "Fuzzy Logic with Engineering Application", McGraw Hill, 2000. 4. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 2003.

CLO1: Implement machine learning through neural networks

CLO 2: Able to write genetic algorithms to solve optimization problem
CLO 3: Understand fuzzy concepts and develop a fuzzy expert system to derive decisions

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
Weightage of course contributed to each PSO	9	7	8	6	8	7

Title of the Course	PROJECT WITH VIVA VOCE									
Category	CORE			**Paper Number**			CORE XV			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**

	0	5	25	II	IV	16	30	50	50	100
Pre-requisite			UG Level Programming knowledge							