MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI-627 012, TAMILNADU, INDIA

CENTRE FOR INFORMATION TECHNOLOGY AND ENGINEERING

Board of Studies Meeting Held on 29.03.2022

M.Phil. INFORMATION TECHNOLOGY
(CBCS-University Department)

Regulations, Scheme and LOCF based Syllabus
For those who joined from the academic year 2022-2023 onwards

Submitted by

Chairman, BOS and Head ,
Centre for Information Technology and Engineering,

to

The Registrar
Manonmaniam Sundaranar University
Tirunelveli - 12

MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI – 627 012, TAMILNADU, INDIA

CENTRE FOR INFORMATION TECHNOLOGY AND ENGINEERING
M.Phil. Information Technology

Regulations, Scheme and LOCF based Syllabus
For those who joined from the academic year 2022-2023 onwards

The Objective of CITE Department is to create IT manpower catering to the need and expectations of IT Industry capable of making decisions that demonstrate their standing of being an ethical computing professional; Impart Applied communication skills to students in order to promote ideas in IT engineering and technology fields.

Vision

The CITE Department Aims to become a Center of Excellence in Core fields of Information Technology and Engineering with its efficient teaching and innovative research environment that makes knowledgeable and competent professionals who are socially oriented human beings.

Mission

The mission of Information Technology and Engineering Department is to educate students in IT And Engineering fields by providing in state-of-art knowledge IT in order to enable them create and consume information for an Ever Dynamic Information Society in an ethical way.

PREAMBLE

Programme Objective: The Master of Philosophy (MPhil) Program aims to train students to conduct independent research in Information Technology. A candidate for an MPhil degree is expected to demonstrate knowledge in the discipline and to synthesize and create new knowledge, making a contribution to the field.

The MPhil Programme seeks to train students in original research in Information Technology and to cultivate independent and innovative thinking that is essential for a successful research career in environmental science. A candidate for a MPhil degree is expected to demonstrate mastery of knowledge in the chosen discipline and to synthesize and create new knowledge, making an original and substantial contribution to the discipline.

Curriculum Highlights: The M.Phil. degree programme in Information Technology is to equip post graduate students with an integrated set of skills that will allow them to develop their research careers in this area of information technology. The focus of the program is to equip students with the theoretical and practical that is necessary to enable them to practical knowledge in the design of complex Computer applications/science. The program not only presents the knowledge in the design and implementation of computer applications but also prepares students to embrace future developments in the field and has a demonstrated professional relevance.

Learning Freedom to Students through MOOCs: Courses can be done by a student on Massive Open Online Courses - MOOC platform SWAYAM, edX, etc that can be credit transferred to the course basket as equivalent to classroom based courses based on the recommendations of Board of Studies approved from time-to-time. With two decades of experienced faculty and industry expertise, the curriculum has contents capable of producing superior student outcomes.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: Technical Expertise- Implement fundamental domain knowledge of core courses for developing effective computing solutions by incorporating creativity and logical reasoning.

PEO2: Successful Career- Deliver professional services with updated technologies in information technology based career.

PEO3: Soft Skills- Develop leadership skills and incorporate ethics, team work with effective communication & time management in the profession.

PEO4: Research- Graduates of the programme will contribute significantly in the technological developments of Information Technology through research practices.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Apply knowledge of mathematics, science and algorithm in solving complex Computer engineering problems.

PSO2: Generate solutions by conducting experiments and applying techniques to analyze and interpret data

PSO3: Design component, or processes to meet the needs within realistic constraints.

PSO4: Identify, formulate, and solve Software Engineering, Networking and Data Mining problems.

PSO5: Comprehend professional and ethical responsibility in computing profession.

PSO6: Recognize the need for, and an ability to engage in life-long learning.

PSO7: Knowledge of contemporary issues and emerging developments in computing profession.

PSO8: Utilize the techniques, skills and modern computer Engineering tools, Software and techniques necessary for Engineering practice.

PSO9: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

PSO10: Design research problems and conduct research in computing environment.

PEO vs. PSO Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
PEO1	S	S	M	S	M	M	S	S	M	S
PEO2	M	M	S	M	S	S	M	M	M	M
PEO3	M	M	S	M	M	S	S	M	S	M
PEO4	S	S	M	M	L	M	M	M	M	M

* S- Strong, M – Middle, L – Low

A. REGULATIONS

M.Phil. degree programme in Information Technology exposes students, the fundamental setup and latest trends of Information Technology (IT) through a set of hand-picked IT oriented subjects to pursue career in contemporary IT industry and in academics as well.

A1: Duration of the Course:

The M.Phil. programme is a 1 year full time programme spread over two semesters.

A2: Eligibility for Admission:

The minimum eligibility conditions for admission to the M.Phil. programme in Information Technology are given below.

The candidates who seek admission into the first semester of the M.Phil. programme in Information Technology course will be required to have passed the Master's degree (M.Sc. /M.C.A./ equivalent) from Manonmaniam Sundaranar University or any other Indian University or equivalent, in any one of the following disciplines:

1. Information Technology
2. Networking
3. Ecommerce
4. Software Engineering
5. Information Technology & Ecommerce

6. Computer Application
7. Computer Science
8. Information Technology and Management
9. Cyber Security
10. Data Analytics
11. Data Science
12. Any other qualification recognized as equivalent to the above disciplines

A3: Credit Requirement for the Degree:

The general Regulations of the Choice Based Credit System programme of Manonmaniam Sundaranar University are applicable to this programme. The University requirement for the M.Phil. programme is completion of 40 credits of course work, out of which 16 credits should be through Dissertation and Viva-Voce, remaining 24 credits should be through Core and Elective papers. A typical theory course (Core/ Elective/ Supportive Course) has 8 credits. No candidate will be eligible for the Degree of Master of Philosophy in Information Technology, unless the student has undergone the prescribed courses of study for a period not less than 2 semesters and has acquired 40 credits and other passing requirements in all subjects of study.

Consolidated Percentage of Marks = $\frac{Total\ of\ (\%\ of\ Marks\ X\ Credits)}{Total\ Credits\ Acquired}$

A4: Attendance Requirement:

A candidate will be permitted to appear for the semester examination only if the candidate keeps not less than 75 percent attendance. The University condonation rules are applicable for those who lack minimum of 75% attendance. The candidates with less than 60% attendance will have to repeat the concerned entire semester.

A5: Assessment

Semester examination will be conducted for all subjects of study, at the end of each Semester. The assessment will comprise Continuous Internal Assessment (CIA) carrying a maximum of 25% marks and end-semester Examination carrying a maximum of 75% marks in each theory subject (Core/Elective).

For Dissertation and Viva-Voce, the CIA is carried out for 75 marks and the External Assessment (Final Project Presentation, Thesis/Dissertation) is for 75 marks. Viva-Voce is carried

out for 50 marks (25 marks internal and 25 marks external). The student will be tested for his understanding of basic principles of the core Specializations. The internal assessment for a total of 75 marks will be made by Project Supervisor. The Project Supervisor will conduct three reviews in each level of progress. On completion of the work, a Thesis/Dissertation should be prepared in the prescribed format and submitted to the department. The Dissertation presentation and Viva-Voce examination is conducted by a committee of one external examiner and one internal examiner appointed by the HOD/Professor/ Co-ordinator of Students' Project works.

A6: Passing Requirements

A candidate who secures not less 50 percent marks in end-semester Examination and not less than 50 percent of the total marks (Continuous Internal Assessment + end-semester Examination) in any subject of study will be declared to have passed the subject.

A Candidate who successfully completes the course and satisfies the passing requirements in all the subjects of study and curricular requirements will be declared to have qualified for the award of the Degree.

A7: Classification of successful candidates

The candidates who passed written papers, practical papers and Projects shall be classified as follows. Total Marks secured in written papers, practical papers and Project work altogether put as overall percentage along with the credits.

The classification is as follows,

	Marks Overall %	**Classification**
1.	60% and above	I Class
2.	50% to below 60%	II Class
3.	75% and above	I Class with Distinction

A8. Power to Modify

The University may from time to time revise, amend or change the regulations, scheme of examinations and syllabus, if found necessary and such amendments, changes shall come into effect from the date prescribed.

These regulations will come into effect from the academic year 2022-2023 onwards.

B. SCHEME OF EXAMINATION

M.Phil. in Information Technology (CBCS) - FULL - TIME

(Joined July 2022-2023 onwards)

Duration: ONE YEAR (Two Semesters – 40 Credits)

Sem	Title of the Subject	Status*	Hrs /Week	Credits	Maximum Marks				Passing Minimum Percentage %	
					Int	Ext	Viva-Voce	Total	Ext	Total
FIRST SEMESTER										
I	Research and Teaching Methodology	C	8	8	25	75	--	100	50	50
I	Data Sciences and Big Data Analytics	C	8	8	25	75	--	100	50	50
I	Elective 1	E	8	8	25	75	--	100	50	50
	I Semester total credits			**24**						
SECOND SEMESTER										
II	Dissertation and Viva Voce	D	16	16	75	75	50	200	50 %	50%
	II Semester total credits			**16**						
	OVERALL TOAL CREDITS			**40**						

*** C – Core, E – Elective, D –Dissertation**

Sl.No.	Title of the Subject	Status*	Hrs/week	Credits	Maximum Marks				Passing Minimum %	
					Int	Ext	Viva-Voce	Total	Ext	Total
LIST OF ELECTIVES										
A1	Advanced Digital Signal and Image Processing	E	8	8	25	75	--	100	50	50

A2	Pattern Recognition and Image Analysis	E	8	8	25	75	--	100	50	50
A3	Machine Learning	E	8	8	25	75	--	100	50	50
A4	Internet of Things	E	8	8	25	75	--	100	50	50
A5	Digital Forensics	E	8	8	25	75	--	100	50	50
A6	Robotics	E	8	8	25	75	--	100	50	50
A7	Modern Communication System	E	8	8	25	75	--	100	50	50
A8	Deep Learning	E	8	8	25	75	--	100	50	50
A9	High Performance Computing	E	8	8	25	75	--	100	50	50
A10	Pervasive, Grid and Cloud Computing	E	8	8	25	75	--	100	50	50
A11	Mobile and Cellular Computing	E	8	8	25	75	--	100	50	50
A12	Network Programming	E	8	8	25	75	--	100	50	50
A13	Advanced Network Security	E	8	8	25	75	--	100	50	50

M.Phil. INFORMATION TECHNOLOGY DEGREE PROGRAMME

C. SYLLABUS FOR M.Phil in INFORMATION TECHNOLOGY

SEMESTER I

LIST OF COURSES
(For The Candidates Admitted From 2022-23 Onwards)

S.No.	Course Code	Title
1		Research and Teaching Methodology
2		Data Sciences and Big Data Analytics

Course Code	Course Name	**Category**	L	P	Credit
	Research and teaching methodology	PC	8	0	8

Preamble

- To determine the impact of educational transformation on higher.
- To motivate and produce own learning.
- To apply new research skills effectively throughout their lives.

Prerequisite

- To acquire skills in Computer science and Information Technology.

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Level
CO1	Understand the basic objectives and significance of scientific research through knowledge.	Understanding, Remember
CO2	Formulate and execute the research problems and methods.	Remember, Apply
CO3	Plan the statistical methods for scientific research.	Apply , Create
CO4	Define the teaching methodology and solving the research problems	Apply, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	S	M	L	S	M	S	M	S	M
CO2	S	S	L	M	S	M	S	S	S	S
CO3	S	S	M	M	S	M	S	S	S	S
CO4	S	S	L	M	M	M	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

C. SYLLABUS FOR M.Phil. (INFORMATION TECHNOLOGY)

Core 1	Research and Teaching Methodology

Unit I - BASIC RESEARCH PROCESS: Objectives and Motivations - Distinct Approaches and Significance of Research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs Experimental Researches - The significance of research - Research Methodology vs Research Methods - Research Process - Finding a Research Topic and Beginning Research - Directed Study - Research Problem Formulation - Extensive Literature Survey and Choosing an Idea - Measures of Good Research; **Understanding Science and Scientific Research:** Goal and Process - Definitions by Contrast - Scientific Methods - Criteria to Evaluate Theories - Knowledge and Abstraction - The Origins of Knowledge - The Role of Science in Knowledge Creation - Knowledge and Objectivity - Perception and ―Direct Observation - Science and Truth - Critical Thinking - Logical Arguments - Deduction and Induction.

Unit-II – Research Methodology for Science: What is known as science? - Fusion of Science, Research, Engineering & Technology - Distinctions between Science and Technology - Pseudoscience - Science And Ethics - Science vs Engineering - Distinct perspectives of goals and Importance of Knowing How Engineering Research is done - Stages in Research Execution Process; **Formulating and Executing a Research Problem:** Understanding and Formulating a Research Problem - Issues with Choosing the Research Problem - Need for Defining the Research Problem - Various steps involved in Defining the Research Problem - Designing Research Plan for Science and Engineering - Components and Key Parameters of a Good Research Plan - Types of Research Plan - Developing an Experimental Plan for Research - **Research Methods for Science:** - Legacy of Ideas in Computing - Computing Research - The Evolution - An Overview of Scientific Research Methods - Theoretical vs. empirical methods in Computing - Theoretical Problems and Models in Computing. An Overview Statistical Research Methods for Science - The Classical four steps of the Scientific Method - Test of hypotheses - Applying the Scientific Method - Likely Mistakes and Errors - Science and Experimental Errors - Control of Measurement Errors in Scientific Experiments - Hypotheses, Models, Theories and Laws - Circumstances where Scientific Methods are not applicable.

Unit-III - Statistical Research Methods for Science: Role of Statistics in Scientific Experiments - Link between Probability and Statistics - Branches of Statistics for Research - Descriptive and Inferential Statistics - Statistical Parameters Commonly Encountered in Research - Statistical Data Sets - Raw Data Processing - Statistical Outliers - Statistical Analysis - Statistical Measurement Scales - Variables and Statistics - Qualitative to Quantitative Conversion - Practical Cases of Discrete Variables in Statistics - Discrete vs.

Continuous Variables - Inferential Statistics - Experimental Probability - Bayesian Probability - Confidence Interval - Significance of Significance Test - Statistical Significance and Sample Size - Margin of Error - Experimental Error - Random Error - Systematic Error - Data Dredging - Data Snooping - Data Fishing - Statistical Power Analysis - Ethics in Statistics - Philosophy of Statistics - Statistical Validity and Reliability. Deductive Methods in Computing - Ordinary Mathematical Proofs - Inference systems and their applications - Inductive Methods in Computing - Mathematical Induction - Recursive definitions and proofs by induction - Induction Vs Deduction, Deductive Method - Repetitions, Patterns, Identity - Causality and Determinism - Limitations in Formal Logical Systems - Fuzzy Logic and its Applications.

Unit-IV – Acquiring and Disseminating Research in Digital Era: Searching for Research Papers - Identifying and Developing Research Topic - Finding Background Information - Use Encyclopedias and Dictionaries - Exploit Bibliographies - Using Catalogs to Find Books and Media - Using Indexes to Find Periodical Articles - Finding Internet Resources - Categories of Search Tools Available - Beginning Point on the Web - The Five-Step Search Strategy - Search Strategies NOT Recommended for Finding Web Documents - Search Engines Suitable for Search Needs - Three Types of Search Tools - Finding Subject-Focused Directories for a Specific Topic or Field - Finding the Invisible Web or the Deep Web - Method of Evaluating Web Pages - Reasons for Evaluating What is Found on the Web - Citation Styles, Style Guides, and Avoiding Plagiarism - Citing Sources - Writing and Presentation of a Research Paper for a Conference and a Journal; Writing a good thesis: Research report writing - Thesis outline - Presenting Progress of Research Work to Doctoral Committee - Getting into the Real Business of Writing Thesis - The Ten Commandments for Thesis Writing - Converting your research thesis into a monograph.

Unit-V – Methodology of Teaching: Teaching - Objectives of Teaching, Phases of Teaching -Teaching Methods Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project Method, Seminar- Integrating ICT in Teaching: Individualized Instruction, Ways for Effective Presentation with Power Point- Documentation - Evaluation: Formative, Summative& Continuous and Comprehensive Evaluation - Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development- Teaching Later Adolescents.

Reference Books:

1. Dr.Krishnan Nallaperumal, “Research Methodology for Science and Engineering", Publication Division, Manonmaniam Sundaranar University, Tirunveli, 2018.
2. “Thesis & Assignment Writing” By Anderson, Berny H. Dujrston, H. Pode, Wiley Eastern Ltd., New Delhi.
3. “Research Methodology” R. Panneerselvam, PHI, New Delhi 2005

4. C. R. Kothari – Research Methodology Methods and Techniques – Wishwa Prakashan Publishers – Second Edition.
5. Dr. Rajammal, P. Devadas – A Handbook on Methodology of Research – Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education.
6. Scientific Social Surveys and Research - Young Pauline. V.
7. Sampath.K., Panneerselvem, A. & Santhanam,S. (1984) Introduction to educational technolog.(2nd revised ed.), New Delhi: Sterling Publisher.
8. Sharma,S.R.(2003). Effective classroom teaching modern methods, tools & techniques. Jaipur: Mangal Deep.
9. Vedanayagam, E.G. (1989). Teaching technology for college teachers New York: Sterling Publisher.

Course Code	Course Name	**Category**	L	P	Credit
	Data Sciences and Big Data Analytics	PC	8	0	8

Preamble

- To acquire knowledge in different Big Data Analytics concepts.
- To acquire skills in Data Sciences and its role in future data.

Prerequisite

- Introduction to Data Analytics

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Define the scope, role and its application of Big data analytics.	Understand, Remember
CO2	Apply the right algorithm in Data Analytics problem with the raw data using R programing.	Apply, Analyze, Create, Evaluate

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	S	L	L	S	S	S	S	S	M
CO2	S	S	L	M	S	S	M	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	17
Understand	6	6	6	18
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	2	2	2	10
Create	2	2	2	10

Core 2	DATA SCIENCES AND BIG DATA ANALYTICS

Unit I Introduction to Big Data Analytics : Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

Unit II Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation : Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA.

Unit III Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics – Reasons to choose and cautions – Additional Algorithms - Association Rules : A Priori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Validation and Testing – Diagnostics. Regression: Linear Regression and Logistic Regression:– Use cases – Model Description – Diagnostics - Additional Regression Models.

Unit IV Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Naive Bayes – Bayes Theorem – Naïve Bayes Classifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis : Overview – Box – Jenkins Methodology – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model - Text Analysis : Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

Unit- V Advanced Analytics-Technology and Tools: Map Reduce and Hadoop : Analytics for Unstructured Data .- Use Cases – Map Reduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – NoSQL - Tools in Database Analytics : SQL Essentials - In Database Text Analysis - Advanced SQL - Analytics Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization.

Reference Books:

1. Anil Maheshwari. (2017). Data Analytics. McGraw Hill Education.
2. John Wiley & Sons.(2015)Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons , Inc
3. Noreen Burlingame.(2012).The little book on Big Data. New Street publishers.
4. Norman Matloff.(2011).The Art of R Programming: A Tour of Statistical Software Design. No Starch Press; 1 edition.

Major Project	**DISSERTATION AND VIVA VOCE**

Objective of this course is to facilitate transfer of knowledge acquired by a student to a field of his chosen specialization for application to solving a problem. The Co-ordinator of Students' Project works from the department shall coordinate this course. Student is expected to collect and study relevant material under mentorship of a Project Supervisor, identify a suitable problem and propose methodology towards its solution. Alternately a student can explore hardware / software implementation of existing solution(s).

The student will be tested for his understanding of basic principles of the core Specializations. The internal assessment will be made by Project Supervisor. The Project Supervisor will conduct three reviews in each level of progress. On completion of the work, a thesis report should be prepared in the prescribed format and submitted to the department. The end-semester university examination, will have a thesis presentation and Viva-Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the HOD/Professor/ Co-ordinator of Students' Project works.

GROUP A: SUBJECTS FOR ELECTIVES

Course Code	Course Name	**Category**	L	P	Credit
	Advance Digital Signal and Image Processing	PC	8	0	8

Preamble

- To get the knowledge about digital signal and image processing.
- To make the learners who are effectively doing the research on signal and image processing.

Prerequisite

- Digital Image Processing

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Define the different transforms are applied in the area of biomedical signal, speech and image processing.	Remember, Apply, Analyze, Create
CO2	To get the knowledge of image preprocessing transformation.	Understand, Remember

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1		M								M
CO2		S					L			S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A1	ADVANCED DIGITAL SIGNAL AND IMAGE PROCESSNG

UNIT I

Introduction: Overview of discrete time signal and systems, Types of discrete time systems, Analysis of discrete-time linear time invariant systems, Multi rate signal processing: Decimation by factor D, I sampling rate conversion by a rational factor I/D. Z-transform, Properties of Z- transform. **Frequency domain analysis**: Discrete Fourier transform (DFT), Inverse DFT, Inter relationship with z-transform and Hilbert-transforms, FFT algorithms- Decimation in time and decimation in frequency. DSP applications in the area of biomedical signal, speech, and image.

UNIT II

The Digitized Image and its Properties: Applications of image processing, image function, image representation, sampling, quantization, color images, metrics and topological properties of digital images, histograms, image quality, noise image.

UNIT III

Image Pre-processing: Pixel brightness transformation, geometric transformation, local pre- processing- image smoothening, scale in image processing, spatial operation, intensity transformation and spatial filtering, color models, gray scale transformation.

UNIT IV

Image Restoration & Segmentation: Image degradation and re-storage process, segmentation, Point, line and edge detection, threshold detection methods, parametric edge models, edges in multispectral images, Region based segmentation, image representation, border following and chain codes, boundary descriptors, regional descriptors.

UNIT V

Pattern Recognition Fundamentals: Basic concepts of pattern recognition, fundamental problemsin pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model.

Reference Books:

1. Digital Image Processing: Rafel C. Gonzalez Richard E. Woods, Second edition, Addison- Wisley.
2. Digital Image Processing: A K Jain, PHI
3. R. M. Haralick, L. G. Shapiro. Computer and Robot Vision. Addison-Wesley, 1993.
4. D. A. Forsyth, J. Ponce. Computer Vision: A Modern Approach. Prentice-Hall, 2003.

5. Pattern Recognition and Image Analysis: Earl Gose, Richard Johnsonbaugh, Prentice Hall of India Private Limited, 1999.
6. Pattern Recognition principles: Julus T. Tou and Rafel C. Gonzalez, Addison –Wesley publishing company.
7. .Alan V. Oppenheim & Ronald W. Schafer, " Digital Signal Processing" PHI, 2002
8. Sanjit K. Mitra, " Digital Signal Processing: A computer based approach" TMH, Second Edition, 2003.
9. John G. Proakis, Dimitris G. Mamalakis, Digital Signal Processing, Principles, Algorithmsand Applications.
10. Alan V. Oppenheim Ronald W. Schafer, Digital Signal Processing, PHI, India.

Course Code	Course Name	**Category**	L	P	Credit
	Pattern Recognition and Image Analysis	PC	8	0	8

Preamble

- To understand the stages of Pattern Recognition System in image analysis for various recognition based application.

Prerequisite

- Digital Image Processing.

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Understand and apply Image Processing for various recognition applications.	Apply, Create, Understand
CO2	Identify the basic concepts of Machine Learning applications.	Apply, Remember, Analyze

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	S	S	L	S	S	M	S	S	M
CO2	S	S	S	M	S	S	L	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A2	PATTERN RECOGNITION AND IMAGE ANALYSIS

UNIT I

Introduction: Machine perception, pattern recognition example, Pattern Recognition Systems, the design cycle, learning and adaptation - Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification-zero–one loss function, classifiers, discriminant functions, and decision surfaces.

UNIT II

Normal density: Univariate and multivariate density, discriminant functions for the normal density-different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT III

Un- supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering - Pattern recognition using discrete hidden Markov models - Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs.

UNIT IV

Continuous hidden Markov models: Continuous observation densities, multiple mixtures per state, speech recognition applications - Digital image models, sampling and quantization, basic relationships between pixels, image geometry. Image enhancement: Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain.

UNIT V

Image Segmentation and Edge Detection: Region Operations, Crack Edge Detection, Edge Following, Gradient operators, Compass and Laplace operators. Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection, image morphology, image security.

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stroke, Pattern Classifications, Wiley.
2. Lawrence Rabiner, Biing – Hwang Juang Fundamentals of Speech Recognition, Pearson
3. Gonzalez R.C & Woods R.E., Digital Image Processing, Addison Wesley, 1992.
4. Jain A.K., Fundamentals of Digital Image Processing, Prentice Hall of India.
5. Reddy M.Anji, Digital Image Processing, BS Publications.

Course Code	Course Name	**Category**	L	P	Credit
	Machine Learning	PC	8	0	8

Preamble

- To learn the importance of Machine Learning
- To understand basic Machine learning algorithms.
- To know how to apply the learning algorithms for various prediction problems.

Prerequisite

- Introduction to data analytics

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Know the importance of Machine Learning	Understand, Remember
CO2	Apply the various machine learning algorithms for prediction problem	Apply, Understand, Create, Analyze
CO3	Learn the knowledge of all the aspects of machine learning applications.	Remember, Understand

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	L	L	S	S	S	S	S	M
CO2	S	S	L	L	S	S	M	S	S	S
CO3	S	S	M	L	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A3	Machine Learning

UNIT I:

Introduction to Machine Learning - Defining learning systems, Goals and applications of machine learning in different fields such as health care, banking, telecommunication, digital marketing and so on. Aspects of developing a learning system: training and testing data, concept representation, function approximation, a general overview of supervised, semi-supervised, unsupervised learning algorithms and the usage of each algorithm.

UNIT II:

Basics of Python: Introduction to Python, **Control structure and function:** if-elif-else, while loop, for loop, break and continue, Introduction to function, Types of functions, Function arguments, Lambda functions, File Handling, packages and modules.

Python Data Structures: Lists, Tuples, Dictionary, Sets, strings, **Numpy:** Numpy operation, Array and its operation, Matrix and associated operations, Linear algebra and related operations using python. Understand the advantage of using Python libraries for implementing Machine Learning models. Types of data sets.

UNIT III:

Pandas data frame and data frame related operations on dataset : Reading and writing data files, pandas append, insert, replace, dropping columns from data frame, group by and aggregate function, join operations, Exploratory data analysis, Data preparation and preprocessing (Dealing with missing value, cross-validation, classification, performance measure),

Data visualization on dataset using matplotlib and seaborn libraries: Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

UNIT IV:

Introduction to Regression - Linear, Non-linear, Simple and Multiple regression, and their applications, **Introduction to Classification technique** - KNN, ANN, Decision Trees and SVM. Pros and cons of each method, and different classification accuracy metrics.

UNIT V:

Introduction to clustering approaches - Types of clustering, including k-means clustering, Partitioned-based Clustering, Hierarchical Clustering, and Density-based Clustering.

Decision Tree Learning: - Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over-fitting. **Support Vector Machines:** Maximum margin linear separators. Kernels for learning non-linear functions. Bayesian Learning: theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies.

Reference Books:

1 Tom Michel, Machine Learning, McGraw Hill, 1997
2 Introduction to Machine Learning with Python, Andreas C. Mueller
3 Mastering Python for data science, Samir Madhavan
4 Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
5 McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython.

Course Code	Course Name	**Category**	L	P	Credit
	Internet of Things	PC	8	0	8

Preamble

- To gain the knowledge on bases of Internet of Things (IoT) architecture - protocols and relationship between IoT and WoT.

Prerequisite

- Network security.

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Level
CO1	Understand the basics of IoT	Remember, Apply
CO2	Learn the IoT Architecture	Understand, Apply
CO3	Understand the IoT Protocols	Understand, Remember, Analyze
CO4	Learn the IoT in web	Understand, Remember
CO5	Apply all the aspects in IoT applications	Apply, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	M	S	M	S	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	M	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A4	Internet of Things

UNIT I

Introduction to IoT, IOT Architecture, Sensing, Actuation, Basics of Networking,Basics of Networking Communication Protocols.

UNIT II

Communication Protocols, Sensor Networks, Machine - to - Machine Communications and Introduction to SDN, SDN for IoT.

UNIT III

Interoperability in IoT, Introduction to Arduino Programming, IoT development tools /platforms, Integration of Sensors and Actuators with Arduino, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

UNIT IV

IOT based Cloud Computing, Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes, Data Handling and Analytics.

UNIT V

IOT Based Connected Vehicles, Smart Grid, Industrial IoT. Applications of IOT, Case Study: Agriculture, Healthcare, Activity Monitoring, Implementation of IoTconcepts

Reference Books:

1. Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press).
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press).
3. Buyya, R., & Dastjerdi, A. V. (Eds.). (2016). Internet of Things: Principles and paradigms. Elsevier.
4. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting everything”, 1st Edition, Apress Publications, 2013.

Course Code	Course Name	**Category**	L	P	Credit
	Digital Forensics	PC	8	0	8

Preamble

- To know the recovery and investigation of material found in digital devices, often in relation to computer crime.
- To cover investigation of all devices capable of storing digital data.

Prerequisite

- Introduction to data privacy

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Apply the knowledge of forensic science in investigation for collecting digital evidence.	Understand, Remember
CO2	Understand the digital data related to digital forensic environment.	Understand, Remember
CO3	Apply the knowledge of collecting evidences using various tools.	Apply, Analyze, Create
CO4	Analyze the best practice guidelines for digital evidence examination.	Analyze, Understand
CO5	Learn the other sources of evidences and validation of forensic report.	Understand, Remember

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	S	S	S	S	S	S	S	S	L
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	M	S
CO4	S	S	M	M	S	S	S	S	S	S
CO5	S	S	S	L	S	S	S	S	S	L

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A5	Digital Forensics

UNIT I

INTRODUCTION: Introduction to Forensic Science, Digital Forensics, Digital Evidence. Digital Forensics Process: – Identification, Collection, Examination, Analysis, Presentation Phases.

Cyber Crime Law- International Legal Framework of Cybercrime Law, Digital Crime, Investigation Methods for Collecting Digital Evidence.

UNIT II

FORENSICS ENVIRONMENTS: Hardware and Software Environments – Storage Devices, Operating System, File Systems, and Metadata, Locating evidence in file systems-Password security, Encryption, and Hidden files. Case study – linkingthe evidence to the user, Data Analysis using forensics tool ILookIX

UNIT III

COLLECTING EVIDENCES: Use of Digital Evidence, File Metadata and Correlation with Other Evidence, Technical Complexities of Digital Evidence. Data carving, Date and time problems, Physical Acquisition and Safekeeping of Digital Evidence. Forensic Imaging Processes. Case Study – IXImager, Understanding .ASB Container.

UNIT IV

ANALYZING DIGITAL EVIDENCE : Selecting and Analyzing Digital Evidence - Locating digital evidence, Categorizing files, Eliminating superfluous files, Validating the Evidence . Case study – illustrating the recovery of deleted evidence held in volume shadows.

UNIT V

OTHER SOURCES OF EVIDENCES : Windows and Other Operating Systems asSources of Evidence, Examining Browsers, E-mails, Messaging Systems, and

Mobile Phones, Internet and Cloud Challenges in Digital Forensics. Digital forensic Report writing & Presentation, Validation of Report.

Reference Books:

1. Richard Boddington, Practical Digital Forensics, PACKT publishing, First Edition, 2016 ANDRE ÅRNES.
2. Practical Mobile Forensics, PACKT publishing , 2014 Satish Bommisetty, Rohit Tamma, Heather Mahalik
3. "Guide to Computer Forensics and Investigations" 4e, Nelson, Phillips Enfinger, Steuart, Cengage Learning.
4. Android Forensics Investigation, Analysis, and Mobile Security for Google Android, Andrew Hoog, John McCash.

Course Code	Course Name	**Category**	L	P	Credit
	Robotics	PC	8	0	8

Preamble

- To attain the extensive knowledge on Robotic systems and its applications, Robatic vision and Robot manipulators.

Prerequisite

- Internet of Things

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Learn the basic components of robotic systems knowledge and its applications.	Understand, Remember
CO2	Understand the concept of inverse kinematics problems, robot manipulators sensing and vision	Understand, Remember
CO3	Apply the Arm Dynamics technique in robotics.	Apply, Analyze, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	L	S	S	S	S	S	M
CO2	S	S	S	L	S	S	S	S	S	S
CO3	S	S	M	M	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A6	ROBOTICS

UNIT I

Basic components of robotic systems,Robot classification, Robot specifications, Applications, Direct Kinematics: Coordinateframes; Rotations; Homogeneous coordinates; D- H representation; The Arm Equation.

UNIT II

Inverse Kinematics: Inverse kinematics problem, General properties of solutions, Tool configuration, Robotic work cell, Workspace analysis. Trajectory planning. Workspaceenvelope. Workspace fixtures. Pick and place operation. Continuous-path motion. Interpolated motion. Straight line motion.

UNIT III

Sensing and Control of Robot Manipulators: Different sensors in robotics: Range; Proximity; Touch; Torque; Force and others. Computed torque control; Near Minimum time control; Variable structure control; Non-Linear decoupled feedback control; Resolved motion and Adaptive control.

UNIT IV

Robotic Vision: Image acquisition and Geometry. Pre-processing; Segmentation and Descriptionof 3-D structures; Recognition and Interpretation.

UNIT V

Robot Arm Dynamics: Lagrange-Euler formulation; Newton Euler formulation; Generalized D'Alembert's equation.

Robot Programming Languages, Robot Intelligence and Task Planning: Characteristics of Robot level languages. Task level languages- with examples C, prolog. Assembly etc. Problem reduction; Use of predicate logic; Robot learning; Expert systems.

Reference Books:

1. Fundamental of Robotics: Analysis and Control- Robert J. Schilling.
2. Robotics: Control, Sensing,Vision and Intelligence- K.S. Fu, R.C. Gonzalez and Lee.
3. Robotics and Control – R. K. Mittal and I. J. Nagrath.
4. Coifet Chirroza, "An Introduction to Robot Technology" Kogan Page.
5. Y. Koren "Robotics for Engineers" Mcgraw Hill.
6. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill.
7. J.J. Craig, "Robotics" Addison-Wesley.
8. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
9. Asfahl, "Robots & Manufacturing Automation" Wily Eastern.

Course Code	Course Name	**Category**	L	P	Credit
	Modern Communication System	PC	8	0	8

Preamble

- To understand the concept of information communication over the network, ISDN, ATM Network and WAN, CAN, VAN Architecture.

Prerequisite

- Computer Networks

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Learn the basic concepts of Network evolution	Understand, Remember
CO2	Understand the concept of ISDN frame mode services.	Understand, Remember
CO3	Acquire the knowledge of ATM network concept Architecture and Modern communication system application.	Apply, Analyze, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1		M	S	L	S	S	S	S	S	M
CO2		S	S	S	S	S	L	S	S	S
CO3		S	M	S	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A7	**MODERN COMMUNICATION SYSTEMS**

UNIT-I: Network Evolution – The ISDN – The Basic Rat ISDN customer's Interface: The customer's Installation layer 1, 2, 3. Primary rate ISDN access: background – signaling – evaluation of PABX signaling – International standards for inter –PABX signaling.

UNIT-II: Frame mode services: Store and Forward Switching – Data grams and Virtual Circuits - Flow and Congestion Control – New ISDN Frame mode Services – Frame Format.

UNIT-III: ATM Network concepts and Architecture: ATM's position in the OSI Reference Model – B-ISDN protocol reference model – ATM functions and layers – ATM signaling principles – The ATM layer – ATM switching principles.

UNIT-IV: Modern Communication: Fundamentals of Information Handling – Information media as viewed from the Human Interface – Various facets of modern Communication systems – Composition of Modern Communication systems.

UNIT-V: Components of modern Communication systems: Home systems – Home system image – Home systems and their service Trends – Access systems for Home systems. Business Communications: Basic structure of the Office system in a single office / Plant – Basic Structure of the Office system connected to WAN's. The general structure of the office system – Actual Composition of CAN and WAN. Mobile Communication in the information society- Technical Background of Mobile Communication various Mobile Communications services – Positioning of VAN – Classification by service operation mode – Classification of VAN purpose – Classification of specific Industry service type VAN's from the added value viewpoint – New Electronic Media. Construction of Global Infrastructure: Satellite Communications systems – TV Broadcasting – Approaches to meeting new goals – Possibilities of new Broadcasting forms – Information service center systems – Automatic Interpretation telephone systems – Teleconferencing systems.

Reference Books:

1. "ISDN Explained" John M.Griffiths 2nd Edition March 1995 John Willey & sons. (Unit I & Unit II)
2. "Introduction to ATM Networking" Walter J. Goralski J. McGraw Hill Inc. (Unit III)
3. "Computers and communications" Koji Kobayashi the MID Press 1986. (A version of c and C). (Unit IV & Unit V)

Course Code	Course Name	**Category**	L	P	Credit
	Deep Learning	PC	8	0	8

Preamble

- To know the importance of Deep Learning.
- To learn basic deep learning algorithms.
- To understand how to apply the perceptron learning algorithms for various prediction problems.

Prerequisite

- Machine Learning

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Understand the concept of activation function and perceptron learning.	Understand, Create
CO2	Learn all the deep learning algorithms and its applications	Understand, Remember
CO3	Learn the concept of gradient descent and back propogation techniques.	Apply, Analyze, Remember

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A8	Deep Learning

UNIT I: Introduction to Tensor Flow : Computational Graph, Key highlights, Creating a Graph, Regression example, Gradient Descent, Tensor Board, Modularity, Sharing Variables, Keras Perceptrons: What is a Perceptron, XOR Gate

UNIT II: Activation Functions : Sigmoid, ReLU, Hyperbolic Fns, Softmax Artificial Neural Networks : Introduction, Perceptron Training Rule, Gradient Descent Rule

UNIT III: Gradient Descent and Backpropagation: Gradient Descent, Stochastic Gradient Descent, Backpropagation, Some problems in ANN Optimization and Regularization : Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyper parameters

UNIT IV: Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications

UNIT V: Deep Learning applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics

Reference Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 20.

Course Code	Course Name	**Category**	L	P	Credit
	High Performance Computing	PC	8	0	8

Preamble

- To understand the concept of cluster computing architecture, Grid application and the associated infrastructure of cloud computing services.

Prerequisite

- Network security

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Basic concepts in Cloud computing	Understand
CO2	Different Infrastructure Security in Cloud	Apply, Create
CO3	Policy and Compliance in Cloud Environment	Remember
CO4	Data lifecycle and encryption, architecture	Apply, Analyze
CO5	Various Cloud Security Architecture	Apply, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	L	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A9	HIGH PERFORMANCE COMPUTING

UNIT I - Cluster Computing and its Architecture

Cluster Computing and its Architecture: Ease of Computing - Scalable Parallel Computer Architecture - Towards Low Cost Parallel Computing & Motivation - Windows opportunity - A Cluster Computer and Its Architecture - Cluster Classification - Commodity Components for Clusters - Network Services/Communication SW - Cluster Middleware and Single Systems Image- Resource management & Scheduling (RMS).

UNIT II – Cluster Setup and Administration

Cluster Setup and Administration: Introduction - Setting up the cluster - Security - System Monitoring – System Tuning.

UNIT III - Introduction to Grid and its Evolution

Introduction to Grid and its Evolution: Beginning of the Grid - Building blocks of Grid - Grid Application and Grid Middleware - Evolution of the Grid: First, Second & Third Generation

UNIT IV – Introduction to Cloud Computing

Introduction to Cloud Computing: Defining Clouds - Cloud Providers - Consuming Cloud Services - Cloud Models – Iaas, Paas, SaaS - Inside the cloud -Administering cloud services - Technical interface - Cloud resources.

UNIT V – Nature of Cloud

Nature of Cloud: Tradition Data Center - Cost of Cloud Data Center - Scaling computer systems - Cloud work load - Managing data on clouds - Public, private and hybrid clouds Cloud Elements: Infrastructure as a service - Platform as a service - Software as a service

Reference Books:

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India.
4. Ronald Krutz, Cloud Security, Wiley India.
5. Cloud Computing, A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter , McGrawHill.

Course Code	Course Name	**Category**	L	P	Credit
	Pervasive, Grid and Cloud Computing	PC	8	0	8

Preamble

- To understand the concept of cloud computing security and its application, computer security, network security and information security.

Prerequisite

- Network Security

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Learn the concept of pervasive computing infrastructure.	Understand, Remember
CO2	Understand the concept of Grid technologies architecture and its applications.	Understand, Apply, Analyze, Create
CO3	Study the concept of cloud technologies and cloud relational databases.	Understand, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A10	PERVASIVE, GRID AND CLOUD COMPUTING

UNIT I:

Pervasive Computing Infrastructure-Applications-Device Technology- Hardware, Human-Machine Interfaces, Biometrics, And Operating Systems- Device Connectivity-Protocols, Security , And Device Management-Pervasive Web Application Architecture-Access From PCs And PDAs- Access Via WAP

UNIT II:

Grids and Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications- Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids

UNIT III:

Grid Management systems, security, Grid Grid-Enabling software and Grid enabling network services, Data Grid - Virtualization Services for Data Grids, Peer-to-Peer Grids - Peer-to-Peer Grid Databases for Web Service Discovery and application execution.

UNIT IV:

Introduction to Cloud Computing- Definition, Characteristics, Components- Cloud provider- Administering & Monitoring cloud services-benefits and limitations- Deploy application over cloud- Introduction to Cloud Technologies: SOAP, Webservices, AJAX and mashups, Virtualization Technology, Multitenant software.

UNIT V:

Cloud Relational databases- Cloud file systems- Cloud computing security architecture- Cloud computing security challenges- Issues in cloud computing- Cloud Middleware- Mobile Cloud Computing- Inter Cloud issues.

Reference Books:

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by GautamShroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Jochen Burkhardt, pervasive computing: Technology and Architecture of Mobile Internet Applications, Addison-Wesley Professional; 3rd edition, 2007
5. Fran Bermn, Geoffrey Fox, Anthony Hey J.G., "Grid Computing: Making the Global Infrastructure a Reality", Wiley, USA, 2003.
6. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004.
7. Ian Foster, Carl Kesselman, "The Grid2: Blueprint for a New Computing Infrastructure". Morgan Kaufman, New Delhi, 2004.
8. Ahmar Abbas, "Grid Computing: Practical Guide to Technology andApplications", Delmar Thomson Learning, USA, 2004.

Course Code	Course Name	**Category**	L	P	Credit
	Mobile and Cellular Computing	PC	8	0	8

Preamble

- To get the knowledge of fundamentals of wireless communication, telecommunication network system, LAN and mobile multimedia networks.

Prerequisite

- Network communication

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Learn the basic fundamentals of wireless communications.	Understand, Remember
CO2	Understand the concept of telecommmunication networks, mobile network layer and LAN	Create
CO3	Study the concept of TCP, WAP, mobile multimedia networks and its applications.	Apply, Analyze

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	L	S	S	S
CO3	S	S	M	S	S	S	S	S	S	

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A11	MOBILE AND CELLULAR COMPUTING

UNIT I: WIRELESS COMMUNICATION FUNDAMENTALS

Introduction - Wireless transmission - Frequencies for radio transmission - Signals - Antennas - Signal Propagation - Multiplexing - Modulations - Spread spectrum - MAC - SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks.

UNIT II: TELECOMMUNICATION NETWORKS

Telecommunication systems - GSM - GPRS - DECT - Satellite Networks - Basics - Parameters and Configurations - Capacity Allocation - FAMA and DAMA - Broadcast Systems - DAB - DVB.

UNIT III: WIRLESS LAN

Wireless LAN - IEEE 802.11 - Architecture - services - MAC - Physical layer - IEEE 802.11a - HIPERLAN - Blue Tooth.

UNIT IV: MOBILE NETWORK LAYER

Mobile IP - Dynamic Host Configuration Protocol - Routing - DSDV - DSR - Alternative Metrics.

UNIT V: TRANSPORT AND APPLICATION LAYERS

Traditional TCP - Classical TCP improvements - WAP- Introduction to 4G mobile networks- Case study - Mobile multimedia networks.

Reference Books:

1. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, 2003.
2. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002.
3. Mobile cellular Telecommunications – W.C.Y.LEE, TMH, 2nd Edition, 2006.
4. Principles of mobile Communications – Gordon L. Stuber, Springer International, 2nd edition, 2007.
5. Wireless Communications – T.S.Rapport, Pearson Education, 2nd edition, 2002.
6. Wireless mobile Communications – Lee, McGrahill, 3rd Edition, 2006.
7. Wireless Communication and networking – J.W.Mark and WeihulaZhqung, PHI, 2005.
8. Wireless Communication Technology, R.Blake, Thompson Asia, Pvt Ltd, 2004.
9. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, 2003.
10. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002.
11. KavehPahlavan, PrasanthKrishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
12. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
13. HazysztofWesolowshi, "Mobile Communication Systems", John Wiley and Sons Ltd, 2002.

Course Code	Course Name	**Category**	L	P	Credit
	Network Programming	PC	8	0	8

Preamble

- To understand the concept of valuable information resides on the network. There is proliferation of the networks in daily lives both academic and business environment.

Prerequisite

- Network Security

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Study the concept of system programming file formats network programming- Socket, Multiplexing.	Remember, Understand
CO2	Understand the concept of inter-process communication, handling out of band data and XDR, RPC applications	Apply, Analyze, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	L	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A12	NETWORK PROGRAMMING

Unit I

Introduction to Systems Programming: Files, System Files, File Formats, Buffered I/O, Directories, File System, Inodes, links, fcntl, links, locks, Device I/O, Terminal I/O, ioctl(), Files and Devices ,Signals, video I/O ,Multi-Tasking

Unit II

Processes and Inter-Process Communication: timers, polling vs interrupts, environment, fork, exec, wait, environment, exit and wait, pipe, fifos, message queues, semaphore.

Unit III

Network Programming: Sockets, Operation, Socket types, Domains Name Binding, osing Sockets, I/O Multiplexing, Client/Server Models, Connection Based Services,

Unit IV

Handling out of Band Data, Connectionless Services, Design issues of Concurrent and Iterative servers, Socket options

Unit V

XDR and Remote Procedure Calls, Network Programming at the level of Programming Language (can use Java or Python as case study)

Reference Books:

1. Unix Network Programming, W. Richard Stevens, Prentice Hall, 1998
2. Internetworking with TCP/IP, Volume3, Douglas Comer, Prentice Hall, 2000
3. Internetworking with TCP/IP, Volume1, Douglas Comer, Prentice Hall, 2000

Course Code	Course Name	**Category**	L	P	Credit
	Advanced Network Security	PC	8	0	8

Preamble

- To understand the concept of security in computer networks, the information security -valuable information resides in the network and cryptographic application in network security.

Prerequisite

- Network Security

Course Outcomes

On the successful completion of the course, students will be able to

Course Outcomes		Bloom's Level
CO1	Learn the basic concepts of security over the network.	Understand, Remember
CO2	Understand the concept of Asymmetric cryptography.	Understand, Remember
CO3	Study the concept of public key infrastucture of Identity Based Cryptography at the application layer over the network..	Apply, Analyze, Create

Mapping with Programme Outcomes

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	S	M	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	L	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S

Assessment Pattern

Bloom's Category	Continuous Internal Assessment (25)			Terminal Examination (75)
	I	II	III	
Remember	5	5	5	22
Understand	8	8	8	23
Apply	5	5	5	10
Analyze	5	5	5	10
Evaluate	0	0	0	0
Create	2	2	2	10

A13	ADVANCED NETWORK SECURITY

Unit I:

Introduction to the concepts of Security: The need for security, security approaches, principles of security, modular arithmetic, prime numbers, relative prime numbers, Euler's function, Symmetric Cryptography: Overview of symmetric cryptography, Algorithm types and Modes, International Data Encryption, Algorithm (IDEA), Advanced Encryption Standard (AES).

Unit II:

Asymmetric Cryptography: Overview of asymmetric cryptography, Rabin algorithm, ElGamal Algorithm, Knapsack Algorithm, Elliptic Curve Cryptography.

Unit III:

Identity Based Cryptography: Introduction, Boneh-Franklin IBE (BF-IBE), Sakai-Kasahara IBE (SK-IBE), Boneh-Boyen IBE, (BB-IBE).

Unit IV:

Public Key Infrastructure: Digital Certificates, Key Management. Hash Functions, Digital Signature, Message Integrity, Message Authentication, Entit Authentication

Unit V:

Security at the Application Layer: Email, PGP. Security at the Transport Layer:SSL and TLS. Security at the Network Layer: IPSec. System Security: Malicious Programs, IDS, Firewalls.

Reference Books:

1. William Stallings, Cryptography & Network Security: Principles and Practice, Pearson.
2. Stallings William, Network Security Essentials (Applications and Standards), Pearson Education.
3. Maiwald Eric, Fundamentals of Network Security, Dreamtech.
4. Char lie Kaufman, Radia Perlman & Mike Speciner, Network Security - Private Communication in a Public World, Pearson/PHI.
5. Whitman, Principles of Information Security, Thomson