KERALA TECHNOLOGICAL UNIVERSITY

ERNAKULAM – I CLUSTER

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

COMPUTER SCIENCE : SPECIALIZATION IN IMAGE PROCESSING

(2015 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN COMPUTER SCIENCE : SPECIALIZATION IN Image Processing

SEMESTER 1 (CREDITS: 23)

Exam Slot	Course No	Course Title	Core/ Elective	L-T-P	Internal Marks	End Semester Exam		Credits
						Marks	Duration (hrs)	
A	06 CS 6 01 7	Mathematical Foundation for Computer Science	Core	4-0-0	40	60	3	4
B	06 CS 6 02 7	Digital Image Processing	Core	4-0-0	40	60	3	4
C	06 CS 6 03 7	Advanced Data Structures & Algorithms	Core	4-0-0	40	60	3	4
D	06 CS 6 04 7	Computer Graphics & Volume Visualisation	Core	3-0-0	40	60	3	3
E	06 CS 6 x5 7	Elective I	Elective	3-0-0	40	60	3	3
	06 CS 6 06 7	Research Methodology	Core	0-2-0	100	0	0	2
	06 CS 6 07 7	Seminar	Seminar	0-0-2	100	0	0	2
	06 CS 6 08 7	Digital Image Processing Lab I	Lab	0-0-2	100	0	0	1
				24 Hrs				**23 Credits**

Semester I - MCSIP Elective I	
06 CS 6 15 7	Advanced Data Mining
06 CS 6 25 7	Human Computer Interaction
06 CS 6 35 7	Network Security and Cryptography

SEMESTER 2 (CREDITS: 19)

Exam Slot	Course No	Course Title	Core/ Elective	L-T-P	Internal Marks	End Semester Exam		Credits
						Marks	Duration (hrs)	
A	06 CS 6 01 8	Advanced Digital Image Processing	Core	4-0-0	40	60	3	4
B	06 CS 6 02 8	Computer Vision	Core	3-0-0	40	60	3	3
C	06 CS 6 03 8	Pattern Recognition	Core	3-0-0	40	60	3	3
D	06 CS 6 x4 8	Elective II	Elective	3-0-0	40	60	3	3
E	06 CS 6 x5 8	Elective III	Elective	3-0-0	40	60	3	3
	06 CS 6 06 8	Mini Project	Project	0-0-4	100	0	0	2
	06 CS 6 07 8	Digital Image Processing Lab II	Lab	0-0-2	100	0	0	1
				22 Hrs				**19 Credits**

Semester II - MCSIP Elective II	
06 CS 6 14 8	Bioinformatics
06 CS 6 24 8	Wireless Sensor Networks
06 CS 6 34 8	Data Compression

Semester II - MCSIP Elective III	
06 CS 6 15 8	Embedded Systems and Applications
06 CS 6 25 8	Soft Computing
06 CS 6 35 8	Social Network Analysis
06 CS 6 45 8	

SEMESTER 3 (CREDITS: 14)

Exam Slot	Course No	Course Title	Core/ Elective	L-T-P	Internal Marks	End Semester Exam		Credits
						Marks	Duration (hrs)	
A	06 CS 7 x1 7	Elective IV	Elective	3-0-0	40	60	3	3
B	06 CS 7 x2 7	Elective V	Elective	3-0-0	40	60	3	3
	06 CS 7 03 7	Seminar	Seminar	0-0-2	100	0	0	2
	06 CS 7 04 7	Project – Phase I	Project	0-0-12	50	0	0	6
				20 Hrs				**14 Credits**

Semester III - MCSIP Elective IV	
06 CS 7 11 7	Natural Language Processing
06 CS 7 21 7	Digital Video Processing
06 CS 7 31 7	GIS and Remote Sensing

Semester III - MCSIP Elective V	
06 CS 7 12 7	Imaging and Multimedia Systems
06 CS 7 22 7	Medical Image Techniques and Analysis
06 CS 7 32 7	High Performance Computing

SEMESTER 4 (CREDITS: 12)

Exam Slot	Course No	Course Title	Core/ Elective	L-T-P	Internal Marks	End Semester Exam		Credits
						Marks	Duration (hrs)	
	06 CS 7 01 8	Project – Phase II	Project	0-0-21	70	30	0	12
				21 Hrs				**12 Credits**

Total Credits for the Course: 68 credits

SEMESTER I

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 01 7	MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE	4-0-0-4	2015

PREREQUISITES: Basics of probability and Calculus

COURSE OBJECTIVES:

- To understand the fundamental concepts of probability-statistics, Random processes and to develop a mathematical foundations on image processing.
- All kinds of operation performed on images in order to extract qualitative or quantitative data, perform measurements and apply statistical analysis.

SYLLABUS:

Divisibility- Congruences, Fermat's theorem –Finite difference methods – Groups, homomorphism theorems-Probability , conditional probability, Probability distribution-Random Processes.

EXPECTED OUTCOME:

Students will get knowledge to perform measurements and apply statistical analysis on images.

TEXT BOOK:

1. Donald F. Stanat and David F. McAllister, Discrete mathematics in Computer Science.

REFERENCES:

1. Thomas Koshy, Elementary number theory with Applications, Elsevier
2. I.N.Herstein, Topics in Algebra.JOHN Wiley & SONS. 1990.
3. V. Krishnan Probability and Random Processes 2006, John Wiley & Sons
4. H. Cormen, C. E. Leiserson, R. L. Rivest, C Stein, Introduction to Algorithms, Prentice Hall India.
5. G. Chartrand and P. Zhang, Introduction to Graph Theory, McGraw-Hill Companies,
6. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India.
7. Linear Algebra 2nd Edition (Paperback) by Kenneth Hoffman, Ray Kunze, PHI Learning, 2009.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Divisibility, gcd, prime numbers, fundamental theorem of arithmetic, primality testing, solution of congruences, Wilson's theorem. Congruences, Fermat's theorem, Euler function, Chinese remainder theorem.	**10**	**25%**
II	Groups, homomorphism theorems, cosets and normal subgroups, Lagrange's theorem, Ring. Field. Polynomial arithmetic, quadratic residues, resiprocity, discrete logarithms, elliptic curve arithmetic.	**10**	**25%**
III	Probability axioms, conditional probability, discrete and continuous random variables, cumulative distribution function (CDF), probability mass function (PMF), probability density function (PDF), conditional PMF/PDF,	**10**	**25%**

	expected value, variance, functions of a random variable, expected value of the derived random variable, multiple random variables,sums of random variables, moment generating function, random sums of random variables, joint CDF/PMF/PDF.		
IV	Random Processes- Introduction and Classification, Guassian Process, Poisson Process, Markov process.	**10**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 02 7	DIGITAL IMAGE PROCESSING	4-0-0-4	2015

PREREQUISITES: NIL

COURSE OBJECTIVES:

- The objective of this course is to understand the basic principles and methods of digital image processing
- .To be able to formulate solutions to general image processing problems and have a comprehensive background in image filtering.
- The primary goal of this course is to lay a solid foundation for students to study advanced image analysis topics such as computer vision systems, biomedical image analysis, and multimedia processing & retrieval.

SYLLABUS:

2D Signals, 2D Systems, Classification of 2D Systems, Convolution and Correlation, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sampling and Quantisation, Image Transforms, Comparison of transforms, Image Enhancement, Image Restoration and Denoising, Applications of Digital Image Restoration, Image Compression, Morphological Image Processing.

EXPECTED OUTCOME:

- The ability to apply principles and techniques of digital image processing in applications related to digital imaging system design and analysis.
- The ability to analyze and implement image processing algorithms.
- To Gain hands-on experience in using software tools for processing digital images.

TEXT BOOK:

1. Digital Image Processing, Gonzalez.R.C & Woods. R.E., 3/e, Pearson Education, 2008.

REFERENCES:

1. Digital Image Processing, Kenneth R Castleman, Pearson Education, 1995.
2. Digital Image Procesing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education,2009.
Pvt Ltd, NewDelhi
3. Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India, 1989.
4. Image Processing, Sid Ahmed, McGraw Hill, New York, 1995.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	2D Signals, Separable and Periodic Sequences, 2D Systems, Classification of 2D Systems, Convolution and Correlation – Different Methods and Applications. Digital Image, Classification of digital images, Image-Types and File Formats, Fundamental Steps in Digital Image Processing, Components of an Image Processing	**14Hrs**	**25%**

	System, Elements of Visual Perception, Image Sampling and Quantisation, Basic Relationships between Pixels, Mathematical Tools used in digital image processing.		
II	Image Transforms: 2D Orthogonal and Unitary Transforms, 2D DFT, DCT, Walsh Transform, Hadamard Transform, Haar Transform, Slant Transform, KL Transform, SVD – Properties and Examples. Comparison of transforms. Image Enhancement: Point Operations – Types, Basic Intensity Transformation Functions, Histogram Processing. Fundamentals of Spatial Filtering, Smoothing and Sharpening Spatial domain Filters. Fundamentals of Frequency Domain Filtering, Smoothing and Sharpening Frequency domain Filters. Bit Plane Slicing, Homomorphic Filter, Image Arithmetic.	**14Hrs**	**25%**
III	Image Restoration and Denoising: Image Degradation, Image Blur-Types, Image Restoration Techniques-Classification, Image Restoration Model, Linear and Nonlinear Image Restoration Techniques. Blind Deconvolution-Classification. Image Denoising, Noises in Image-Classification, Median Filtering, Perfomance Metrics, Applications of Digital Image Restoration.	**14Hrs**	**25%**
IV	Image Compression: Fundamentals, Some Basic Compression Methods - Run Length Coding, Huffman Coding, Arithmetic Coding, Bit Plane Coding, Block Truncation Coding. JPEG Compression. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, Hit or Miss Transformation, Some Basic Morphological Algorithms, Grey Scale Morphology.	**14Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 03 7	ADVANCED DATA STRUCTURES AND ALGORITHMS	4-0-0-4	2015

PREREQUISITES: Algorithm,Analysis and Design

COURSE OBJECTIVES:

- The primary objective of this course is to introduce new and advanced data structures,algorithmic design and analyis.
- Also solve problems using different data structures and design techniques and compare their performance and tradeoffs.
- And also implement algorithms and data structures in c++.

SYLLABUS:

Basics of Algorithm Analysis: Computational Tractability, Asymptotic Notation,Algorithm Design Methods:Greedy Method- 0/1 Knapsack Problem,NP and Computational Intractability,Network Flow: The Maximum-Flow Problem.

EXPECTED OUTCOME:

Get a broad understanding of how to design,write, and analyse the performance of c/c++ programs that handles structured data and perform more complex task,typical of larger software projects.

TEXT BOOK:

1. Introduction to Algorithms (3rd Ed): Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press (2009).

REFERENCES:

1. Algorithm Design: Jon Kleinberg and Eva Tardos, AW (2005)
2. Data structures, Algorithms and Applications in C++, Sartaj Sahni, WCB McGraw-Hill
3. Anany V. Levitin. Introduction to the Design & Analysis of Algorithms (2nd Ed): A W (2006)
4. Randomized Algoritms: Rajeev Motwani and Prabhakar Raghavan, Cambridge University Press; Reprint edition (2010)
5. Introduction to Evolutionary Computing: Agoston E. Eiben, J.E. Smith, Springer (2010)

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Basics of Algorithm Analysis: Computational Tractability, Asymptotic Notation, A survey of common running times. Fundamental Data Structures- Trees: BST, B-Tree, AVL Tree, Splay Tree, Tries-Binary Tries, Multiway Tries. Priority Queue: ADT, Heaps, Leftist Trees, Application: Heap Sort; Binomial Heaps, Fibonacci Heaps	**14Hrs**	**25%**

II	Algorithm Design Methods: Greedy Method- 0/1 Knapsack Problem, Topological Sorting, Divide and Conquer- Strassen‟s Matrix Multiplication, Closest Pair of Points, Dynamic Programming-Image Compression, All Pairs Shortest Path, Backtracking- Travelling Sales Person, 8 Queens Person, Branch and Bound- Max Clique, Nearest Neighbour Search(NNS).	**14Hrs**	**25%**
III	NP and Computational Intractability: Polynomial-Time Reductions, The Satisfiabflity Problem, Efficient Certification and the Definition of NP, NP-Complete Problems, Sequencing, Problems, Partitioning Problems, Numerical Problems, Co-NP and the Asymmetry of NP, A Partial Taxonomy of Hard Problems. Randomized algorithms: Birthday Paradox, Quick sort, bucket sort, mini-cut, median finding- Random graphs, Ramsey number, Hamiltonian cycles.	**14Hrs**	**25%**
IV	Network Flow: The Maximum-Flow Problem and the Ford-Fulkerson Algorithm, Maximum Flows and Minimum Cuts in a Network, Choosing Good Augmenting Paths, Bipartite Matching Problem, Image Segmentation. Computational Geometry: Line segment properties, Finding the convex hull, Finding the closest pair of points	**14Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 04 7	ADVANCED COMPUTER GRAPHICS & VOLUME VISUALISATION	3-0-0-3	2015

PREREQUISITES: Basics of computer coordinate system and image creation in computers.

COURSE OBJECTIVES:

- To enable the students to acquire knowledge of image data creation by a computer specifically with help from specialized graphical hardware and softwares.
- It make the students aware about displaying art and image data effectively and beautifully to the user, and processing image data received from the physical world .

SYLLABUS:

Introduction to Computer Graphics, Applications, Basic Primitives- Transformations– Clipping-Surfaces and Meshes-Projection-Advanced Rendering Techniques-Direct X-Open GL.

EXPECTED OUTCOME:

Students will get knowledge of image data creation by a computer specifically with help from specialized graphical hardware and softwares.

TEXT BOOKS:

1. David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill, 2 nd Ed., 1997

REFERENCES:

1. Shreiner, “OpenGL Programming Guide: The Official Guide to Learning OpenGL,
2. Versions 3.0 and 3.1”, Addison Wesley, 7 th Ed., 2009
3. Steven Harrington, "Computer graphics: A Programming approach", McGraw Hill, 2 nd Ed., 1987.
4. Donald D. Hearn, M Pauline Baker, Warren Carithers, "Computer Graphics with Open GL ",PHI, 4 th Ed., 2010.
5. Tomas Akenine-Moller, Eric Haines, Naty Hoffman, “Real-Time Rendering”, AK Peters, 3 rd Ed.,2008.
6. Alan Watt and Mark Watt, “Advanced Animation and Rendering Techniques”, Addison-Wesley,1992.
7. Matt Pharr and Greg Humphreys, “Physically based rendering: From Theory to Implementation”, Morgan Kaufmann, 2 nd Ed., 2010.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to Computer Graphics, Applications, Basic Primitives: points, lines, circles. 3D Transformations, 3D rotation based on Arbitrary Axis, Composition of 3D transformation. Clipping: 3D Cyrus Beck clipping, 3D midpoint subdivision algorithm.	**12Hrs**	**25%**
II	Surfaces and Meshes. Subdivision, Distance fields and	**14 Hrs**	**25%**

	level sets, Physically-basedModeling, Stable fluid Solver, Lattice Boltzmann method, Bezier Curves, Splines, B-splines,Visible Surface Detection Methods, Appel's Algorithm, Haloed Line Algorithm.		
III	Advanced Rendering Techniques:- Photorealistic rendering: GlobalIllumination, Participating media rendering, Ray Tracing, Monte Carlo algorithm, Photonmapping. Volume Rendering:- Volume graphics overview, Marching cubes, Direct volumerendering.	**16Hrs**	**25%**
IV	Direct X:- Direct 3D architecture, primitives – point, line, triangle, Overview ofresources: Texture / vertex / buffers/ index buffers / Surface / depth buffers / stencil buffers /render targets / Flichain states, state management . Open GL: Introduction to OpenGL,OpenGL command syntax,OpenGL as state machine,OpenGL rendering pipeline,OpenGL related libraries,Describing points lines and polygon, Displying points lines and polygon,Normal vector,Vertex arrays.	**14 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 15 7	ADVANCED DATA MINING	3-0-0-3	2015

PREREQUISITES: Database Management Systems.

COURSE OBJECTIVES: The key objective of this course is to uncover the fundamental concepts of data mining,to demonstrate the potential of gathering large sets of data, and analyzing these data sets to gain useful business understanding .

SYLLABUS: Data Mining-Data Mining Functionalities-Association Rule Mining-Classification and Prediction-Classification Methods-Cluster Analysis-Outlier Analysis-Multidimensional Analysis and Descriptive Mining of Complex Data Objects- Multimedia Data Mining – Text Mining.

EXPECTED OUTCOME: Students will get knowledge to understand and apply most current data mining techniques and applications.

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw –Hill Edition, Tenth Reprint 2007.

References:

1. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Data Mining: Data Mining Functionalities – Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems-Classification of Data Mining Systems-Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.	**10**	**25%**

II	Classification and Prediction: Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.	**10**	**25%**
III	Cluster Analysis: Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.	**10**	**25%**
IV	Mining Object, Spatial, Multimedia, Text and Web Data:Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining –Multimedia Data Mining – Text Mining – Mining the World Wide Web.	**10**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 25 7	**HUMAN COMPUTER INTERACTION**	3-0-0-	2015

PREREQUISITES: Database Management Systems.

COURSE OBJECTIVES: The key objective of this course is to analyze how humans interact with the technology and also to recognize how a computer system may be modified to include human diversity.

SYLLABUS: HCI foundations-reasoning and problem solving-Interactive systems-Elements of the WIMP interface-Interaction design basics-Implementation support-Elements of windowing systems-Models and Theories.

EXPECTED OUTCOME: Students will get knowledge to gather meaningful feedback from users.

TEXT BOOK:

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3 rd edition, Pearson Education, 2005.

REFERENCES:

1. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
2. B. Shneiderman; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).
3. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
4. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
5. B. Shneiderman; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).
6. Selected research papers (details will be provided at the end of relevant materials).
7. Jacob Nieilsen; Usability Engineering; Morgan Kaufmann, Academic Press, London, 1993.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	HCI foundations-The Human: Input–output channels, Human memory, Thinking: reasoning and problem	**10Hrs**	**25%**

	solving, Emotion, Individual differences, Psychology and the design of interactive systems, The Computer: Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning.		
II	Interactive systems- Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, The context of the interaction, Experience, engagement and fun. Paradigms for interaction.	**10Hrs**	**25%**
III	Design Process:- Interaction design basics-The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping, Design for non-Mouse interfaces, HCI in the software process, Iterative design and prototyping, Design rules, Principles to support usability, Standards and Guidelines, Golden rules and heuristics, HCI patterns.	**10Hrs**	**25%**
IV	Implementation support - Elements of windowing systems, User interface management systems, Evaluation techniques, Evaluation through expert analysis, Evaluation through user participation, Universal design principles, User support-Requirements and approaches, Models and Theories - Cognitive models, Goal and task hierarchies, Linguistic models. Collaboration and communication - Face-to-face communication, Conversation, Text-based communication, Group working, Dialog design notations, Diagrammatic notations.	**10Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 35 7	**NETWORK SECURITY AND CRYPTOGRAPHY**	3-0-0-3	2015

PREREQUISITES: Basic Knowledge of Computer Networking,Number Theory

COURSE OBJECTIVES:
This course will explore the ISO OSI network stack and discuss common security weaknesses,vulnerabilities,attack methods and mitigation approaches.Provides students with a high level understanding of information security, threats,elements of cryptography,protocols,architectures,and technologies for secure systems and services.

SYLLABUS: Introduction: Attacks, Services and Mechanisms, Security attacks, Security services,Classical Techniques,Modern Techniques, Algorithms ,Conventional Encryption: Placement of Encryption function,Key distribution, Random Number Generation. Public Key Cryptography Number Theory,Message authentication and Hash Functions ,Hash and Mac Algorithms,Digital signatures and Authentication Protocols: Digital signatures, Authentication Protocols, Authentication Applications

EXPECTED OUTCOME: Students will be familiar with network security threats and countermeasures and exposed to the importance of integrating people,processeses and technology.

TEXT BOOK:
1.Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.

REFERENCES:
1.Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

2. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)

3. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.

4. Principles of Information Security, Whitman, Thomson.

5. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH

6. Introduction to Cryptography, Buchmann, Springer

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks

I	Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques	**10Hrs**	**25%**
II	Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.	**10Hrs**	**25%**
III	Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat‟s and Euler‟s theorems, Testing for primality, Euclid‟s Algorithm, the Chinese remainder theorem, Discrete logarithms. Message authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.	**10Hrs**	**25%**
IV	Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication Protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service. Electronic Mail Security: Pretty Good Privacy, S/MIME.	**10Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 06 7	RESEARCH METHODOLOGY	0-2-0-2	2015

PREREQUISITES: NIL.

COURSE OBJECTIVES:

- To understand the steps involved in doing research**.**
- To formulate a research problem.
- To learn the basic statistical measures.
- To develop report writing skills.
- To know about the ethics in research and IP rights management.

SYLLABUS:

Research Objectives, Data Collection, Analysis, Interpretation, Forming a research problem, Basic statistical measures, Ethics of Research, Guidelines in report writing, Intellectual Property Rights.

EXPECTED OUTCOME:

Students who successfully complete this course will have demonstrated an ability to:- .

- Understand the steps involved in research.
- Formulate a research problem.
- Assimilate the basic statistical measures.
- Create a well formed report.
- Interpret the dos and donts so that IP rights are not violated.

TEXT BOOKS:

1. C. R. Kothari, Research Methodology, Methods and techniques (New Age International Publishers, New Delhi, 2004).
2. R. Panneerselvam, Research Methodology (Prentice Hall of India, New Delhi, 2011).

REFERENCES:

1. Articles from ACM/IEEE Journals/Conference Proceedings and equivalent documents, standard textbooks and web based material, approved by the supervisor.

COURSE PLAN

Module	Contents	Hours	Internal Marks
I	Introduction - Meaning of Research, Objectives, Motivation, Types of Research. Research process- Problem definition-Objectives of Research- Research design- Data collection –Data Analysis –Interpretation of Results- Validation of Results. Formulation of a Research problem.	**6 Hrs**	**25%**
II	Basic Statistical measures - Measures of central tendency	**8 Hrs**	**25%**

	– Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Measures of variation – Range, Mean Deviation, Quartile Deviation, Coefficient of Variation and Standard Deviation, Measures of skewness.		
III	Ethics of Research- Scientific Misconduct- Forms of Scientific Misconduct. Measurement of errors - Measurement uncertainty. Statistical test of hypothesis- T-test, Z Test, F-test, Chi-square test.	**8 Hrs**	**25%**
IV	Guidelines for writing a PhD thesis - Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. Impact factor - Validity, Merits, limitations. Other measurements of impact: h-index-advantages, criticism of h-index-modification of h-index, Intellectual property rights (IPR) - forms of IPR- patents-copyrights-Trademarks-Industrial design-geographical indication.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 07 7	SEMINAR	0-0-2-2	2015

COURSE OBJECTIVES:

- To introduce the students to research, understand research papers and prepare presentation material
- To understand cutting edge technology in the chosen area
- To improve oral communication skills through presentation
- To prepare original technical write up on the presentation

SYLLABUS:

The aim of this course is to introduce the student to research, and to acquaint him with the process of presenting his work through seminars and technical reports. Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. The student is expected to do an extensive literature survey and analysis in an area related to computer science *(other than the area of specialization)*. The study should preferably result in design ideas, designs, algorithms, and theoretical contributions in the form of theorems and proofs, new methods of proof, new techniques or heuristics with analytical studies, implementations and analysis of results.

The presentation shall be of 30 minutes duration and a committee with the Head of the Department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Students shall individually prepare and submit a seminar report based on experimental study / industrial training on the corresponding topic, in the prescribed format given by the Department. The reference shall include standard journals (ACM/IEEE), conference proceedings and equivalent documents, reputed magazines and textbooks, technical reports and web based material, approved by the supervisor. The references shall be incorporated in the report following IEEE standards reflecting the state-of-the-art in the topic selected.

EXPECTED OUTCOME:

- Improvement in proficiency in English
- Improvement in presentation skills
- Improvement in analytical and reasoning ability
- Improvement in technical writing

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 08 7	DIGITAL IMAGE PROCESSING LAB- I	0-0-2-1	2015

COURSE OBJECTIVES:

- To implement basic and advanced image processing algorithms.

SYLLABUS: Following experiments, related to image processing concepts need to be implemented: Use of open-source
image processing tools is encouraged to do experiments.

1. Introductory Cycle to familiarize the working environment/tool.
2. Cycle 1: Digital Signal Processing Basics
3. Cycle 2: Image Transforms
4. Cycle 3: Image Enhancement
5. Cycle 4: Image Restoration and Denoising
6. Cycle 5: Binary Image Processing

Laboratory Softwares to be used

- GNU Octave 3.8 or higher
- Scilab 5.5 or higher
- Choice of any open-source tool with the prior permission obtained from the department.

EXPECTED OUTCOME:

Students will get ability to:

- Understand discrete transform works including concepts of basic images.
- Understand about quantisation in both spatial and frequency domain.

REFERENCES:

1. R C Gonzalez, R E Woods, S L Eddins, Digital Image Processing using Matlab", 2e, Gatesmark
Publishing, 2009
2. Jayaraman S, Veerakumar T, Esakkirajan S, Digital Image Processing", Mc Graw Hill Education, 2009
3. Anil K Jain, Fundamentals of Digital Image Processing", Prentice Hall, 1989
4. Chris Soloman, Toby Breckon, Fundamentals of Digital Image Processing: A Practical Approach with
Examples in Matlab", Wiley-Blackwell, 2010

SEMESTER 2

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 01 8	ADVANCED DIGITAL IMAGE PROCESSING	4-0-0-4	2015

PREREQUISITES: Programming experience,background in image processing,graphics or computer vision,familarity with the basic concepts of Linear Algebra,calculus and probability.

COURSE OBJECTIVES:

- The objective of this course is to discuss advanced topics in image processing and analysis that build on the introduction course.
- To understand about scientific methodology which includes reading of scientific publications and book chapters, summarizing the contents, developing strategies to implement the algorithms, and finally presenting the theory, tests, and applications.
- To implement solutions for complex image processing problems.

SYLLABUS:

Image Segmentation: Fundamentals, Classification of Image-segmentation Techniques,Representation,Description,Colour Image Processing,Wavelet-based Image Processing,Object Recognition,Applications of Object Recognition,Sources of 3D data,3D data sets, Image processing in 3D, Measurements on 3D images.

EXPECTED OUTCOME:

The ability to apply principles and techniques of digital image processing in applications related to advanced topics in digital imaging system design and analysis. The ability to analyze and implement advanced image processing algorithms and the ability to modify it.

TEXT BOOKS:

1. R C Gonzalez, R E Woods, S L Eddins, Digital Image Processing using Matlab", 2e, Gatesmark Publishing, 2009

REFERENCES:

1. Jayaraman S, Veerakumar T, Esakkirajan S, Digital Image Processing", Mc Graw Hill Education, 2009
2. John C.Russ, “The Image Processing Handbook”, CRC Press, 2007.
3. Mark Nixon, Alberto Aguado, “Feature Extraction and Image Processing”, Academic Press, 2008.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Digital Image Segmentation: Fundamentals, Classification of Image-segmentation Techniques, Thresholding, Region-Based Segmentation, Edge Linking, Hough Transform, Active Contour, Watershed Transformation, Use of Motion in Segmentation Representation: Boundary Following, Chain Codes, Signatures, Boundary Segments, Skeletons. Description: Boundary Descriptors- Shape Numbers,	**10Hrs**	**25%**

	Fourier Descriptors, Statistical Moments. Region Descriptors- Topological Descriptors, Texture, Moment Invariants..		
II	Colour Image Processing: Light and Colour, Colour Formation, Human Perception of Colour, Colour Models, Chromaticity Diagram, Colour Image Quantisation, Histogram-Colour Image, Colour Image Filtering, Gamma Correction, Pseudo-colour, Colour Image Segmentation. Wavelet-based Image Processing: Wavelet, Wavelet Transform-Discrete and Continuous, Wavelet-Examples, Multiresolution Analysis. Contourlet Transform, Image Pyramid. Digital Image Watermarking- Spatial and Frequency Domain, Applications.	**10Hrs**	**25%**
III	Object Recognition: Automated O-R Systems, Patterns and Pattern Class, Approaches to Object Recognition- Bayes Classification, Template Matching, Non-Parametric Density Estimation, Neural network approach, Structural Pattern Recognition. Applications of Object Recognition.	**11Hrs**	**25%**
IV	3D Visualization:Sources of 3D data, Serial sections, Optical sectioning, Sequential removal, Stereo measurement, 3D data sets, Slicing the data set, Arbitrary section planes, The use of color, Volumetric display, Stereo viewing, Special display hardware, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.	**11Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 02 8	COMPUTER VISION	3-0-0-3	2015

PREREQUISITES: Basics of Digital image processing

COURSE OBJECTIVES:

- Students will be able to understand the methods for acquiring, processing, analyzing, and understanding images.
- It will give an insight to the theory behind artificial systems that extract information from images.

SYLLABUS:

Introduction- Radiation and Illumination –Imaging Optics-Radiometry of Imaging-Solid-State Image Sensing-Geometric Calibration of Digital Imaging Systems-Three-Dimensional Imaging Techniques-Motion-Probabilistic Modelling in Computer Vision-Fuzzy Image Processing-Case Study.

EXPECTED OUTCOME:

Students will get knowledge to perform scene reconstruction, event detection, video tracking, object recognition, object pose estimation, learning, indexing, motion estimation, and image restoration.

TEXT BOOKS:

1. Bernd Jahne, Horst Haubecker, "Computer Vision and Applications", Academic Press.

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 1st Ed., 2010.
2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", 2nd Ed., 2011.
3. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 1st Ed., 2012.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	**Introduction:** Components of a vision system, Imaging systems, Signal processing for computer vision, Pattern recognition for computer vision, Performance evaluation of algorithms. **Radiation and Illumination:** Introduction, Fundamentals of electromagnetic radiation, Radiometric quantities, Fundamental concepts of photometry, Interaction of radiation with matter, Illumination techniques. **Imaging Optics:** Introduction, Basic concepts of geometric optics, Lenses, Optical properties of glasses, Aberrations, Optical image formation, Wave and Fourier optics.	**10 Hrs**	**25%**
II	**Radiometry of Imaging:** Introduction, Observing surfaces, Propagating radiance, Radiance of imaging, Detecting	**11 Hrs**	**25%**

	radiance **Solid-State Image Sensing:** Introduction, Fundamentals of solid-state photosensing, Photocurrent processing, Transportation of photosignals, Electronic signal detection, Architectures of image sensors, Color vision and color imaging, Practical limitations of semiconductor photosensors. **Geometric Calibration of Digital Imaging Systems:** Introduction, Calibration terminology, Parameters influencing geometrical performance, Optical systems model of image formation, Camera models, Calibration and orientation techniques, Photogrammetric applications.		
III	**Three-Dimensional Imaging Techniques:** Introduction, Characteristics of 3-D sensors, Triangulation, Time-of-flight (TOF) of modulated light, Optical Interferometry (OF). **Motion:** Introduction, Basics: flow and correspondence, Optical flow-based motion estimation, Quadrature filter techniques, Correlation and matching, Modeling of flow fields	**11 Hrs**	**25%**
IV	**Probabilistic Modelling in Computer Vision:** Introduction, Why probabilistic models, Object recognition as probabilistic modelling, Model densities, Practical issues. **Fuzzy Image Processing:** Introduction, Fuzzy image understanding, Fuzzy image processing systems, Theoretical components of fuzzy image processing, Selected application examples. **Case Study:** Any two applications- Object Recognition with Intelligent Cameras/ Fast 3-D Full Body Scanning for Humans and Other Objects/ Motion Tracking/ Multicolor Classification of Astronomical Objects.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 03 8	PATTERN RECOGNITION	3-0-0-3	2015

PREREQUISITES: Basic knowledge of probability, statistics and random variables, linear algebra

COURSE OBJECTIVES:

- To equip with basic mathematical and statistical techniques commonly used in pattern recognition.
- Achieving this objective will not only help you understand, compare and contrast various pattern recognition techniques , but also provide you with an adequate background onprobability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.
- To provide a detailed overview of some advanced topics in pattern recognition and a project opportunity toconduct independent, cutting-edge and publishable research

SYLLABUS:

Pattern Recognition Systems, Design cycle, Learning and Adaptation,Applications of pattern recognition.,Bayesian Decision Theory,Minimum-Error-Rate Classification, Bayesian parameter Estimation,Problems of Dimensionality,Non Parametric Techniques, Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, Multilayer Neural Networks,Nonmetric Methods,Algorithm-Independent Machine Learning,MDL Principle,Clustering

EXPECTED OUTCOME:

- Student understands the fundamental pattern recognition and machine learning theories.
- Student acquires the ability to design and implement certain important pattern recognition techniques.

TEXT BOOK:

1. R.O. Duda, P.E. Hart, D.G. Stork, “Pattern Classification”, John Wiley and Sons, 2000.

REFERENCES:

1. V. S. Devi, M. N. Murty, “Pattern Recognition: An Introduction”, Universities Press, Hyderabad, 2011.
2. Earl Gose, Steve Jost, “Pattern Recognition and Image Analysis”, PHI Publishers, 1997.
3. Robert J. Schalkoff, “Pattern Recognition: Statistical Structural and Neural Approaches”, John Wiley & Sons Inc., New York, 1992.
4. Tou and Gonzales, “Pattern Recognition Principles”, Wesley Publications Company, London 1974.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction: Machine Perception, Pattern Recognition Systems, Design cycle, Learning and Adaptation,Applications of pattern recognition. Bayesian Decision Theory: Introduction, Bayesian Decision	**11 Hrs**	**25%**

	Theory Continuous and Discrete Features,Minimum-Error-Rate Classification, Classifiers, Discriminant Functions, Decision Surfaces, Normal Density, Discriminant Functions for Normal Density, Bayesian Belief networks		
II	ML Estimation, Bayesian Estimation, Bayesian parameter Estimation: Gaussian Case and General Theory,Problems of Dimensionality, PCA, Fisher Linear Discriminant, Expectation-Maximisation, Hidden Markov Model. Non Parametric Techniques: Density Estimation, Parzen Windows, k-Nearest-Neighbour Estimation,Computational Complexity of k-Nearest Neighbour Rule, Metrics and NN Classification, Reduced Coulomb Energy networks.	**11 Hrs**	**25%**
III	Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, Two Category Linearly Separable Case, Perceptron Criterion Function, Minimum Squared-Error Procedures, Ho-Kashyap Procedures, SVM. Multilayer Neural Networks: Backpropagation Algorithm, Convolutional Networks, Recurrent Networks.	**10 Hrs**	**25%**
IV	Nonmetric Methods: Decision Trees, CART, Recognition with Strings, Rule Based Methods. Algorithm-Independent Machine Learning: No Free Lunch Theorem, Minimum Description Length (MDL), MDL Principle. Clustering: k-Means, Fuzzy k-Means, Hierarchical Clustering, Criterion Functions for Clustering, Cluster Validity.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 14 8	BIOINFORMATICS	3-0-0-3	2015

PREREQUISITES: Basics of Bioinformatics

COURSE OBJECTIVES: The key objective of this course is tounderstand the inherent structure of biological information.It include the analysis of gene and protein sequences to reveal protein evolution and splicing.

SYLLABUS: Molecular biology primer,Bioinformatics tools and databases,Introduction to Bio-programming languages,Phylogenetic trees,Combinatorial pattern matching,Microarrays, Gene expression, Algorithms for Analyzing Gene Expression data**.**

EXPECTED OUTCOME: Students will get knowledge about biology and biotechnology.Analyse legal,social and ethical considerations related to bioinformatics.

TEXT BOOKS:

1. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT Press, 2004.

REFERENCES:

1. David W Mount, Bioinformatics- Sequence and Genome Analysis, (2/e), Cold Spring Harbor Laboratory Press, New York, 2004.
2. D. E. Krane and M. L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.
3. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2003.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Molecular biology primer, gene structure and information content, Bioinformatics tools and databases, genomic information content, Sequence Alignment, Algorithms for global and local alignments, Scoring matrices, Dynamic Programming algorithms.	**10Hrs**	**25%**
II	Introduction to Bio-programming languages, Restriction Mapping and Motif finding, Gene Prediction, Molecular Phylogenetics, Phylogenetic trees, Algorithms for Phylogenetic Tree construction.	**10 Hrs**	**25%**
III	Combinatorial pattern matching, Repeat finding, Keyword Trees, Suffix Trees, Heuristic similarity search	**10Hrs**	**25%**

	algorithms, Approximate pattern matching.		
IV	Microarrays, Gene expression, Algorithms for Analyzing Gene Expression data, Protein and RNA structure prediction, Algorithms for structure prediction. Emerging trends in bioinformatics algorithms and databases. Case Study: Use 'R' to perform statistical computations and comparisons on samples available from any of the standard repository like Gene Expression Omnibus (GEO).	**10Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 24 8	WIRELESS SENSOR NETWORKS	3-0-0-3	2015

PREREQUISITES: Basics of Computer Networking

COURSE OBJECTIVES: The objective of this course is to present an overview on wireless sensor networks. It aims to develop create an understanding of MAC protocols,routing protocols and operating system for wireless sensor networks.

SYLLABUS: Introduction to wireless sensor networks-Architecture- Single-node, Network-MAC Protocols: MAC protocols for wireless sensor networks-The IEEE 802.15.4 MAC protocol-Localization and positioning-Routing protocols:Challenges and Design Issues-Data-centric and content-based networking-Operating Systems for Wireless Sensor Networks-Applications.

EXPECTED OUTCOME: Students will understand different MAC protocols,routing protocls,corresponding operating systems and respective applications.

TEXT BOOKS:

1. Jun Zheng, Abbas Jamalipour, "WIRELESS SENSOR NETWORKS- A Networking Perspective", John Wiley and sons Publication.

REFERENCES:

2. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons 1st Ed., 2005.

3. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed., 2004.

4. Feng Zhao, Leonidas Guibas,"Wireless Sensor Network", Elsevier, 1st Ed., 2004.

5. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to wireless sensor networks: Overview, Technological Background, Network architectures and Protocol Stack: Network Architectures for WSN, Classification for WSN, Protocol Stack for WSN. Architecture: Single-node architecture: Hardware components & design constraints, Operating systems and execution environments, Network architecture:	**10Hrs**	**25%**

	Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.		
II	MAC Protocols: MAC protocols for wireless sensor networks, Sparse topology and energy management (STEM), S-MAC, Contention-based protocols-CSMA protocols, PAMAS, Schedule-based protocols-LEECH-SMACS, The IEEE 802.15.4 MAC protocol. Localization and positioning: Properties of localization and positioning procedures,Possible approaches, Single-hop and multihop localization, Self-configuring localization systems.	**10Hrs**	**25%**
III	Routing protocols: Routing Challenges and Design Issues in Wireless Sensor Networks, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes. Data-centric and content-based networking: Data-centric routing, Data-centric storage.	**10Hrs**	**25%**
IV	Operating Systems for Wireless Sensor Networks: Operating System Design Issues, Examples of Operating Systems. Applications: Area Monitoring and Intelligent Vehicle Health Management Applications, Habitat and Environment Monitoring	**10Hrs**	**25%**

Course No.	**Course Name**	**L-T-P-Credits**	**Year of Introduction**
06 CS 6 34 8	DATA COMPRESSION	3-0-0-3	2015
PREREQUISITES: Basics of Digital image processing.			
COURSE OBJECTIVES: Students will be able to understand different compression techniques available.			
SYLLABUS: Introduction Compression Techniques-Different Methods of Compression Basic Techniques-Dictionary methods-Image Compression Intuitive Methods, Image Transforms-Video Compression-Audio Compression.			
EXPECTED OUTCOME: Students will get knowledge to apply different compression techniques on image, audio and video data.			

TEXT BOOKS:

1. "Data compression - The complete Reference", David salomon, Springer Publications (4th Edition), 2006.

REFERENCES:

1. "The Data compression Book", Mark Nelson and Jean-Loup Gailly, Mark Nelson and Jean-Loup Gailly,

BPB publications (2nd Edition), 1995

2. "Introduction to Data Compression", Khalid Sayood, Harcout India (P) Ltd,2/e ,New Delhi,2002.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction Compression Techniques - Lossy compression & Lossless compression, modeling and compression Mathematical modeling for Lossless compression- Physical models probability models, Markov Models and composite source models. Mathematical modeling for Lossy compression - physical models, Probability models and linear systems models.	**10 Hrs**	**25%**
II	Different Methods of Compression Basic Techniques: Run length encoding, RLE Text compression, RLE image compression and scalar quantization. Statistical Methods: Information theory concepts, Huffman coding, Adaptive Huffman coding, facsimile compression Arithmetic coding and Adaptive, Arithmetic coding and Text compression. Dictionary methods: String compression, LZ 77, LZSS, LZ78, LZW.	**10 Hrs**	**25%**
III	Image Compression Intuitive Methods, Image Transforms, JPEG, Progressive Image compression, Vector quantization, Adaptive Vector Quantization, Block Matching, Block Truncation coding. Context Tree weighting, Block Decomposition, Binary Tree predictive coding, Quad Trees and Finite Automata Methods.	**10 Hrs**	**25%**
IV	Video Compression: Digital Video, Video compression, MPEG and H.261. Audio Compression: Digital Audio, The Human Auditory System, μ -Law and A-Law companding, ADPCM Audio compression.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 15 8	EMBEDDED SYSTEMS	3-0-0-3	2015

PREREQUISITES: Fundamentals of embedded systems paradigms

COURSE OBJECTIVES:

- To develop an understanding of the technologies behind the embedded computing system.

SYLLABUS:

Introduction to Embedded Systems-Devices and Communication Buses for Devices Network-Embedded Programming-Interprocess Communication-RTOS.

EXPECTED OUTCOME:

Students who successfully complete this course will have demonstrated an ability to

- distinguish between embedded and general purpose system.

TEXT BOOK:

1. David E Simon," An Embedded Software Primer", Addison-Wesley Professional, 12 th Ed., 1999.

REFERENCES:

1. Mark Nelson "Data Compression Book" BPB. Rajkamal, "Embedded Systems Architecture, Programming and Design", TATA McGraw Hill, 2e 2008.
2. Sriram V Iyer, Pankaj Gupta, "Embedded Realtime Systems Programming", Tata McGraw- Hill, 1 st Ed., 2004.
3. Tammy Noergaard, "Embedded System Architecture – A Comprehensive Guide for Engineers and Programmers", Newnes, Elsevier, 1 st Ed., 2005.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to Embedded Systems: Embedded Systems, Processor embedded into a system, Embedded Hardware Units and Devices in a system, Embedded Software in a system, Examples of embedded systems, Design Process in embedded systems, Formalization of System Design, Classification of Embedded Systems.	**10 Hrs**	**25%**
II	Devices and Communication Buses for Devices Network: IO Types and Examples, Serial Communication Devices, Parallel Device Ports, Timer and Counting Devices, Wireless Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Serial Bus Communication Protocols, Parallel Bus Device Protocols, Network Protocols, Wireless and Mobile System Protocols.	**10 Hrs**	**25%**
III	ISR Concept, Interrupt Sources, Interrupt Servicing	**10 Hrs**	**25%**

	Mechanisms, Multiple Interrupts. Embedded Programming: Programming in assembly language (ALP) and in High Level Language C, C Program Elements: Header and source files and pre-processor directives - Macros and functions – Data Types, Data Structures, Modifiers, Statements, Loops and Pointers – Objected Oriented Programming – Embedded Programming in C++.		
IV	Interprocess Communication: IPC, Signal Function, Semaphore Function, Message Queue, Mailbox, Pipe, Socket, RPC. RTOS: OS Services - Process Management- Memory Management - Device, File and IO Subsystem management -Interrupt Routine in RTOS Environment – RTOS - Basic Design - RTOS Task Scheduling Models, Interrupt Latency, Response of the tasks as Performance Metrics. Case Study: Embedded Software Development, Testing, Simulation and Debugging Tools.	**12 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 25 8	SOFT COMPUTING	3-0-0-3	2015

PREREQUISITES: Good understanding of distributed systems will be appreciated.

COURSE OBJECTIVES:

- Lay a foundation on obtaining working solutions quickly, accepting approximations and unconventional approaches.

SYLLABUS:

Introduction to Neuro – Fuzzy and Soft Computing,Derivative-based Optimization, Knowledge Representation,Adaptive Neuro-Fuzzy Inference Systems.

EXPECTED OUTCOME:

Students who successfully complete this course will have demonstrated an ability to

- identify and select a suitable soft computing technology to solve the problem ; construct a solution and implement a soft computing solution.

TEXT BOOK:

1. "Neuro Fuzzy and Soft computing", Jang J.S.R.,Sun C.T and Mizutani E – Pearson education, 2004

REFERENCE:

1. Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006.
2. "Fundamentals of Neural Networks", Laurene Fauseett, Prentice Hall India, New Delhi, 1994.
3. "Fuzzy Logic Engineering Applications", Timothy J.Ross, McGrawHill, NewYork, 1997.
4. "Neural networks,Fuzzy logics,and Genetic algorithms", S.Rajasekaran and G.A.Vijayalakshmi Pai Prentice Hall of India, 2003.
5. "Fuzzy Sets and Fuzzy Logic", George J.Klir and Bo Yuan, Prentice Hall Inc., New Jersey, 1995.
6. "Principles of Soft Computing" S.N.Sivanandam, S.N.Deepa Wiley India Pvt Ltd.
7. "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", Amit Konar, CRC Press, 2008.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models–Input Space Partitioning and Fuzzy Modeling.	**11 Hrs**	**25%**

II	Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms Simulated Annealing – Random Search – Downhill Simplex Search.	**11 Hrs**	**25%**
III	Introduction, Knowledge Representation – Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainity Basic knowledge Representation Issues Knowledge acquisition – Heuristic Search: Techniques for Heuristic search Heuristic Classification - State Space Search: Strategies Implementation of Graph Search Search based on Recursion Patent-directed Search Production System and Learning.	**10 Hrs**	**25%**
IV	Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 35 8	SOCIAL NETWORK ANALYSIS	3-0-0-3	2015

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To study the mapping and measuring of relationships and flows between people, groups, organizations,computers, urls and other connected information or knowledge entities.

SYLLABUS:

An Introduction to Social Network Data Analytics,Random Walks in Social Networks and their Applications,Evolution in Social Networks,Models and Algorithms for Social Influence Analysis,Visualizing Social Networks,Visualizing Social Networks,Multimedia Information Networks in Social Media.

EXPECTED OUTCOME:

Students who complete the course will have demonstrated the ability to do the following:

- Get idea about the strategy for investigating social structures through the use of network and graph theories.

TEXT BOOKS:

1. Charu C. Aggarwal, "Social Network Data Analytics", Springer.
2. Wasserman, Stanley, & Faust, Katherine. Social Network Analysis: Methods and Applications. Cambridge: Cambridge University Press, 1994.

REFERENCES:

1. Scott, John. Social Network Analysis: A Handbook. 2nd Ed. 1994. Newberry Park, CA: Sage
2. Robert Hanneman and Mark Riddle. Introduction to Social Network Methods, 2004.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	An Introduction to Social Network Data Analytics: Introduction, Online Social Networks: Research Issues, Research Topics in Social Networks. Statistical Properties of Social Networks: Preliminaries, Static Properties, Dynamic Properties. Random Walks in Social Networks and their Applications: Random Walks on Graphs: Background, Application in Computer Vision, Text Analysis, Collaborative Filtering.	**12 Hrs**	**25%**
II	Evolution in Social Networks: Framework, Challenges of Social Network Streams, Incremental Mining for Community Tracing, Tracing Smoothly Evolving Communities. Models and Algorithms for Social Influence Analysis: Influence Related Statistics, Social Similarity and Influence. Privacy in Social Networks: Privacy breaches in	**10 Hrs**	**25%**

	social networks, Privacy-preserving mechanisms.		
III	Visualizing Social Networks: A Taxonomy of Visualizations. Data Mining in Social Media: Data Mining Methods for Social Media, Ethnography and Netnography, Event Maps. Text Mining in Social Networks: Keyword Search, Classification and Clustering Algorithms, Transfer Learning in Heterogeneous Networks.	**10 Hrs**	**25%**
IV	Multimedia Information Networks in Social Media: Network of Personal Photo Albums, Network of Geographical Information, Inference Methods. Social Tagging and Applications: Tags: Why and What, Tagging System Design, Tag analysis, Visualization of Tags, Applications of Tags.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 06 8	MINI PROJECT	0-0-4-2	2015

SYLLABUS:

The mini project is designed to develop practical ability and knowledge about tools/techniques in order to solve the actual problems related to the industry, academic institutions or similar area. Students can take up any application level/system level experimental design / implementation tasks of relatively minor intensity and scope as compared to the major-project, pertaining to a relevant domain of study, preferably based on security. Projects can be chosen either from the list provided by the faculty or in the field of interest of the student. At the end of each phase, presentation and demonstration of the project should be conducted, which will be evaluated by a panel of examiners. A detailed project report duly approved by the guide in the prescribed format should be submitted by the student for final evaluation.

Publishing the work in Conference Proceedings/ Journals with National/ International status with the consent of the guide will carry an additional weightage in the review process.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 6 07 8	DIGITAL IMAGE PROCESSING LAB II	0-0-2-1	2015

COURSE OBJECTIVES:

- To learn about compression and coding schemes.

SYLLABUS: This lab is divided into two sections:
(a) Advanced Digital Image Processing
(b) Data Compression

- Students are required to do experiments on both sections compulsory and use of open-source tools is encouraged to do the experiments.

Advanced Digital Image Processing

- Cycle 1: Image Segmentation
- Cycle 2: Colour Image Processing
- Cycle 3: Wavelet based Image Processing
- Cycle 4: Object Recognition and Neural Network Simulation.

Data Compression

- RLE
- Huffman and Adaptive Huffman Coding
- Arithmetic and adaptive Arithmetic Coding
- LZ77, LZSS, LZ78, LZW
- Scalar and Vector Quantisation
- Block Matching, BTC and Block Decomposition
- JPEG

Laboratory Softwares to be used

- GNU Octave 3.8 or higher
- Scilab 5.5 or higher
- Choice of any open-source tool with the prior permission obtained from the department.

EXPECTED OUTCOME:
Students will be able to:

- Gain practical knowledge in Digital Image Processing which will pave the way to do their projects.

REFERENCES:

1. R C Gonzalez, R E Woods, S L Eddins, Digital Image Processing using Matlab", 2e, Gatesmark
Publishing, 2009.
2. Jayaraman S, Veerakumar T, Esakkirajan S, Digital Image Processing", Mc Graw Hill Education, 2009.
3. Anil K Jain, Fundamentals of Digital Image Processing", Prentice Hall, 1989.
4. Chris Soloman, Toby Breckon, \Fundamentals of Digital Image Processing: A Practical Approach with
Examples in Matlab", Wiley-Blackwell, 2010.

5. “Data compression - The complete Reference”, David salomon, Springer Publications (4th Edition), 2006.
6. “Introduction to Data Compression”, Khalid Sayood, Harcout India (P) Ltd,2/e ,New Delhi,2002.

SEMESTER 3

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 11 7	NATURAL LANGUAGE PROCESSING	3-0-0-3	2015

PREREQUISITES: Basics of language processors, grammars.

COURSE OBJECTIVES:

- To uncover the concepts of natural language processing, grammars, parsing and ambiguity resolution in grammars.

SYLLABUS:

Introduction to Natural Language Understanding- Linguistic Background-Grammars and Parsing-Top-Down and Bottom-Up Parsers- Feature Systems and Augmented Grammars-Grammars for Natural Language-Handling questions in Context-Free Grammars-Ambiguity Resolution: Statistical Methods, Estimating Probabilities, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars-Encoding Ambiguity in Logical Form.

EXPECTED OUTCOME:

After the completion of this course the student will be able to:

- Will understand concept of natural language processing,it's applications,different parsers,grammars and methods for ambiguity resolution.

TEXT BOOKS:

1. James Allen, Natural Language Understanding, 2/e, Pearson Education, 2003.

REFERENCES:

1. D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education, 2002.
2. Christpher G. Manning, Hinrich Schütze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts.1999.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax	**10 Hrs**	**25%**
II	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks	**12 Hrs**	**25%**
III	Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling	**12 Hrs**	**25%**

	questions in Context-Free Grammars, Hold mechanisms in ATNs. Human preferences in Parsing,Encoding uncertainty, Deterministic Parser.		
IV	Ambiguity Resolution: Statistical Methods, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	**8 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 21 7	DIGITAL VIDEO PROCESSING	3-0-0-3	2015

PREREQUISITES:
Basic video understanding and knowledge about Digital Image Processing

COURSE OBJECTIVES:

- To understand the fundamental concepts of Video processing like Video Enhancement and Restoration,Motion tracking and video streaming.

SYLLABUS:
Divisibility- Congruences, Fermat's theorem –Finite difference methods – Groups, homomorphism theorems-Probability , conditional probability, Probability distribution-Random Processes.

EXPECTED OUTCOME:
After the completion of this course the student will be able to:

- Get knowledge to perform operations on videos.

TEXT BOOK:

1. Alan C. Bovik, 'The Essential Guide to Video Processing', Elsevier Science, edition 2, 2009.

REFERENCES:

1. Handbook of Image and Video processing – Al Bovik (Alan C Bovik),Academic Press, Second Edition, 2005.
2. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, 'Video Processing and Communications', Prentice Hall, 2002.
3. Murat Tekalp, 'Digital Video Processing', Prentice Hall, edition 1, 1996.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to video processing: Principles of colour video processing, Video display, Composite versus component video, Progressive and interlaced scan, Sampling of video signals. Motion Estimation and Detection, Basic of video coding: Categorization of video coding schemes, Information Theory for source coding, Binary encoding, Scalar quantization, Vector quantization, Wave form based coding, Block-based transform coding, Predictive coding, Temporal prediction and transform coding	**8 Hrs**	**25%**
II	Video Enhancement and Restoration, Video Quality Assessment, Video Segmentation.	**12 Hrs**	**25%**
III	Tracking: Motion Tracking in Video, Optimisation: Pel-Recursive Methods, Bayesian Methods. Video Surveillance.	**12 Hrs**	**25%**
IV	Streaming video over the internet and wireless IP networks: Architecture for video streaming systems,	**10 Hrs**	**25%**

	Video compression, Application layer QoS control for streaming video, Continuous media Distribution services, Streaming servers, Media synchronization, Protocols for streaming video, Streaming video over wireless IP networks.		

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 31 7	GIS AND REMOTE SENSING	3-0-0-3	2015

PREREQUISITES: Basic concepts in physics

COURSE OBJECTIVES:

The Student will be able to:-

- Get a foundation in the fundamentals of with image processing methods and techniques as applied in solving environmental and urban problems and application of GIS methods and techniques in solving practical problems.

SYLLABUS:

Introduction to GIS, Basic Geographic concepts, GIS Applications, Coordinate Systems, Data Display and Cartography Digital Terrain Modelling, Applications of digital terrain models. Principles of Remote Sensing– Principles of electromagnetic remote sensing, Remote sensing system ,Classification. Image characteristics of remote sensing systems, The sensor and sensor platforms, Remote n sensing Data Acquisition and Dissemination, Image enhancement using spatial transforms. Data fusion related to GIS and remote sensing, Global Positioning System (GPS), Image registration and Multi Image fusion, Image Rectification, Thematic Classification, Hyper spectral Image analysis. Case Studies, Familiarization with any GIS software.

EXPECTED OUTCOME:

Students who successfully complete this course will have demonstrated an ability to understand aerospace remote sensing foundations and the use of remote sensor data and image interpretation and processing techniques for environmental applications.

TEXT BOOKS:

1. Chor Pang Lo, Albert K. W. Yeung, Concepts and techniques of geographic information systems Prentice Hall, 2002.
2. Kang-Tsung-Chang, Introduction to Geographical Information Systems, Tata Mc-Graw-Hill Edition.

REFERENCES:

1. Dr. B.C Panda, "Remote sensing – Principles and Applications", Viva Books.
2. Michael N. Demers, Fundamentals of Geographic Information Systems, 3rd Ed, John Wiley & Sons, 1999.
3. Robert A. Schowengerdt, Remote Sensing: Models and Methods for Image Processing, Academic Press, 2007.
4. Victor Mesev, Integration of GIS and Remote Sensing (Mastering GIS: Technol, Applications & Mgmnt), John Wiley & Sons, 2007.
5. Heywood Ian, An Introduction To Geographical Information Systems, 3rd Edition, Pearson Education India, 2010.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to GIS- Evolution of GIS, Components of GIS, Basic Geographic concepts, GIS Applications, Coordinate Systems: Geographic Coordinate System, Map Projections-Examples, Projected Coordinated Systems, Working with Coordinate Systems in GIS, GIS data models- Georelational Vector Data Model, Raster Vector Data Model, Object based Vector Data Model.Data Input- Existing GIS Data, Metadata, Conversion of existing data, Creating New Data.	**11 Hrs**	**25%**
II	Data Display and Cartography: Cartographic Symbolization, Types of maps, Typography, Map Design, Map Production. Data Exploration, Attribute data Query, Spatial Data Query, Raster Data Query, Geographic Visualization. Vector Data Analysis, Raster Data Analysis. Digital Terrain Modelling- approaches to digital terrain data, Acquisition of digital terrain data and – Data Analysis, Processing and Visualization- Applications of digital terrain models.	**11 Hrs**	**25%**
III	Principles of Remote Sensing– Principles of electromagnetic remote sensing, Remote sensing system Classification. Image characteristics of remote sensing systems, The sensor and sensor platforms, Remote sensing Data Acquisition and Dissemination, The Sensing – Data Loading and Image Restoration, Image Rectification and Registration, Image Statistics extraction using radiometric data, Image enhancement using spectral transforms, Image enhancement using spatial transforms.	**10 Hrs**	**25%**
IV	Data fusion related to GIS and remote sensing- Why GIS remote sensing fusion, Problems in GIS- remote sensing data fusion, Present and Future solutions. Global Positioning System (GPS), Image registration and Multi Image fusion, Image Rectification, Thematic Classification- Classification Process, Feature Extraction, Training the Classifier, Subpixel Classification, Hyper spectral Image analysis. Case Studies in GIS, GIS design, Research Areas in GIS, Familiarization with any GIS software.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 12 7	IMAGING AND MULTIMEDIA SYSTEM	3-0-0-3	2015

PREREQUISITES:
Basics of multimedia system.

COURSE OBJECTIVES:
The Student will be able to:-.

- To equip with fundamental knowledge of digital media system.

SYLLABUS:
Introduction to Multimedia-Data and File Format Standards-Input and Output Technologies-Distributed Multimedia systems

EXPECTED OUTCOME:
Students who successfully complete this course will have demonstrated with an ability to analyze different media and design issues related to multimedia system.

TEXT BOOKS:

1. Jonathan Rosenoer, "Cyber Law: The law of the Internet", Springer, 1997 Ralf Steinmetz, Klara Steinmetz, "Multimedia Computing, Communications & Applications", Pearson education, 2009.
2. Multimedia Systems by Jhon F. Koegel Buford – Pearson Education, 2001.

REFERENCES:

1. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2nd Edition, Prentice Hall, 1996 Prabat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall India, 2007, New Delhi.
2. Tay Vaughan, "Multimedia Making It Work", McGraw Hill, 2011.
3. Parekh R "Principles of Multimedia" Tata McGraw-Hill, 2006.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Introduction to Multimedia: Multimedia Elements – Multimedia applications – MultimediaSystem Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases. Defining the scope of multimedia: Hypertext and Collaborative research-Multimedia and personalized Computing, Multimedia on the map, emerging applications, Multimedia applications, Hybrid Devices, Designers perspective, Key challenges ahead, Technical, regulatory, Social issues Multimedia File systems and information models	**11 Hrs**	**25%**

II	Data and File Format Standards: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format – AVI Indeo File Format – MPEG Standards –TWAIN. Image computing: The basics of processing 2D images- Thresholding -Convolution-Edge detection- Mathematical Morphology and Shape Descriptors-Noise Reduction- Image Fusion. Image Security: Image Forensics - Steganography -Image Cryptography Techniques-Chaos based and Non- Chaos based methods.	**11 Hrs**	**25%**
III	Input and Output Technologies: Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images and Animation – Full Motion Video -Video Motion Analysis. Multimedia Application Classes – Types of Multimedia Systems – Virtual Reality – Components of Multimedia Systems -Multimedia Authoring Systems – Multimedia Authoring Tools – User Interface Design- Mobile Messaging – Hypermedia Message Components -Hypermedia Linking and embedding	**10 Hrs**	**25%**
IV	Distributed Multimedia systems: Architectures and issues for Distributed Multimedia systems Synchronization, and QOS Architecture, The role of Standards, A frame work for Multimedia systems Operating systems Support for Continuous Media Applications Limitation of work station Operating systems, New OS support, Experiments Using Real Time Mach Goals of Multimedia Systems services, Multimedia systems services Architecture, Media stream protocol Multimedia Devices, Presentation Services, and the User Interface. Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyper applications.	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 22 7	IMAGE TECHNIQUES AND ANALYSIS	3-0-0-3	2015

PREREQUISITES:
Basics of digital image processing.

COURSE OBJECTIVES:
The Student will be able to:-

- Get an overview on medical image techniques and analysis.
- Develop create an understanding of medical image modalities, storage, segmentation and registration

SYLLABUS:
Medical Image Processing- Imaging Modalities-Medical Image Storage- Formats - DICOM- Medical Image Visualization-Medical Image Segmentation- Histogram-based methods- Segmentation with Neural Networks- Medical Image Registration- Medical Image Search and Retrieval- Applications.

EXPECTED OUTCOME:
Students who successfully complete this course will have demonstrated an ability to familiarize principles of different imaging modalities, storage applications, segmentation techniques and high level image processing registration.

TEXT BOOK:

1. Bankman I.N. "Hand book of Medical Imaging-Processing and Analysis", Academic Press.

REFERENCES:

1. Bovik A.I. "Handbook of Image and Video processing", Academic Press.
2. Jiri Jan, "Medical Image Processing, Reconstruction and Restoration- Concepts and Methods", CRC Tayler & Francis, 2006.
3. L. Landini, V. Positano, M.L. Santarelli, "Advanced Image Processing in Magnetic Resonance Imaging", CRC Tayler & Francis, 2005.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Medical Image Processing: Introduction to medical imaging, importance, applications, trends, challenges; Medical Image Formation Principles: X-Ray and Computed Tomography(CT) imaging , Basic principles of CT, Imaging Modalities: Magnetic Resonance Imaging (MRI) Mathematics of MR, spin physics, NMR spectroscopy, imaging principles, Nuclear Imaging-positron emission tomography (PET), single photon emission Tomography (SPECT), Ultrasound Imaging , mathematical principles, applications.	**11 Hrs**	**25%**
II	Medical Image Storage: Archiving and Communication Systems and Formats Picture archiving and communication	**11 Hrs**	**25%**

	system (PACS), Formats -DICOM, Radiology Information Systems (RIS) and Hospital Information Systems (HIS); Medical Image Visualization: Fundamentals of visualization, surface and volume rendering/visualization.		
III	Medical Image Segmentation: Histogram-based methods, Region growing, watersheds, Multispectral Techniques, Segmentation by Fuzzy clustering methods and issues, Segmentation with Neural Networks, Segmentation with deformable models.	**10 Hrs**	**25%**
IV	Medical Image Registration: Introduction, Intensity-based methods, Joint histograms, Information theory measures, cost functions, clinical applications of Image registration; Medical Image Search and Retrieval: Current technology in medical image search, content-based image retrieval, new trends; Applications: Image Guided Surgery, Image Guided Therapy, Computer Aided Diagnosis/Diagnostic Support Systems	**10 Hrs**	**25%**

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 32 7	HIGH PERFORMANCE COMPUTING	3-0-0-3	2015

PREREQUISITES:
Basics of parallel computing.

COURSE OBJECTIVES:
The Student will be able to:-

- Uncover the fundamental concepts of parallel architecture, their algorithms.
- Develop create an overview of cluster based distributed computing, GPUs and CUDA architecture and applications.

SYLLABUS:
Parallel Architecture- Introduction-Implications for Programming Models-Basic Parallel Algorithmic Techniques-Overview of Cluster based distributed computing: Hardware technologies for cluster computing, Software and software architectures for cluster computing-Overview of GPUs: architecture, features and Programming model- Introduction to Heterogeneous Computing – OpenCL-CUDA: Architecture, Programming Model-Applications of CUDA.

EXPECTED OUTCOME:
Students who successfully complete this course will have demonstrated an ability to

- To understand an overview of parallel architecture, GPUs and CUDA systems, their architecture and applications.

TEXT BOOK:

1. David Culler, J.P. Singh, Anoop Gupta, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann, 1st Ed., 1998.

REFERENCES:

1. Joseph Jaja, "Introduction to Parallel Algorithms", Addison-Wesley Professional, 1st Ed., 1992.Multimedia Security Handbook, BorkoFurht, DarkoKirovski, CRC Press, 2004
2. Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, "Introduction to Parallel Computing", Addison-Wesley Professional, 2nd Ed., 2003.
3. Michael Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill, 1st Ed., 2003.
4. Benedict R Gaster, Lee Howes, David R Kaeli Perhaad Mistry Dana Schaa, Heterogeneous Computing with OpenCL McGraw-Hill, Inc. Newyork , 2011.
5. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General-Purpose GPU Programming", Addison-Wesley Professional, 1st Ed., 2010.
6. NVIDIA CUDA C- Programming Guide.
7. CUDA C- Best Practices Guide, NVIDIA.
8. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors: A Hands-on Approach", Morgan Kaufmann, 1st Ed., 2010.

COURSE PLAN

Module	Contents	Hours	Sem Exam Marks
I	Parallel Architecture: Introduction, Why Parallel Architecture, Convergence of Parallel Architecture, Fundamental Design Issues, The Parallelization	**11 Hrs**	**25%**

	Process, Partitioning for Performance, Performance Factors, Implications for Programming Models.		
II	Basic Parallel Algorithmic Techniques: Pointer Jumping, Divide-and-Conquer, Partitioning, Pipelining, Accelerated Cascading, Symmetry Breaking, Min/Max, Sum, Searching, Merging, Sorting, Sorting Networks, Selection. Overview of Cluster based distributed computing: Hardware technologies for cluster computing, Software and software architectures for cluster computing: Shared memory (OpenMP) and Message-Passing (MPI/PVM) models. Dynamic process creation, one-sided communication, Parallel I/O.	**11 Hrs**	**25%**
III	Overview of GPUs: architecture, features and Programming model. System issues: cache and data management, languages and compilers, stream processing, GPU-CPU load balancing. Writing Parallel Programs, GPU-Computer Architecture, Introduction to Heterogeneous Computing – OpenCL; The OpenCL Kernel, The OpenCL Memory Model, The OpenCL Execution Model; OpenCL Platform and Devices; OpenCL Execution Environment, An Overview of OpenCL API; Heterogeneous Programming in OpenCL.	**10 Hrs**	**25%**
IV	CUDA: Architecture, Programming Model, Development Environment, Parallel Programming in CUDA C, Thread Cooperation, Constant Memory and Events, Texture Memory, Streams, Performance Metrics, Applications of CUDA.	**10 Hrs**	**25%**

Course No.	**Course Name**	**L-T-P-Credits**	**Year of Introduction**
06 CS 7 03 7	SEMINAR	0-0-2-2	2015

COURSE OBJECTIVE:

- To introduce the students to research, understand research papers and prepare presentation material
- To understand cutting edge technology in the chosen area
- To improve oral communication skills through presentation
- To prepare original technical write up on the presentation

SYLLABUS:

The aim of this course is to introduce the student to research, and to acquaint him with the process of presenting his work through seminars and technical reports. Students have to register for the seminar and select a topic in consultation with any faculty member offering courses for the programme. The student is expected to do an extensive literature survey and analysis in an area related to *Image Processing*. The study should preferably result in design ideas, designs, algorithms, and theoretical contributions in the form of theorems and proofs, new methods of proof, new techniques or heuristics with analytical studies, implementations

and analysis of results.

The presentation shall be of 30 minutes duration and a committee with the Head of the Department as the chairman and two faculty members from the department as members shall evaluate the seminar based on the coverage of the topic, presentation and ability to answer the questions put forward by the committee.

Students shall individually prepare and submit a seminar report based on experimental study / industrial training on the corresponding topic, in the prescribed format given by the Department. The reference shall include standard journals (ACM/IEEE), conference proceedings and equivalent documents, reputed magazines and textbooks, technical reports and web based material, approved by the supervisor. The references shall be incorporated in the report following IEEE standards reflecting the state-of-the-art in the topic selected.

EXPECTED OUTCOME:

- Improvement in proficiency in English
- Improvement in presentation skills
- Improvement in analytical and reasoning ability
- Improvement in technical writing

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 04 7	PROJECT – PHASE I	0-0-12-6	2015

SYLLABUS:

Every student should carry out project, related to areas of Information Security, under the supervision of a Supervisor(s). The project work shall commence in the third semester and shall be completed by the end of fourth semester. Candidates are required to undertake a suitable research project work; the topic shall be approved by a committee constituted by the Head of the concerned Department. Every student will be required to present the topic at the beginning of the Phase-I to illustrate the scope of the work and to finalize the topic. The third semester includes the design phase and the fourth semester includes the implementation and final thesis submission.

The student should report the status of their progress weekly to the concerned supervisor. Students should submit the project report at the end of the respective semesters, on dates announced by the college/department. Project evaluation will be based on presentations, viva voce, demonstration, review reports, design reports and final thesis. Progress of the project work is to be evaluated at the end of the third semester. For this a committee headed by the head of the department with two other faculty members in the area of the project, of which one shall be the project supervisor. If the project is done outside the college, the external supervisor associated with the student will also be a member of the committee.

Normally students are expected to do the project within the college. However they are permitted to do the project in an industry or in a government research institute under a qualified supervisor from that organization. This is only possible in the fourth semester and the topic of investigation should be in line with the project part planned in the 3rd semester. Student should apply for this through the project supervisor indicating the reason for this well in advance, preferably at the beginning of the 3rd semester.

Project evaluation marks shall be as follows:-

Total marks for the Project: 150

In the 3rd Semester: Marks:50

Project Progress evaluation:

Progress evaluation by the Project Supervisor : 20 Marks

Presentation and evaluation by the committee : 30 Marks

SEMESTER 4

Course No.	Course Name	L-T-P-Credits	Year of Introduction
06 CS 7 01 8	PROJECT – PHASE II	0-0-21-12	2015

SYLLABUS:

The Phase II work shall be based on the work in Phase I. Normally students are expected to do the project within the college. However they are permitted to do the project in an industry or in a government research institute under a qualified supervisor from that organization; the topic of investigation should be in line with the project part planned in the 3rd semester. Student should apply for this through the project supervisor indicating the reason for this well in advance, preferably at the beginning of the 3rd semester. This application is to be vetted by a departmental committee constituted for the same by the Principal and based on the recommendation of the committee the student is permitted to do the project outside the college. The same committee should ensure the progress of the work periodically and keep a record of this. The application for this shall include the following:-

Topic of the Project, Project work plan in the 3rd Semester, Reason for doing the project outside, Institution/Organization where the project is to be done, External Supervisor Name, Designation , Qualification and Experience, Letter of consent of the External Supervisor as well as from the organization.

Final evaluation of the project will be taken up only on completion of the project in the fourth semester. This shall be done by a committee constituted for the purpose by the principal of the college. The concerned head of the department shall be the chairman of this committee. It shall have two senior faculty members from the same department, project supervisor and the external supervisor, if any, of the student and an external expert either from an academic/R&D organization or from Industry as members. Final project grading shall take into account the progress evaluation done in the third semester and the project evaluation in the fourth semester. If the quantum of work done by the candidate is found to be unsatisfactory, the committee may extend the duration of the project up to one more semester, giving reasons for this in writing to the student. Normally further extension will not be granted and there shall be no provision to register again for the project.

Project work is to be evaluated both in the third and the fourth semesters. Based on these evaluations the grade is finalized in the fourth semester.

Project evaluation marks shall be as follows:-

Total marks for the Project: 150

In the 4th Semester: Marks:100

Project evaluation by the supervisor/s	: 30 Marks
Presentation& evaluation by the Committee	: 40 Marks
Evaluation by the External expert	: 30 Marks

Students are required to publish their work in reputed national/ International Journals/ Conference Proceedings etc which will carry weightage in final marks.