SCHEME AND SYLLABUS FOR M.TECH (FULL TIME) DEGREE COURSE

in

COMPUTER SCIENCE AND ENGINEERING

(Specialization: Image Processing)

(2015 Scheme)

under

Faculty of Engineering

of the

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

ALAPPUZHA/PATHANAMTHITTA CLUSTER

(CLUSTER CODE: 03)

SEMESTER 1

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A	03 CS 6071	Fundamentals of Image Processing	4-0-0	40	60	3	4
B	03 CS 6081	Computer Graphics	4-0-0	40	60	3	4
C	03 CS 6091	Data Mining	4-0-0	40	60	3	4
D	03 CS 6101	Artificial Neural Network & Fuzzy System	3-0-0	40	60	3	3
E		Elective I	3-0-0	40	60	3	3
S	03 RM 6001	Research Methodology	1-1-0	100			2
T	03 CS 6901	Seminar I	0-0-2	100			2
U	03 CS 6811	Image Processing and Computer Graphics Laboratory	0-0-2	100			1
		TOTAL	**19-1-4**	**500**	**300**	**-**	**23**

TOTAL CONTACT HOURS : 24
TOTAL CREDITS : 23

Elective I

03 CS 6111 Advanced Computer Networks
03 CS 6121 Multimedia Systems
03 CS 6131 Data Structures and Algorithms

SEMESTER 2

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A	03 CS 6092	Image Analysis and its Applications	4-0-0	40	60	3	4
B	03 CS 6102	Computer Vision in Image Processing	3-0-0	40	60	3	3
C	03CS 6112	Pattern Recognition	3-0-0	40	60	3	3
D		Elective II	3-0-0	40	60	3	3
E		Elective III	3-0-0	40	60	3	3
V	03 CS 6902	Mini Project	0-0-4	100			2
U	03 CS 6812	Image Analysis and Computer Vision Laboratory	0-0-2	100			1
		TOTAL	**16-0-6**	**400**	**300**	**-**	**19**

TOTAL CONTACT HOURS : 22
TOTAL CREDITS : 19

Elective II

03 CS 6122 Medical Imaging Techniques

03 CS 6042 Image Forensics and Biometric Security

03 CS 6132 Artificial Intelligence and Robotics

Elective III

03 CS 6142 Random Processes

03 CS 6152 Fractals and its Applications

03 CS 6162 Soft Computing Techniques in Image Processing

SEMESTER 3

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A		Elective IV	3-0-0	40	60	3	3
B		Elective V	3-0-0	40	60	3	3
	03 CS 7903	Seminar II	0-0-2	100	0	0	2
	03 CS 7913	Project (Phase 1)	0-0-8	50	0	0	6
		TOTAL	**6-0-10**	**230**	**120**	**6**	**14**

TOTAL CONTACT HOURS : 16
TOTAL CREDITS : 14

Elective IV

03 CS 7063	Computer Modeling and Visualization
03 CS 7073	GIS and Remote Sensing
03 CS 7083	Video Surveillance

Elective V

03 CS 7093	Wavelet Analysis and its Applications
03 CS 7043	Intellectual Property Rights
03 CS 7103	Parallel Computing

SEMESTER 4

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credit
					Marks	Duration (hours)	
	03 CS 7914	Project (Phase 2)	0-0-21	70	30	-	12
		TOTAL	**0-0-21**	**70**	**30**	**-**	**12**

TOTAL CONTACT HOURS : 21
TOTAL CREDITS : 12

TOTAL NUMBER OF CREDITS: 68

Semester I

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6071	Fundamentals of Image Processing	4-0-0	4	2015

Course Objectives

- This course provides a general understanding of the fundamentals of digital image processing.
- Familiarize the use of basic theories and computer algorithms to perform image processing on digital images.
- Develop hands-on experience in using computers to process images.
- Develop critical thinking about shortcomings of the state of the art in image processing

Syllabus

Digital Image Processing: - Fundamental steps and concepts in Digital Image processing, Mathematical tools used in image processing, Image Enhancement Techniques, Fundamentals of spatial filtering, Intensity transformation and spatial filtering using fuzzy techniques. Image Transforms and Filtering in Frequency domains. Filtering Concepts in frequency Domain. Edge Detection and Image segmentation, Image Restoration and Reconstruction, Geometric Transformation and Image registration. Colour Image Processing, Morphological Image processing, Image representation and description, Multispectral Image Analysis.

Expected Outcome

- Provides skill base that is necessary to further explore advanced topics of Image Processing.
- Gain hands-on experience in using software tools for processing digital images.
- Helps to be in a position to make a positive professional contribution in the field of Digital Image Processing.

References

1. Gonzalez. R.C & Woods ,"Digital Image Processing", R.E. 3/e, Pearson Education, 2008(higher)
2. Kenneth R Castleman, "Digital Image Processing",Pearson Education, 1995.
3. S. Jayaraman, S. Esakkirajan, T. Veerakumar, "Digital Image Processing",McGraw Hill Education, 2009.Pvt Ltd, New Delhi
4. Anil Jain.K, "Fundamentals of Digital image Processing", Prentice Hall of India, 1989.
5. Sid Ahmed, "Image Processing", McGraw Hill, New York, 1995.
6. William K. Pratt, "Digital Image Processing: PIKS Scientific Inside", Wiley Interscience, 4th Ed, 2007
7. Bernd Jahne, "Digital Image Processing", Springer, 6th Ed, 1997

03 CS 6071- COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Digital Image Processing: Fundamental steps in Digital Image processing, Fundamental Concepts in Digital Image Processing,2D Signals and Systems, Simple Image Formulation, Image Sampling and Quantization, Some basic relationships between pixels, Mathematical tools used in image processing, Convolution & correlation, Image Intensity Transformation, Some basic spatial intensity transformation functions.	9	25
FIRST INTERNAL EXAM			
II	Image Enhancement Techniques, Histogram Processing, Fundamentals of spatial filtering, Smoothing using spatial filters, Sharpening using spatial filters, Intensity transformation and spatial filtering using fuzzy techniques.	7	25
	Image Transforms and Filtering in Frequency domains, Fourier Transforms, sampling and its properties. Filtering Concepts in frequency Domain, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters.	7	
III	Edge Detection and Image segmentation. Basic Concepts of Edge Detection. Different Methods for Edge detection and Segmentation.	5	25
	Image Restoration and Reconstruction, Noise Models, Restoration and noise reduction in spatial and frequency domain, Different restoration techniques, Image Reconstruction from projections.	5	
	Geometric Transformation and Image registration.	4	
SECOND INTERNAL EXAM			
IV	Colour Image Processing, Colour image representations, Relation between different colour image representations, Colour transforms and colour image filtering, Smoothing and sharpening in colour images, Operations in RGB vector space.	6	25
	Morphological Image processing, Basic Concepts, Basic Morphological Algorithms, Gray scale Morphology.	4	
	Image representation and description-Fundamental Concepts-Representation-Boundary Descriptors-Regional Descriptors. Multispectral Image Analysis- Colour Image Processing in 3D, Computerized axial Tomography, Stereometry, Stereoscopic Image Display, Shaded surface display.	6	

END SEMESTER EXAM

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6081	**Computer Graphics**	4-0-0	4	2015

Course objectives

1. This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. Gives an introduction to computer graphics techniques, focusing on 3D modelling, image synthesis, and rendering.
3. This course also covers the mathematical nature of 2- and 3-D environments, the properties of the various surfaces and their simulation.
4. The goal of this course is to provide an introduction to the theory and practices of computer graphics and examine applications of modelling, design and visualization.

Syllabus

Introduction to Computer Graphics:-Computations on Polygons. Introduction to 3D Graphic. OpenGL. Visible Surface Detection. Solid Modelling Techniques:-Representation, Techniques. Advanced Rendering Techniques. Volume Rendering and Visualization. Texture Mapping. Surfaces and Meshes. Curves and surfaces. Global Illumination Techniques. DirectX

Expected Outcome

- This course helps to understand the interactive computer graphics architecture and exemplifies the major computer graphics application areas.
- This course gives basic knowledge about some classic 2D and 3D graphics algorithms.
- This course provides adequate knowledge to create computer models of 2D and 3D objects using mathematical knowledge and skills.
- Implement the computer models using OpenGL and provides in-depth knowledge about multimedia API's like DirectX.

References

1. David B. Rogers, "Procedural Elements for Computer Graphics" , Tata Mc GrawHill, 2001.
2. M Pauline Baker, " Donald Hearn" , 2/E Pearson Education, 2003
3. Foley, Van Dam, Feiner, Hughes, "Fundamentals of Interactive Computer Graphics", AW 1990
4. Schaum's Outline Series, "Theory & Problems of Computer Graphics" Mc GrawHill, 2009.
5. Jonas Gomes & LuizVelha , "Image Processing for Computer Graphics" Springer,1997.
6. Rafael C. Gonzalez & Paul Wintz, "Digital Image Processing" - AW,1987.
7. Dave Shreiner, Mason woo, Jackie Neider, Tom Davis "Open GL Program guide". PE ,2007

8. Alan Watt and Mark Watt "Advanced Animation and Rendering Techniques ", Addison-Wesely

9. Tomas Akenine-Moller,Eric Haines, Naty Hoffman "Real Time Rendering" –, AK peters 3rd Ed.
10. Matt Pharr and Greg Humphreys "Physically based rendering from theory of Implementation", Addison-wesley, 1992.
11. Michal J Laszlo" Computational Geometry and Computer Graphics in cpp"
12. Jonas Gomes, Luiz Velho "Computer Graphics Theory and practices"

03 CS 6081- COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Introduction to Computer Graphics:-Computations on Polygons:-Transformations, Point inclusion Problems, Polygon Filling, Clipping, Triangularization of polygons .	4	25
	Introduction to 3D Graphic: Geometric and modeling transformations, projections, clipping Filling shapes- 3D flood fill.	4	
	OpenGL:-Relevance of OpenGL, OpenGL extensions, OpenGL SDK, OpenGL command Syntax, OpenGL Rendering Pipeline, Simple OpenGL Programs, The Gasket program, Polygons and recursion.	6	
	The three-dimensional gasket, Plotting implicit functions, 3D shape construction and manipulation using OpenGL.	4	
FIRST INTERNAL EXAM			
II	Visible Surface Detection: concept, classification, techniques:- painters algorithm, ray casting method, (Culling), Hidden Surface removal Algorithm: (applet)	5	25
	Solid Modeling Techniques:-representation, techniques: - Boundary representation, cell decomposition. Advanced Rendering Techniques:-constant intensity shading , Gouraud shading, Phong shading. Image based rendering Techniques.	6	
	Volume Rendering & visualization:-Concepts, techniques in image processing (Tomography) Texture Mapping:-Concepts, different techniques and application in image processing (Handling Image Distortion)	5	
III	Surfaces and Meshes:-Parametric Surfaces, Implicit Surfaces, Meshes. Curves and surfaces : Concepts, properties and application in image processing. Rendering Curves and Surfaces. Splines, properties, applications in image processing-Snake Algorithm.	5	25
	Global Illumination techniques, Reflection techniques-Diffuse, Specular.	4	
SECOND INTERNAL EXAM			

IV	Direct x:-Direct 3D Architecture, Primitives, Simple programming concepts.	5	25
	Animation:-Fundamental Concepts, methods for controlling animation: - Spline Driven, Quarterions, Deformation.	5	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6091	**Data Mining**	4-0-0	4	2015

Course objectives

1. To learn about the general architecture of data mining systems, as well as gain insight into the kinds of data on which mining can be performed the types of patterns that can be found, and how to tell which patterns represent useful knowledge.
2. To learn methods for mining the simplest form of frequent patterns and basic techniques for data classification

Syllabus

Data mining:-Basic Concepts and Functionalities, Classification of Data Mining Systems, Online Analytical Processing, Data Warehousing, Data Preprocessing. Association rule mining: Naïve algorithm, the Apriori algorithm. Classification: Decision tress, Naïve Bayes method. Prediction. Cluster Analysis. Clustering methods. Partitional Algorithm. Divisive and Agglomerative methods. GA based clustering, Large Database. Web Mining. Image Mining. Image Clustering and Image Classification.

Expected Outcome

1. This course provides a comprehensive understanding of different data mining tasks and the algorithms most appropriate for addressing them.
2. Defines knowledge discovery and data mining and helps to recognize the key areas and issues in data mining.
3. Gives a fair idea about what type of data are to be mined and present a general classification of tasks and primitives to integrate data mining system.
4. It helps to determine whether a real world problem has a data mining solution.

References

1. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", Morgan Kaufmann, 2nd Ed., 2005.
2. G. K. Gupta "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
3. Soumen Chakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", Morghan Kaufmann, 1st Ed., 2005.
4. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall, 1st Ed., 2002.
5. Da Ruan, Guoqing Chen, Etienne E. Kerre, Geert Wets, "Intelligent Data Mining: Techniques and Applications (Studies in Computational Intelligence)", Springer, 1st Ed., 2010.
6. Masoud Mohammadian, "Intelligent Agents for Data Mining and Information Retrieval", Idea Group Publishing, 2004.
7. I. H. Witten and E. Frank." Data Mining: Practical Machine Learning Tools and Techniques". Morgan Kaufmann. 2000.
8. D. Hand, H. Mannila and P. Smyth. "Principles of Data Mining". Prentice-Hall. 2001.

03 CS 6091/6262 - COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Data mining:-Basic Concepts and Functionalities, KDD process, Architecture of a typical Data Mining System, Classification of Data Mining Systems, Different kinds of data used for mining, Kinds of Patterns that can be Mined, Major Issues in Data Mining. Data Preprocessing: - Data cleaning, data integration and transformation, data reduction, Discretization and concept hierarchy generation. Data Warehouse: Basic concepts, Differences between Operational Database Systems and Data Warehouses, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models, Typical OLAP Operations.	13	25
INTERNAL TEST I			
II	Association Rules mining- Introduction, basics, Naïve Algorithm, Improved Naïve algorithm, the Apriori algorithm, Frequent, closed and maximal Item set. Mining frequent patterns without candidate generation. Classification and Prediction:-Decision Tree - tree induction algorithm, Split algorithm based on information theory, Split algorithm based on the Gini index- Naïve Bayes method- Estimating predictive accuracy of classification methods.	13	25

III	Cluster Analysis: -Desired features of cluster Analysis, Types of data in cluster analysis, Computing Distance, clustering methods: Partitional methods -MST, Squared Error, K-Means, Nearest Neighbour, PAM, Hierarchical methods-Single link, average Link, Complete Link, Dendrogram - Divisive and Agglomerative methods- GA based clustering, Categorical algorithm, Dealing with Large Databases, Quality and validity of cluster analysis methods.	13	25
INTERNAL TEST II			
IV	Web Mining:-Introduction, Web data, Web Knowledge mining Taxonomy, Web Content Mining, Web usage Mining, Ontology based web mining research, Web Mining Application. Image Mining:-Need of Image Mining, Classification of Image Mining techniques, Image Clustering and Image Classification, Association Rule Mining, Different Image Mining techniques, Applications.	13	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6101	Artificial Neural Networks and Fuzzy Systems	3-0-0	3	2015

Course objectives

1. This course provides the knowledge of Neural Networks and Fuzzy Logic Control and uses these for controlling real time systems.
2. It explores the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.
3. The objective of this course is intended for students to apply neural networks and fuzzy systems to model and solve complicated practical problems.

Syllabus

Basic concepts- Perceptron- Adaline – Madaline - Learning rules-Supervised learning -Adaptive network- Radial basis network modular network. Unsupervised learning- Learning vector quantisation – Adaptive resonance theory – Bidirectional Associative Memory. Crisp sets. Fuzzy sets- Fuzzy logic. Operations on fuzzy sets. Crisp and fuzzy relations. Membership functions-defuzzification methods. Adaptive Neuro Fuzzy based inference systems - Data clustering algorithms. Neuro fuzzy control.

Expected Outcome

1. This course exposes the students to the concepts of different supervised and unsupervised neural networks.

2. To provide adequate knowledge about feed forward and feedback neural networks and machine learning concepts.
3. This course helps to achieve an understanding of the technical potential and the advantages and limitations of the learning and self organizing systems of today.
4. This course helps to understand the concept of fuzziness involved in various systems and provide adequate knowledge about fuzzy set theory.
5. It provides adequate knowledge of application of fuzzy logic control to real time systems.

References

1. Jang J.S.R.,Sun C.T and Mizutani E "Neuro Fuzzy and Soft computing",– Pearson education, 2004
2. Laurene Fauseett "Fundamentals of Neural Networks", Prentice Hall India, New Delhi,1994.
3. Timothy J.Ross "Fuzzy Logic Engineering Applications" , McGrawHill,NewYork,1997.
4. S.Rajasekaran and G.A.Vijayalakshmi "Neural networks,Fuzzy logics,and Genetic algorithms", Pai Prentice Hall of India,2003
5. " George J.Klir and Bo Yuan,"Fuzzy Sets and Fuzzy LogicPrentice Hall Inc., New Jersey,1995
6. " S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing Wiley India Pvt Ltd.

03 CS 6101- COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Basic concepts- single layer perceptron - Multi layer perceptron – Adaline – Madaline - Learning rules - Supervised learning-Back propagation networks-Training algorithm, Advanced algorithms-Adaptive network- Radial basis network modular network.	8	25
FIRST INTERNAL EXAM			
II	Introduction- unsupervised learning -Competitive learning networks-Kohonen self organizing networks-Learning vector quantisation - Hebbian learning – Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network– Adaptive resonance theory –Bidirectional Associative Memory.	8	25
III	Crisp sets - Fuzzy sets– Fuzzy logic. Operations on fuzzy sets, combinations of operations – general aggregation operations. Crisp and fuzzy relations- orderings – Membership functions – methods of generation – defuzzification methods.	15	25

03 CS 6101- COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
	SECOND INTERNAL EXAM		
IV	Adaptive Neuro Fuzzy based inference systems - Data clustering algorithms. Rule base structure identification – Neuro fuzzy control. Specialized Learning, Back propagation through Real – Time Recurrent Learning.	9	25
	END SEMESTER EXAM		

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6111	Advanced Computer Networks	3-0-0	3	2015

Course Objectives

1. This Course help the students to uncover and understand the current direction of computer networks and exposes the students to a full span of computer network's frontier and also encourages a performance perspective towards the analysis of computer and communication networks.
2. This course familiarizes the students with basic concept of computer networking area and helps the student to gain expertise in some specific areas of networking.
3. It helps the students to develop an understanding about information assurance as practiced in computer networks and their respective applications along with basic understanding of cryptography and other security policies.
4. It provides the students an opportunity to develop a fair knowledge and gain a deep theoretical understanding in the field of wireless and mobile networks.

Syllabus

Protocol layers and their service models, mail access protocols, Routing, Multimedia networking, Information Security, Network layer security, Cryptography, Wireless Networks, Wi-Fi, Mobile networks, Internet Computing.

Expected Outcome

- This course provides an advanced knowledge and understanding of computer networks and its applications.
- It provides an insight about the concept of routing, multimedia and real time streaming protocols.
- This course provides a deep understanding about the concept of information security and how information security can be achieved by cryptography.
- This course provides basic principles of wireless and mobile networks with focus on computer and data networks, Knowledge of basic protocols and interfaces.

References

1. Douglas E. Comer , "Computer Networks and Internets", PE.
2. Leon-Garcia-Widjaja, "Communication Networks" ,TMH.
3. Douglas E .Comer, "Internetworking with TCP / IP " , PE.
4. Forouzan Behrouz A;, "TCP/IP protocol suite" TMH.
5. Andrew S. Tanenbaum ,"Computer Networks " , PHI.
6. William Stallings; "Data and Computer Communication", PHI.
7. Craig Zacker ,"The Complete reference of Networking", TMH.
8. Jochen Schiller, "Mobile Communications ", 2nd Edition, Addison Wesely, Pearson Education
9. William Stallings, "Wireless Communications and Networks" , Prentice Hall-2005

10. Rappaport, "Wireless Communications Principals and Practices' , 2nd Edition, Prentice Hall
11. YI Bing Un , "Wireless and Mobile Network Architectures', John Wiley
12. P.Nicopqlitidis, "Wireless Networks', John Wiley M. Richharia, "Mobile Satellite Communication: Principles and Trends', Pearson Education.

03 CS 6111 - COURSE PLAN

Module	Contents	Hours Allotted	% Marks in End of Semester Examination
I	Protocol layers and their service models:-layered architecture, messages, segments, datagrams and frames. Web and HTTP, web caching, user-server interaction:-cookies, electronic mail – SMTP, mail access protocols:-POP3, IMAP.	9	25
	FIRST INTERNAL EXAM		
II	Routing: routing protocols:-Link state routing, Distance vector routing, routing in internet:-RIP,OSPF. Multimedia networking:-Streaming stored audio and video. Real-time streaming protocol (RTSP). Best-Effort- Service. Protocols for real time interactive applications:-RTP, RTCP, SIP.	11	25
III	Information Security:-Need of Information Security. Firewalls, Intrusion Detection Systems (IDS), Honey Pots, Honey Nets, Padded cell systems, Scanning and Analysis Tools, Access Control Devices. Network layer security:- IPsec and virtual private networks. AH and ESP protocols. Cryptography:-symmetric key cryptography, public key encryption. Digital signatures. Authentication functions and its Applications. Internet Security Protocols(TSL/SLG) and System Level Security	12	25
	SECOND INTERNAL EXAM		
IV	Wireless Networks:-Ad-hoc Networks, Sensor Networks. Wifi: 802.11 wireless LANS-architecture, MAC protocol, frames. Cellular internet access-cellular architecture. Mobile networks:- mobility management principles, addressing, routing to a mobile node. Internet Computing:-Introduction, Servlets, Web security.	10	25
	END SEMESTER EXAM		

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6121	Multimedia Systems	3-0-0	3	2015

Course Objectives

1. This course lays a foundation to build advanced multimedia computing applications comprising of images, videos and audio
2. Introduces principles and current technologies of multimedia systems, multimedia standards, and gain hands-on experience in this area
3. Emphasis on technical issues in distributed multimedia systems, multimedia compression and multimedia information systems

Syllabus

Defining the scope of multimedia, Multimedia File systems and information models, Digital Audio representation and processing, Digital Video and Image Compression, Virtual reality systems, Distributed Multimedia systems.

Expected Outcome

1. A comprehensive understanding with multimedia standards, tools and systems
2. A knowledge about the special requirements needed in multimedia computing environment and the various methodologies that have been used in an effort to meet the requirements
3. Extensive practices from multimedia capturing, processing, transmitting, content representing to retrieval
4. Builds a solid background in multimedia for academic researches or industrial applications

References

1. Jhon F. Koegel Buford ,"Multimedia Systems ", Pearson Education,2001.
2. John Vince, "Virtual Reality systems", Addison Wesley, 1995
3. R. Carey and G. Bell, "The Annotated VRML 2.0 reference", Addison Wesley, 1997

03 CS 6121- COURSE PLAN			
Module	**Contents**	**Hours**	**% Marks in End-of-Semester Examination**
I	Defining the scope of multimedia: Hypertext and Collaborative research. Social issues Multimedia File systems and information models: The case for multimedia information Models.	10	25
FIRST INTERNAL EXAM			
II	Digital Audio Representation and processing. Digital audio and computers Video Technology Raster Scanning Principles. Color Video, World wide television standards.	10	25
III	Digital Video and Image Compression, Colour theory instruction to animation, Simulation of physical systems, mathematical modelling, collisions, projectiles, introduction to dynamics, motion kinematics.	11	25
SECOND INTERNAL EXAM			
IV	Distributed Multimedia systems, A frame work for Multimedia systems Operating systems Support for Continuous Media Applications, Multimedia systems services Architecture, Client control of continuous multimedia	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6131	Data Structures and Algorithms	3-0-0	3	2015

Course Objectives

- To elaborate a variety of data structures.
- Deals with their implementation, evaluation and comparison of complex data structure.
- Describes various algorithm design techniques for solving problems.

Syllabus

Abstract data types, Basic concepts of data Structures, Introduction to algorithms and complexity. Time and space complexity, Asymptotic Notations, Recurrences, Arrays, Searching algorithms, Sorting algorithms, Representation of higher dimensional arrays and Sparse matrices. Linked list, Applications of linked list. Stack Queue, Implementation of stack and queue, Circular queue, Deque, Priority Queue. Heaps, heap-based implementations. Trees, Representations, Traversals, Balanced binary search trees, Graphs, Graph Traversals- Shortest path algorithms, Minimum spanning tree algorithms, Connected Components, Biconnectivity, Euler circuits. Dictionary - Array based and Tree based implementations; Hashing - definition and application - LZW encoding. Algorithm Design Paradigms - Greedy, Divide and conquer, Dynamic programming, Backtracking, Branch and Bound. Local Search Approximation. Randomized algorithms. Complexity Theory-Introduction, P and NP, NP-Complete Problems. Approximation algorithms - Bin packing, Travelling salesman problem.

Expected Outcome

- Masters a variety of data structures.
- Obtains basic ability to analyze algorithms and to implement algorithm design techniques to solve problems.

References

1. Mark Allen Weiss, "Data Structures and Algorithms in C++", Addison Wesley, 2003.
2. Adam Drozdek, "Data Structures and Algorithms in C++", Brooks and Cole, 2001.
3. Aho, Hopcroft and Ullmann, "Data structures and Algorithms", Addison Welsey, 1984.
4. Sara Baase, “Computer Algorithms: Introduction to Design and Analysis”, Third Edition, Addison-Wesley, 2000.
5. Aho, Hopcroft and Ullmann, “The Design and Analysis of Computer Algorithms “, Addison Welsey
6. Jean Paul Tremblay and Paul G Soenson, “An introduction to data structures with applications”, Mc GrawHill.
7. Ellis Horowitz and Sartaj Sahni, “An Introduction to Data Structures”, Computer Science Press, Rockville.
8. R. F. Gilberg and B. A. Forouzan, “Data Structures”, Second Edition, Thomson India Edition,2005.

03 CS 6131 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Problem Solving using Computers - Abstraction - Abstract data types; Data Representation; Elementary data types; Basic concepts of data Structures; Introduction to algorithms and complexity. Notion of time and space complexity- Asymptotic Notations-O(n), Ω(n), Θ(n), o(n), ω(n)-Recurrences.	4	25
	Arrays - Computations on arrays - Searching algorithms-Linear, Binary and Fibonacci- Sorting algorithms-Bubble, Quick, Merge, Heap- Lower bound for sorting by comparisons- Representation of higher dimensional arrays and Sparse matrices.	7	
FIRST INTERNAL EXAM			
II	Linked list-Single, double and circular-Applications of linked list. Stack, Queue, Implementation of stack and queue using array and linked list, Circular queue, Dequeue, Priority Queue - Heaps; heap-based implementations.	4	25
	Tree - General Tree representations, Binary trees-Representation, Traversals, Expression trees, Threaded binary trees, Application of binary trees - Huffman coding;	4	
	Search Tree - Binary search tree; Balanced binary search trees - AVL tree; Applications of Search Trees - TRIE; 2-3 tree, 2-3-4 tree; Concept of B-Tree.	5	
III	Graphs – Representation of Graphs, Graph Traversals- DFS, BFS, Application of DFS and BFS, Shortest path algorithms- Dijkstra's algorithm, Floyd's Algorithm, Minimum spanning tree algorithms- Kruskal and Prim's algorithms, Connected Components, Biconnectivity, Euler circuits, Applications of graphs.	8	25
	Dictionary - Array based and Tree based implementations; Hashing - definition and application - LZW encoding.	3	
SECOND INTERNAL EXAM			

IV	Algorithm Design Paradigms - Greedy, Divide and conquer, Dynamic programming, Backtracking, Branch and Bound. Local Search Approximation. Randomized algorithms. Complexity Theory-Introduction, P and NP, NP-Complete Problems. Approximation algorithms - Bin packing, Travelling salesman problem.	8	25
END SEMESTER EXAM			

Course No.	**Course Name**	**L-T-P**	**Credits**	**Year of Introduction**
03RM6001	Research methodology	1-1-0	2	2015

Course Objectives:

- This course is designed to familiarize the student with the research process, problem identification strategies and formulation of a research plan by doing case studies

Syllabus

Introduction to Research Methodologies - Objectives -motivation in research- Significance of research - interaction between industries and research units –research and innovation

Research Formulation- - literature review–

Ethics in research: – copy right – plagiarism – citation – acknowledgement

Research Design – and Report writing

Case Studies : Department / stream specific case study and preparation of a research plan or a review paper

Expected Outcomes:

- Students will be able to write a review paper after critically evaluating the state of the art development in a topic of interest
- Students will acquire capability to write a research proposal in the form of a technical paper which could lead the student towards his / her final thesis topic
- **No formal end semester examination is intended – Evaluation is based on internal oral presentations and a Technical Report or a Research Plan or a Review Paper**

References

1. R. Paneersalvam, "Research Methodology",Prentice Hall of India Pvt. Ltd.,2011
2. Mike Martin, Roland Schinzinger, "Ethics in Engineering" ,McGraw Hill Education, Fourth Edition,.2014
3. Vinod V Sople," Managing Intellectual Property-The Strategic Imperative, EDA", Prentice of Hall Pvt. Ltd.,2014
4. Kothari C R &Gaurav Garg – "Research Methodology- Methods and Techniques",New Age International(P) Ltd Publications,2006
5. Day A Robert,"How to write and publish a scientific paper",Cambridge University,UK,2012
6. Leedy P D,"Practical Research-Planning and Design", Prentice Hall of India Pvt. Ltd.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Introduction** –Need for research- objectives and motivations in research- Significance of research - -need for interaction between academic institutions, industrial and research establishments – research and innovation. Research Formulation- Identifying a research problem- -literature review– **confirming to a research problem based on literature review.**	**4**	**25%**
	FIRST INTERNAL EXAM		
II	Research Ethics – Environmental impacts – Ethical issues - Intellectual Property Rights – Patents – legal formalities in filing patent in India – Copy right– plagiarism – citation and acknowledgement.	3	25%
III	**Research design** –Prepare research plan. **Report writing** – types of report – research report, research proposal, funding agencies for research	3	

	concerned to the specialization, significance of peer reviewed articles and technical paper- - simple exercises - oral presentation		
SECOND INTERNAL EXAM			
IV	**Case Studies** The student is expected to **prepare a research plan** relating to a topic of current interest in the concerned specialization, which has appeared in a recent journal. A minimum of 20 related referred articles should be critically studied. On the basis of this, the student is expected to prepare a review report/paper of publishable quality. **This paper has to be presented for open defence before the departmental committee. (This would carry 50% marks)**	6	50%
END SEMESTER EXAM			

Course No.	**Course Name**	**L-T-P**	**Credits**	**Year of Introduction**
03 CS 6901	Seminar I	0-0-2	2	2015

Course Objectives

To make students,

- identify a domain of interest
- identify sufficient number of latest good quality research papers on a particular problem or allied problems
- do extensive study and analysis of the problem and solution(s)
- prepare a comprehensive report
- make a presentation of 30 minutes based on the topic

Seminar Guidelines

- No specific Syllabus
- Each student shall individually prepare and present a seminar and the topic should be relevant to the stream of study with content suitable for M.Tech level Presentation.
- For selection of topics refer internationally reputed transactions/journals. The primary reference should be published during the last two or three years.
- A detailed write-up /synopsis should be prepared in the prescribed format given by the Department and get the topic approved by the PG Coordinator well in advance.
- The seminar shall be of 30 minutes duration and a committee, with the PG Co-ordinator as the chairman and two faculty members from the department as members shall evaluate the seminar based on the technical content, presentation, depth of knowledge and ability to answer the questions put forward by the committee.
- After the completion of the Seminar work the students would be required to submit two copies of the seminar reports prepared by them in the prescribed format.

Expected Outcome

To student

- gets good exposure to a domain of interest and the research problems in the domain
- gets practice in the art of doing literature survey
- improves his/her writing and presentation skills

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6811	Image Processing and Computer Graphics Laboratory	0-0-2	1	2015

Syllabus

Experiments are based on but not limited to the topics covered in 03 CS 6071: Fundamentals of Image Processing, 03 CS 6081: Computer Graphics

03 CS 6811 – EXPERIMENTS

Experiment No	Description	Hours Allotted
I	1. Image Intensity Transformations and Spatial Filtering 2. Image Intensity Transformations and Spatial Filtering using fuzzy techniques 3. Image filtering in frequency Domain	4
II	1. Image Restoration and Reconstruction 2. Geometric Transformation and Image Registration	3
III	1. Morphological Image Processing 2. Image Segmentation	3
IV	1. Image Representation and Description 2. Image Processing Using wavelets 3. Image Matching	4
V	1. OpenGL Simple Programs	3
VI	1. Polygon Transformation 2. Polygon Clipping 3. Triangulization of Polygon 4. 3D Clipping	4
VI	1. Hidden Surface Removal 2. Surfaces, meshes & applications	4
VII	1. Introduction to Direct x	3

Semester II

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6092	Image Analysis and its Aplications	4-0-0	4	2015

Course Objectives

- The primary goal of this course is to address the various dimensions of image analysis and introduce the students to advanced level of image processing.
- This course is aimed to teach the principles of advanced image analysis, its real time applications and introduces to different advanced computer algorithms to perform image processing on digital images.

Syllabus

Image Acquisition and Processing, Registration and Image Fusion:- fusion techniques. Shape Analysis - Active Appearance Models, Object segmentation. Introduction Compression Techniques- Statistical Methods, Dictionary methods, Image Compression Intuitive Methods, Image Transforms, JPEG, Progressive Image compression, Vector quantization, Adaptive Vector Quantization. Digital Video processing, Video Analysis, Video Compression, Audio Compression.

Expected Outcome

On successful completion of this course, the students will get an in-depth knowledge about the various advanced computing algorithms and its applications in the field of image processing.

References

1. Gonzalez.R.C & Woods,"Digital Image Processing",R.E., 3/e, Pearson Education, 2008.
2. Kenneth R Castleman, "Digital Image Processing", Pearson Education,1995.
3. S. Jayaraman, S. Esakkirajan, T. Veerakumar ,"Digital Image Procesing", McGraw Hill Education ,2009. Pvt Ltd, NewDelhi
4. Anil Jain.K, "Fundamentals of Digital image Processing", Prentice Hall of India, 1989.
5. Sid Ahmed, "Image Processing", McGraw Hill, New York, 1995.
6. David salomon, "Data compression - The complete Reference", Springer Publications (4th Edition),2006.
7. Mark Nelson and Jean-Loup Gailly, Mark Nelson and Jean-Loup Gailly, "The Data compression Book", BPB publications (2nd Edition),1995
8. Khalid Sayood, "Introduction to Data Compression", Harcout India(P) Ltd,2/e ,New Delhi,2002
9. L. O. Gorman and R. Kasturi, "Document Image Analysis"
10. P.s.P Wing "Hand Book of Character Recognition and Document Analysis"
11. Yeo Wang, Jom Osterman "Video Processing and Communication"

03 CS 6092 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Image Acquisition and processing: Concepts, Various techniques, Feature Extraction, Different methods For feature Extraction.	5	25
	Image fusion techniques:- Multi resolution based image fusion, Wavelet transform based image fusion, Region based image fusion.	6	
	Registration and Image Fusion:- Preprocessing, Feature selection, Feature Correspondence and Resampling.	6	
FIRST INTERNAL EXAM			
II	Shape Analysis:-Fundamentals in Shape Analysis, Moment Invariants, Contour-based Invariants -Active Shape Models (ASM) -Active Appearance Models (AAM) -Elliptical Harmonics.	6	25
	Object segmentation:-Generalized Hough Transform,3D Deformable Models -Snakes Level set evolution –Document image analysis	6	
III	Introduction Compression Techniques - Lossy compression & Lossless compression. Different Methods of Compression, Basic Techniques: Run length encoding, RLE Text compression, RLE image compression and scalar quantization. Statistical Methods: Huffman coding, Arithmetic coding and Text compression.	6	25
	Dictionary methods: String compression, LZ77, LZSS, LZ78, LZW. Image Compression Intuitive Methods, Image Transforms, JPEG, Progressive Image compression, Vector quantization, Adaptive Vector Quantization.	6	
SECOND INTERNAL EXAM			
IV	Digital Video processing-Video formation and representation-Video capture and display, Lattice theory and sampling. Video modelling-direct and indirect methods. Video Analysis:-Acquisition, Various Object Detection and tracking methods.	6	22
	Video Compression: - Analog Video, Composite and Components Video, Digital Video, Video compression, MPEG and H.261.	5	
	Audio Compression: - Sound, Digital Audio, ADPCM Audio compression and MPEPG1.	5	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6102	Computer Vision in Image Processing	3-0-0	3	2015

Course Objectives

- The goal of this course is to develop the theoretical and algorithmic basis by which useful information about the world can be automatically extracted and analyzed from a single image or a set of images.
- The course aims to provide a glimpse of what computer vision is about.
- This course also consists of inferring properties of the world based on one or more digital images.

Syllabus

Image formation and Image model, Radiometry, Representation of colour, Filters and Convolution, Edge detection, Texture Representation, The Geometry of multiple views, Affine structure from motion Elements of Affine Geometry, Segmentation by fitting a model, Segmentation and fitting using probabilistic methods. Geometric methods, Data segmentation.

Expected Outcome

- This course will describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.
- This course will help the student to get acquainted with basic possibilities and constraints of computer vision which can be used to solve the problems in the field of robotics and other vision based applications.

References

1. David A forsyth & Jean ponce , "Computer vision – A Modern Approach", Prentice Hall ,2002.
2. Bernd Jahne and Horst HauBecker, "Computer vision and Applications", Academic press, 2000.

03 CS 6102 - COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Image formation and Image model- Components of a vision system-Cameras-Radiometry-Light in space- Light in surface- sources, shadows and shading, Representation of color- A model for image color-Surface color from image color.	9	25
FIRST INTERNAL EXAM			
II	Early vision-Linear Filters and Convolution -Filters as Templates-Normalized co relation and finding patterns-Edge detection-Texture Representation	7	25
	Multiple images-The Geometry of multiple views- Stereopsis-Affine structure from motion Elements of Affine Geometry-Affine structure and motion from two images, Affine structure and motion from multiple images.	7	
III	Middle level vision-Segmentation by clustering-Shot Boundary Detection and Background Subtraction-Image segmentation by clustering pixels-	5	25
	Segmentation by Graph-Theoretic clustering- Segmentation by fitting a model-The Hough Transform-Fitting lines-Fitting curves- Segmentation and fitting using probabilistic methods.	6	
SECOND INTERNAL EXAM			
IV	High level vision-:Geometric methods-Model based vision-Obtaining hypothesis by pose consistency, pose clustering and using Invariants-Verification-smooth surface and their outlines-Aspect graphs- Range data-Range Data segmentation- Range image Registration and model acquisition-Object Recognition.	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6112	Pattern Recognition	3-0-0	3	2015

Course Objectives

- Introduces the basic mathematical and statistical techniques commonly used in pattern recognition which will help the student to understand, compare and contrast various pattern recognition techniques along with an adequate background on probability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.
- Provides variety of pattern recognition algorithms and will give a fair idea about which algorithm works best under what condition and that provide an adequate knowledge on how to solve real world problems using these pattern recognition algorithms.

Syllabus

Perception, Image Processing and Pattern Recognition, Pattern Recognition Systems, Statistical Pattern Recognition: Probability theory, Bayesian Decision Theory. Methods for parameter estimation, parametric techniques for density estimation. Linear discriminant function based classifiers, Sequential Models, Probabilistic Graphical Models, Regression. Feature Extraction and Selection, Dimensionality Reduction, Recent advances in Pattern Recognition.

Expected Outcome

- Introduces the fundamental pattern recognition and machine learning theories.
- Make the students able to design systems and algorithms for pattern recognition with focus on sequences of patterns that are analyzed and analyze classification problems probabilistically and estimate classifier performance.
- Also helps to understand and analyze methods for automatic training of classification systems.

References

1. R.O. Duda, P. E.Hart and D.G. Stork, "Pattern Classification", John Wiley, 2001
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press, 2009
3. C.M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4. Marsland, S." Machine Learning: An Algorithmic Perspective". CRC Press. 2009.
5. Bishop, C. M. "Neural Networks for Pattern Recognition". Oxford University Press. 1995.
6. Hastie, T., Tibshirani, R. and Friedman, J." The Elements of Statistical Learning". Springer. 2001.
7. Koller, D. and Friedman N." Probabilistic Graphical Models". MIT Press. 2009.
8. V. S. Devi, M. N. Murty, "Pattern Recognition: An Introduction", Universities Press, Hyderabad, 2011.
9. Earl Gose , Steve Jost, "Pattern Recognition and Image Analysis", PHI Publishers, 1997.
10. Robert J. Schalkoff, "Pattern Recognition : Statistical Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.
11. Tou and Gonzales, "Pattern Recognition Principles", Wesley Publications company, London 1974.

03 CS 6112- COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction: Machine Perception, Image Processing and Pattern Recognition, Pattern Recognition Systems, Design cycle, Learning and Adaptation, Applications of pattern recognition.	4	25
	Statistical Pattern Recognition: Probability theory basics, Probability density function, Normal density, Bivariate and Multivariate density functions.	3	
	Bayesian Decision Theory-Minimum error rate classification, Classifiers, discriminant functions and decision surfaces.	3	
FIRST INTERNAL EXAM			
II	Methods for parameter estimation-Maximum-Likelihood (ML) estimation-Maximum a posterori (MAP) estimation- Gaussian mixture model (Both unimodal-and multimodal distribution)-Expectation-maximization method	5	25
	Non-parametric techniques for density estimation-Histograms- Kernel Density Estimators- Parzen window method, K-Nearest Neighbor method, Adaptive Decision Boundaries, Adaptive Discriminant Functions, Minimum Squared Error functions.	5	
III	Linear discriminant function based classifiers-Separability, Perceptrons, Support Vector Machines-Minimum Mean Squared Error (MME) method -The Ho-Kashyap method.	5	25
	Probabilistic Graphical Models-Bayesian Networks- Dynamic Bayesian Networks. Sequential Models - Hidden Markov Models. Regression-Linear models for regression-Polynomial regression.	4	
SECOND INTERNAL EXAM			
IV	Feature Extraction and Selection: Entropy minimization, Karhunen Loeve transformation, Feature selection through functions approximation, Binary feature selection.	4	25
	Dimensionality Reduction: Problems of dimensionality, Component analysis and discriminants, Principal Component Analysis, Linear Discriminant Analysis, Fisher discriminant analysis.	5	
	Recent advances in Pattern Recognition: Neural Network structures for Pattern Recognition, Pattern classification using Genetic Algorithms, real life applications	5	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6122	Medical Imaging Techniques	3-0-0	3	2015

Course Objectives

- Covers the basic science and technology behind the principal imaging modalities currently used in medicine and medical research.
- Discusses advanced imaging methods, clinical and research applications, and computation methods.

Syllabus

Ultra Sound In Medicine, X-Ray computed tomography - conversion of x-ray data in to scan image, Magnetic Resonance Imaging - image acquisition and reconstruction techniques MRI, Radio isotope imaging, Infra red Imaging

Expected Outcome

- Master the basic physics and mathematical principles of medical imaging modalities
- Understanding in design of computer simulation experiments
- Guides those who want to expand a career in clinical medicine, medical research, or technological research or development.

References

1. S Webb, Adam Highler, Bristol ,"The Physics of Medical Imaging" , IEEE Press New York,1988.
2. A C Kak, "Principle of Computed Tomography" , IEEE Press New York
3. G A Hay ,"Medical Image Formation Preception and Measurement ".

03 CS 6122 - COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Ultra Sound In Medicine - Introduction, production of ultra sound - properties principles of image formation, capture and display - principles of A -mode, B-mode and M-mode display - Doppler Ultra sound and Colour flow mapping - Applications of diagnostic ultra sound.	10	25
FIRST INTERNAL EXAM			
II	X-Ray computed tomography - Principles of sectional imaging - scanner configuration - data acquisition system - image formation principles - conversion of x-ray data in to scan image - 2D image reconstruction techniques - Iteration and Fourier methods. Types of CT scanners.	9	25
III	Magnetic Resonance Imaging - Principles of MRI pulse sequence- image acquisition and reconstruction techniques MRI instrumentation magnets gradient system RF coils - receiver system Functional MRI - Application of MRI .	8	25
SECOND INTERNAL EXAM			
IV	Radio isotope imaging - Rectilinear scanners, Linear scanners - SPECT - PET Gamma Camera Radio nuclides for imaging, Emission Computed Tomography.	7	25
	Infra red Imaging - Physics of thermography - Imaging systems – Pyroelectric vidicon camera clinical thermography - liquid crystal thermography.	7	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6042	Image Forensics and Biometric Security	3-0-0	3	2015

Course Objectives

1. To familiarize the fundamentals in image processing through image enhancement, image segmentation and edge detection
2. To study the biometric fundamentals and the different biometric technologies
3. To study the basics of information hiding and steganography
4. Study the latest watermarking techniques

Syllabus

Digital Image representation - Fundamental steps in Image Processing, Image Enhancement, Image Segmentation, Biometric fundamentals – Biometric technologies, Biometrics Vs traditional techniques, Key biometric processes, Physiological Biometrics: Leading technologies, Behavioral Biometrics: Leading technologies, Introduction to Information hiding, Principles of Steganography, Current watermarking techniques: History – Basic Principles – applications, Robustness of copyright making Evaluation and benchmarking of watermarking system

Expected Outcome

1. Understand basic concepts in image processing, biometrics, and image hiding
2. Able to apply biometric and watermarking techniques in image processing

References

1. Anil K Jain, Patrick Flynn, Arun A Ross, "Handbook of Biometrics", Springer, 2008
2. Anil K Jain, Arun A Ross, Karthik Nandakumar, "Introduction to Biometrics", Springer, 2011
3. Samir Nanavati, Michael Thieme, Raj Nanavati, "Biometrics – Identity Verification in a Networked World", Wiley-dreamtech India Pvt Ltd, New Delhi, 2003
4. Paul Reid, "Biometrics for Network Security", Pearson Education, New Delhi, 2004
5. John R Vacca, "Biometric Technologies and Verification Systems", Elsevier Inc, 2007
6. Stefan Katzenbelsser and Fabien A. P. Petitcolas, "Information hiding techniques for Steganography and Digital Watermarking", ARTECH House Publishers, January 2004.
7. Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications",Cambridge university press, 2010.
8. Abbas Cheddad, Vdm Verlag and Dr. Muller, "Digital Image Steganography" Aktienge sells chaft & Co. Kg, Dec 2009.9
9. Ingemar Cox, Matthew Miller,Jeffrey Bloom,Jessica Fridrich and Ton Kalker, "Digital Watermarking And Steganography", Morgan Kaufmann Publishers, Nov 2007.

03 CS 6042 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Digital Image representation - Fundamental steps in Image Processing Image Enhancement: The Spatial Domain Methods, The Frequency Domain Methods - Image Segmentation: Pixel Classification by Thresholding, Histogram Techniques, Smoothing and Thresholding-Gradient Based Segmentation: Gradient Image, Boundary Tracking, Laplacian Edge Detection.	8	25
	Biometric fundamentals – Biometric technologies – Biometrics Vs traditional techniques –Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems, FAR, FRR, FTE rate, EER and ATV rate, Applications of Biometric Systems, Security and Privacy Issues.	7	
FIRST INTERNAL EXAM			
II	Physiological Biometrics: Leading technologies : Finger-scan – Facial-scan – Iris-scan – Voice-scan –components, working principles, competing technologies, strengths and weaknesses – Other biometrics technologies : Hand-scan, Retina-scan – components, working principles, competing technologies, strengths and weaknesses – Automated fingerprint identification systems Behavioural Biometrics: Leading technologies: Signature-scan – Keystroke scan – components, working principles, strengths and weaknesses.	11	25
III	Introduction to Information hiding – Brief history and applications of information hiding– Principles of Steganography – Frameworks for secret communication – Security of Steganography systems – Information hiding in noisy data – Adaptive versus non adaptive algorithms – Laplace filtering – Using cover models – Active and malicious attackers – Information hiding in written text – Examples of invisible communications. Steganalysis – Detecting hidden information – Extracting hidden information - Disabling hidden information.	11	25
SECOND INTERNAL EXAM			

03 CS 6042 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
IV	Current watermarking techniques: History – Basic Principles – applications – Requirements of algorithmic design issues – Cryptographic and psycho visual aspects – Choice of a workspace – Formatting the watermark bets - Merging the watermark and the cover – Optimization of the watermark receiver – Extension from still images to video – Robustness of copyright making Evaluation and benchmarking of watermarking system.	12	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6132	Artificial Intelligence and Robotics	3-0-0	3	2015

Course Objectives

- This course introduces the computer systems that exhibit intelligent behavior, in particular perceptual and robotics system.
- This course is an introduction to the basic concepts of artificial intelligence, with illustrations of current state of the art research and applications.

Syllabus

Introduction to AI techniques, Problem, Problem space and search, Basics of ANN and synaptic Dynamics Pattern recognition problems. Computational Intelligence for image processing, Introduction to robotics, robot Arm geometry, Robot Kinematics, Fundamentals of Actuating Systems, End Effectors and Robot Controls, Robot Transformation and sensors.

Expected Outcome

- This course gives an in-depth knowledge about artificial intelligence, knowledge representation, expert systems; it's applications in the field of robotics and real time implementations.

References

1. Mittal and Nagarath, "Robotics and Control", McGraw Hill
2. K.S. Gonzalez, "Robotics: Control, Sensing, Vision and Intelligence",McGraw Hill
3. Saeed B Niku, "Introduction to Robotics: Analysis, systems Applications " Prentice Hall
4. Robert J schilling, "Fundamentals of Robotics : Analysis and Control", Prentice Hall
5. Stuart Russell and Peter Norvig ,"Artificial Intelligence : A Modern Approach"
6. Elaine Rich and Kevin Knight ,"Artificial Intelligence " .
7. AmitKonar ,"Computational Intelligence" .
8. Stefano Cagnoni ,"Evolutionary Image analysis and Signal Processing"
9. Kim Hui Yap, Ling Guan, "Adaptive Image Processing: A computational Image processing perspective"
10. Satish Kumar ,"Neural Network : A class room Approach"

03 CS 6132 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction to AI techniques, Knowledge representation and its application, Image Understanding, Signature Analysis, Expert system and its application, Intelligent control and scheduling. Problem, Problem space and search:-Search and control Strategies, Water jug problem, Production system, Problem characteristics, Mean end analysis, Problem reduction, blind search, Informed Search, Hill climbing methods, Best first search, A* algorithm.	10	25
FIRST INTERNAL EXAM			
II	Basics of ANN and synaptic Dynamics:-Activation dynamic models, Synaptic dynamic models. Pattern recognition problems.	7	25
III	Computational Intelligence for image processing, Evolutionary algorithms, Genetic Algorithms, Neural Networks for Image restoration, Image restoration and edge detection using neural networks and fuzzy systems.	8	25
SECOND INTERNAL EXAM			
IV	Introduction to robotics, Robot Arm geometry, Robot Kinematics, Fundamentals of Actuating Systems, End Effectors and Robot Controls, Robot Transformation and sensors, Embedded systems in robotics, Robot Vision, Robot cell design and Applications, Micro/Nano robotic systems.	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6142	Random Processes	3-0-0	3	2015

Course Objectives

- Probability and random processes are central fields of mathematics and are widely applied in many areas including machine learning, information theory etc. This course will provide an introduction to probability theory and random process and its wide application in many domains.
- This course provides an exposition of the basic theories on probability and random processes and help to understand the engineering problems in terms of a probability model.

Syllabus

Probability theory & Random variables-probability axioms, conditional probability, Functions of a random variable-Two dimensional random variables, Random processes-Markov process & Markov chain, Poisson process & Brownian motion, Gaussian process, Mean and correlation of random processes, Power spectral density, Random processes as inputs to linear time invariant systems-Gaussian process as inputs to LTI systems, Series representation of random process-Fourier series, Karhunen-Loeve expansion.

Expected Outcome

- Understand the description and behavior of random processes.
- Model and analyze systems with random signals.

TextBook

1. S. Palaniammal, " Probability and Random Processes", PHI Learning Pvt. Ltd.

References

1. A. Papoulis and S. U. Pillai "Probability, Random Variables and Stochastic Processes", 4th edition, 2002, McGraw Hill.
2. Geoffrey Grimmett ,"Probability and Random Processes", 3rd edition, 2001, Oxford University Press
3. V. Krishnan ,"Probability and Random Processes", 2006, John Wiley & Sons
4. Albert Leon Garcia ,"Probability and Random Processes for Electrical Engineering", 1993, Prentice Hall
5. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing theory and Queueing" , Network, TataMcGraw Hill

03 CS 6142 – COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Probability theory & random variables : Probability axioms, conditional probability, discrete and continuous random variables, cumulative distribution function (CDF), probability mass function (PMF), probability density function (PDF), conditional PMF/PDF, expected value, variance, functions of a random variable, expected value of the derived random variable, multiple random variables, joint CDF/PMF/PDF	10	25
FIRST INTERNAL EXAM			
II	Functions of multiple random variables, multiple functions of multiple random variables, independent/uncorrelated random variables, sums of random variables, moment generating function, random sums of random variables. The sample mean, laws of large numbers, central limit theorem, convergence of sequence of random variables.	10	25
III	Introduction to random processes, specification of random processes, nth order joint PDFs, independent increments, stationary increments, Markov property, Markov process and martingales, Gaussian process, Poisson process and Brownian motion, Mean and correlation of random processes, stationary, wide sense stationary, ergodic processes, Mean-square continuity, mean-square derivatives.	10	25
SECOND INTERNAL EXAM			
IV	Random processes as inputs to linear time invariant systems: power spectral density, Gaussian processes as inputs to LTI systems, white Gaussian noise. Discrete-time Markov chains: state and n-step transition probabilities, Chapman-Kolmogorov equations, classification of states. Series representation of random process: Fourier series, Karhunen-Loeve expansion.	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6152	Fractals and its Applications	3-0-0	3	2015

Course Objectives

- The objective of this course is to provide an elementary introduction to fractal geometry and there by presenting a variety of deterministic model for simulating real world phenomena.
- This course also helps for an exploration of diverse application fractal geometry and to use this knowledge on solving engineering problems.

Syllabus

Basic set theory, Probability theory, Techniques for calculating dimensions, Calculating Fractal Dimension of Images. Projection of Fractals, Local structure of Fractals, Furstenberg homogeneous sets, Random Fractals:-A random cantor sets, Fractal percolation, Brownian Motion, Fractal Brownian Motion, Fractal Brownian Surfaces, Multifractal Measures, Physical Applications

Expected Outcome

- Explain the basic concept of fractal geometry.
- Construct fractal sets by iterated function system and use it in engineering applications.

References

1. Kenneth Falconer, "Fractal Geometry : Mathematical Foundations and Applications", Wiley 2003
2. Nigel Lesmoir – Gordon, Ralph Edney, "Introducing Fractals : A Graphic Guide", Totem Books 2005
3. Benoit B Mandelbrot, "Fractals and Chaos : The Mandelbrot set and beyond ", 1st ed Springer 2004
4. Heinz – Otto Peitgen, HartmutJurgens, DietmarSaupe, "Introduction to fractals and chaos", springer 1991
5. NeigelLesmoir – Gordon, Ralph Edney, "Introducing fractal geometry", Totem Books, 2000
6. Kenneth Falconer, " The geometry of fractal sets", Cambridge 1985
7. Kenneth Falconer, "Techniques in fractal geometry", Wiley 1997
8. PerttiMattila, "Geometry of sets and measures in Euclidean spaces", Cambridge 1995
9. Christopher Bishop and Yuval Peres, "Fractal sets in probability and analysis"

03 CS 6152 - COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Mathematical background:- Basic set theory, functions and limits, Measures and mass distributions, Probability theory. Hausdroff measures and Dimensions, Box Counting Dimensions, Techniques for calculating dimensions, Calculating Fractal Dimension of Images.	9	25
FIRST INTERNAL EXAM			
II	Local structure of Fractals, Projection of Fractals, Products of Fractals, Intersection of Fractals, Application to encoding Images, Fractals Constructed by iteration, Gibbs measures, Regular Cantor sets.	9	25
III	Local Methods:- Furstenberg homogeneous sets and galleries, Intersection of xm-and xn- invariant sets, Tangent measures and densities. Cassels-Schmidt theorem on normal numbers in cantor sets.	10	25
SECOND INTERNAL EXAM			
IV	Random Fractals:-A random cantor sets, Fractal percolation, Brownian Motion, Fractal Brownian Motion, Fractal Brownian Surfaces, Multifractal Measures:- Coarse Multifractal analysis, Fine Multifractal analysis, Self similar multifractal. Physical Applications:- Fractal Growths, Fluid dynamics and turbulence, Fractal antennas, Applications of Fractals in Image Processing.	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6162	Soft Computing Techniques in Image Processing	3-0-0	3	2015

Course Objectives

- Soft computing techniques in image processing gives detailed knowledge about various soft computing techniques in the field of image synthesis and image analysis and many other domains.
- This course exposes the student to different dimensions of soft computing techniques that can be used in many domains.

Syllabus

Fuzzy set theory, Genetic Algorithms, Swarm Intelligence, Aggregation Functions, Dimensionality Reduction, Feature Extraction, Rough set theory, Decision tree, Wavelets, regression.

Expected Outcome

- Understands the fundamental concepts of numerical methods in soft computing
- Discuss derivative based and derivative free optimization
- Introduces various applications of computational intelligence

References

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997
3. Mitchell Melanie, "An Introduction to Genetic Algorithms", MIT Press, 1998
4. David A. Coley, "Introduction to Genetic Algorithms for Scientists and Engineers", world Scientific Publishers, 1999
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.
6. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies", MIT Press, 2008.
7. Janga Reddy Manne; "Swarm Intelligence and Evolutionary Computing"; Lap Lambert Academic Publishing
8. Rafel . c. Gonzalez , "Digital Image Processing".
9. Shawe-Taylor J. and Cristianini N, "An Introduction to Support Vector Machines", Cambridge University Press (2000).
10. Shouxian Cheng ,"Image Segmentation and Pattern Classification Using Support Vector Machines",

03 CS 6162- COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	FUZZY SET THEORY: 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- Applications of Fuzzy Set Theory and Fuzzy Logic in Image Processing	8	25
FIRST INTERNAL EXAM			
II	Genetic Algorithms – Biological Terminology, Elements of GA – GA Operators, A simple Genetic Algorithm, Mathematical Model for GA, Encoding a problem for GA - Adapting the encoding – Selection Methods- Genetic Operators – Image Enhancements and Segmentation using GA - Dense Pixel Matching using GA.	7	25
	Swarm Intelligence – Concept – Algorithms - Particle swarm optimization, Ant colony optimization, Image Processing Operations.	5	
III	Aggregation Functions – Image reduction using Aggregation Function. Cuckoo Search – Image Enhancement using Cuckoo search.	4	25
	Dimensionality Reduction – concept - Clustering- Feature Selection – Filter and Wrapper Approaches – Feature Extraction - Principal Component Analysis, Eigen Vector. Rough set theory – Image Segmentation using Rough set theory.	6	
SECOND INTERNAL EXAM			
IV	Decision tree – Image classification using decision tree.	3	25
	Wavelets – Fast Wavelet Transform – Wavelet Decomposition Structure – Inverse wavelet Transform – Wavelet in Image Processing.	5	
	Support vector machine – concept – classification – regression – Support vector machine based image classification. Applications of Computational Intelligence – Printed Character Recognition – Soft Computing for colour Recipe Prediction.	6	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6902	Mini Project	0-0-4	2	2015

Course Objectives

The student is expected to do implementation of a sufficiently complex tool or application that demonstrates the significance of any theoretical concept or concepts (or problem or problems) he/she learned in the first or second semester. The work will be supervised and evaluated by a faculty member.

Syllabus

.

- The topic of mini project should be related to the area of specialization.

Expected Outcome

The student gains in-depth knowledge in the concept/problem he/she has undertaken and allied topics. It is essential to submit a clear and concise report that reflects the literature survey, problem identification, project aims and objectives, the engineering design work carried out, tests performed, analysis and discussion of results.

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 6812	Image Analysis and Computer Vision Laboratory	0-0-2	1	2015

Syllabus

Experiments are based on but not limited to topics covered in 03 CS 6092 : Image Analysis and its Applications and 03 CS 6102 : Computer Vision in Image Processing

Experiments

Experiment No	Description	Hours Allotted
I	1. Feature Extraction from Image	3
II	1. Image Fusion 2. Image Registration	5
III	1. Character Recognition	3
IV	1. Run Length Coding 2. Huffman Coding **3.** Dictionary Method Compression Techniques	6
V	1. Segmentation by Fitting 2. Filtering by Templates	5
VI	1. Texture Representation 2. Outlier Detection	4
VII	3. Range Data Segmentation	3

Semester III

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7063	Computer Modeling and Visualization	3-0-0	3	2015

Course Objectives

- The main objective of this course is to give the student a comprehensive understanding of computer modelling and visualization and their applications.
- It also provides understanding about the basic concept of solid modelling, shape construction and setting of its parameters.
- This course also introduces the fundamentals of virtual reality.

Syllabus

Basic Concept, Creating Primitive objects and Patches, Visualization, Solid modelling and material editor, Creating object using nurbs, Surface modelling, Boundary modelling Voxels, Lighting, 3d rendering, Particle systems, virtual reality .

Expected Outcome

- Provides the basic understanding of solid geometry, its construction, key characteristics and virtual reality

References

1. Jayaram k Udupa, "Hand Book of Medical Imaging, Volume 3", SPIE Press, 2000
2. William Shroeder, Ken Martin and Bill Lorensen " The Visualization tool kit : an object oriented approach to 3D graphics", 4th ed. Kitware 2006
3. William Shroeder, Ken Martin and Lisa S Aliva, " The Visualization toolkit Users Guide", 11thed, khware 2010
4. Robert Spence, " Information Visualization: Design for Interaction", 2nd edition, Prentise hall, 2007
5. Charlse D Hansen and Chris R Jhonson "Visualization Handbook", Academic Press 2004
6. Duff, J. M., "Mastering 3D Studio: Modeling, Rendering and Animation", New York: PWS Publishing Company, 1995.
7. "Basics of 3D Modeling", NIIT, Prentice Hall of India, 2004.
8. "3D Animations: An Overview", NIIT, Prentice Hall of India, 2004.
9. Grigore C Burdae and PhilipeCoiffet, "Virtual Reality Technology", 2nded, wiley press 2003
10. Mario A Gutierrrez, Frederic Vexo, Daniel Thalaman, "Stepping into Virtual Reality", Springer 2008
11. William R Sherman and Alan B Craig "Understanding Virtual Reality Interface Application and design", Kaufman Series
12. Rolf R Hainich, "The end of hardware Augmented Reality and beyond", Booksurge Publications 2009

03 CS 7063– COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Basic Concepts:-Vertexes, Faces, Objects, Wireframes, Solid Modelling, Creating Primitive objects and Patches, Time Dependent Transforms, Visualization:-Concepts, Purpose and goals, Applications.	9	25
FIRST INTERNAL EXAM			
II	Solid modelling and material editor, Polygon modelling, Creating shapes by lofting Integrating shape and path to create complex objects, Solid modelling using boolean operations. Creating object using nurbs, Surface modelling, Boundary modelling voxels, Volume rendering and iso surface construction, Basic materials colour and shading, Kinematics, Active dynamics, Passive dynamics.	10	25
III	Lighting:- Properties, Natural and artificial lights ,Creating light object, Omni lights, Target spotlights and free spotlights, Setting light color ,Setting the shadow properties of an object. 3D rendering: Render options and file output, Artificial fog simulation and fog types, Volume light effects, Shear warp factorization.	9	25
SECOND INTERNAL EXAM			
IV	Particle systems:- Uses of particle systems for realistic photo-rendering, Creating simple particle systems, Space Warp:- Concept and application, Space warp that affects particles or geometry.	6	25
	Introduction to Virtual reality:- Virtual reality, Key elements, Components of virtual reality system, Interface to virtual world, Input and output, Rendering in Virtual world, Interacting with virtual world, Applications of Virtual Reality	6	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7073	GIS and Remote Sensing	3-0-0	3	2015

Course Objectives

- Introduces the principles, applications, trends, and pertinent issues of geographical information systems and remote sensing.
- Provides basic knowledge about data and information acquisition, extraction, management and analysis; spatial and statistical modeling; mapping and visualization.
- To describe how geographical information is analyzed and synthesized.

Syllabus

Basic concepts of GIS, Global Positioning system, Surveying, Moving Object representations Geographic data analysis, Remote sensing system classification, Digital Terrain Modelling- surface Analysis, Network Analysis Data Fusion related to GIS and remote sensing, Image rectification, Hyper Spectral Image Analysis.

Expected Outcome

- Understand the principles of remote sensing and digital image processing in remote sensing.
- Understand the principles of geographic information systems (GIS).
- Gain experience in the applications of remote sensing and GIS to solving problems in the environmental and life sciences.
- Gain introduction to the various GIS software and its applications.

References

1. Chor Pang Lo, Albert K. W. Yeung," Concepts and techniques of geographic information systems" Prentice Hall, 2002
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", 3 rd Edition, Pearson Education India, 2010.
6. Paul A Longaly, Michael F Goodchild, David J Maquire and David W Rhind "Geographic Information System and Science", 2nded, Wiley 2005
7. ShashiShekhar and HuiXiong "Encyclopedia of GIS", Springer 2008
8. Matt Duckham, Micheal F Goodchild, Michel Worboys, "Foundations of geographic information

Science", CRC Press, 2003
9. John E Harmon and Steven J Anderson , "The design and Implementation of geographic Information System", Jhonwiley and sons 200

03 CS 7073- COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction and Basic concepts of GIS.GIS Data models, Maps and its Classifications, Mapping process, Geographic Coordinate system of earth, GIS data processing. Global Positioning system, Digital Photogrammetry, Topology of spaces, Network Spaces.	10	25
FIRST INTERNAL EXAM			
II	Surveying, Moving Object representations, Geographic data analysis:- Fuzzy analysis, Geovisualization and its tools, Principles of Remote sensing, Electromagnetic remote sensing, Remote sensing system classification, Image characteristics of Remote sensing systems, Extraction of information from remote sensing images, Integration of GIS and remote sensing	10	25
III	Digital Terrain Modeling, Acquisition of digital Terrain Data, Data analysis, processing and visualization of Digital terrain data, Application of digital terrain models, Trend surface Analysis, Network Analysis.	10	25
SECOND INTERNAL EXAM			
IV	Data Fusion related to GIS and remote sensing, Problems in GIS-remote sensing Fusion, Image registration and Multi image fusion, Image rectification, Thematic Classification, Hyper Spectral Image Analysis	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7083	Video Surveillance	3-0-0	3	2015

Course Objectives

- This course presents the fundamentals of automatic video-surveillance systems, describes its practical application of generic video analysis techniques in this domain, and presents various video-surveillance applications.
- Introduces the concepts for the extraction of useful semantic information for the detection of people presence and trajectory, detection of irregular events etc.

Syllabus

Fundamentals, Image Feature Extraction, Pattern Recognition and Machine Learning, Distributed surveillance Systems, Scene Modelling, Pseudo-Synthetic Video, Pedestrian Detection and Tracking, Vehicle Tracking and Recognition, Human Motion Tracking, Action Recognition, Meta-data information, Intrusion into forbidden or dangerous areas, Hierarchical multi sensor framework for event detection in wide , environments

Expected Outcome

- It covers the area of video surveillance system, acquisition, storage of data in system and it's implementation in distributed and network environment.
- Discusses how objects and shapes are detected and recognized in video surveillance system

References

1. Yunqian Ma, Gang Qian, " Intelligent Video Surveillance: Systems and Technology", CRC Press (Taylor & Francis Group), 2010
2. Fredrik Nilsson, Communications Axis, "Intelligent Network Video: Understanding Modern Video Surveillance Systems", CRC Press (Taylor & Francis Group), 2008
3. Anthony C. Caputo, "Digital Video Surveillance and Security", Butterworth-Heinemann, 1st Ed., 2010
4. Herman Kruegle, "CCTV Surveillance, Second Edition: Video Practices and Technology", Butterworth-Heinemann, 2nd Ed., 2006.
5. Aghajan H, Cavallaro, "Multicamera Network: Principles and Applications", Elsevier, 2009
6. Senior A, "Privacy Detection in Video Surveillance", Elsevier 2009.

03 CS 7083– COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Fundamentals, Image Feature Extraction:-Point detection, Scale invariant Feature Transform, Edge Detection, Colour Feature Extraction. Multi view Geometry:-Perspective Projection Camera Model, Epipolar Geometry. Pattern Recognition and Machine Learning:-SVM and AdaBoost. Background Modelling and Subtraction:-Kernel Density Approximation.	10	25
FIRST INTERNAL EXAM			
II	Distributed Surveillance Systems:-Components, Acquisition, Network, Storage. Distributed communication and system design, Distributed Database for effective management and evaluation of CCTV systems, Multiview tracking systems, Video Annotations, Scene Modeling, Offline learning, Database design, Pseudo-Synthetic Video.	10	25
III	Pedestrian Detection and Tracking:-Pedestrian Detection by boosting local shape feature, Tree learning algorithms, Edgelet Features, Occluded Pedestrian Detection by part combination, Pedestrian Tracking by associating detection responses. Vehicle Tracking and Recognition:-Joint Tracking and recognition framework, Joint appearance-motion generative model, Inference algorithm for joint tracking and recognition, Human Motion Tracking:- Image Feature Representation, Dimension Reduction and Movement Dynamics learning. Human Action Recognition:-Discriminative Gaussian Process Dynamic Model.	11	25
SECOND INTERNAL EXAM			
IV	Meta-data information, Arbitrary Topology Networks, Distributed Multisensor surveillance system for public transport system- Incident Detection functions, Passenger Flow Measurement functions. Intrusion into forbidden or dangerous areas - Camera set-up, Defining camera area, Extracting moving objects, Defining size of the object, Forbidden area, Usage of the Network. Hierarchical multi sensor framework for event detection in wide environments- Static camera networks, Target tracking, Position fusion, Trajectory fusion, Event recognition-a case study.	10	25
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7093	Wavelet Analysis and Applications	3-0-0	3	2015

Course Objectives

- The main objective is to introduce the theory and fundamental concepts necessary to understand and use wavelets and related constructions.
- It discusses the concept of wavelet based transformations and key characteristics of wavelet family from a multi resolution point of view.
- Introduces various imaging techniques that influenced the formation of multi resolution theory

Syllabus

Introduction:-Wavelet, Fourier and Sampling Theory:- Fourier transform. Continuous wavelet transform (CWT), Discrete wavelet transform (DWT), multi resolution analysis. Biorthogonal wavelet bases, Gabour Transforms, Wavelet families, Splines, wavelet transform algorithms: - Mallat Algorithm. Image Processing with Wavelets, Wavelets for the image, Image Compression

Expected Outcome

- The subject gives basic mathematical understanding of fundamentals of wavelets which has applications in the development of tools and techniques which may be used in wide domain.

References

1. Michel Misiti, Yves Misiti, Georges Oppenheim, Jean-Michel Poggi, "Wavelets and their Applications", Wiley-ISTE, 1st Ed., 2007
2. David F. Walnut, "An Introduction to Wavelet Analysis", Birkhäuser, 1st Ed., 2001
3. C. Sidney Burrus, Ramesh A. Gopinath, HaitaoGuo, "Introduction to Wavelets and Wavelet Transforms: A Primer", Prentice Hall, 1st Ed., 1997
4. Lakshman Prasad, S. SitharamaIyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 1st Ed., 1997
5. Michael W. Frazier, "An Introduction to Wavelets Through Linear Algebra", Springer, 1st Ed., 1999
6. Gerald Kaiser, "A Friendly Guide to Wavelets", Birkhäuser, 1st Ed., 2010. 7. P. Wojtaszczyk, "A Mathematical Introduction to Wavelets", Cambridge University Press, 1st Ed., 1997.
7. E.Hernandez&G.Weiss, "A First Course on Wavelets", CRC Press, 1996.
8. L.Prasad&S.S.Iyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 1997.
9. Stephen G. Mallat, "A wavelet tour of signal processing" 2nd Edition Academic Press.
10. Gilbert Strang and Truong Q. Nguyen, "Wavelets and filter banks" 2nd Edition Wellesley-Cambridge Press.

03 CS 7093– COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction:-Wavelet, organization of wavelets, Wavelet tree for a signal. Fourier and Sampling Theory:-Generalized Fourier theory, Fourier transform, Time-frequency analysis. Theory of Frames: Bases, Resolution of unity, Geometrical considerations and the general notion of a frame, Frame projector.	7	25
FIRST INTERNAL EXAM			
II	Continuous wavelet transform (CWT), Discrete wavelet transform (DWT), multi resolution analysis, MRA axioms, Construction of an MRA from scaling functions, The dilation equation and the wavelet equation. Compactly supported orthonormal wavelet bases, Necessary and sufficient conditions for orthonormality. Wavelet Packets, Biorthogonal wavelet bases, Gabor Transforms.	10	25
III	Wavelet families, Orthogonal wavelets with compact support:- Daubechies wavelets, Symlets, Coiflets. Biorthogonal wavelet with compact support. Orthogonal wavelets with non compact support. Real wavelet without filters, Complex wavelet without filters, Finding and designing a wavelet, Construction of wavelet, Continuous analysis, Discrete analysis.	8	25
	Splines:-Cardinal B-spline MRA, Sub band filtering schemes, Wavelet decomposition and reconstruction of functions in $L2$, Fast wavelet transform algorithms: - Mallat Algorithm.	5	
SECOND INTERNAL EXAM			
IV	Image Processing with Wavelets, Wavelets for the image:- 2D wavelet decomposition, Approximation and Detail Coefficients.	4	25
	Edge Detection and Textures, Fusion of images, Denoising of Images.	4	
	Image Compression:-Compression and Wavelets, Principle of Compression by Wavelets, Compression Methods	**4**	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7043	Intellectual Property Rights	3-0-0	3	2015

Course Objectives

- Get a holistic understanding of the complexities involved in the process of attributing intellectual property rights to people.
- This course introduces Intellectual Property (IP) Law in general and its two common categories: Industrial Property (mostly patents) and Copyright

Syllabus

Introduction to Intellectual Property Law, Introduction to Cyber Law, Introduction to Trade mark and Trade mark Registration Process, Introduction to Copyrights and Principles of Copyrights, Semiconductor Chip Protection Act, The law of Patents and International Patent Law, Introduction to Trade Secrets. TRIPS Agreement, Geographical Indication (GI), IPRs in Information and communication technologies (ICT), Intellectual Property Rights in Software-Copyright and Licensing, Software Patents, Free/Open Source Software Licensing. Copyright and neighbouring rights in Internet.

Expected Outcome

- Understand the principles, functions and basic legal rules of IP law
- Recognize the relevant criteria for generating and protecting intellectual works.
- Understand the relevance and impact of IP Law on academic/scientific works/studies.
- Recognize the intellectual property likely to be produced in the academic and professional environment.
- Understand the different forms of infringement of intellectual property rights.

References

1. Debirag E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2. M.Ashok Kumar and Mohd.Iqbal Ali: "Intellectual Property Right" Serials Pub.
3. "Cyber Law. Texts & Cases, South-Western's Special Topics Collections"
4. Prabhuddha Ganguli, " Intellectual Property Rights" Tata Mc-Graw –Hill, New Delhi
5. J Martin and C Turner, "Intellectual Property", CRC Press
6. Richard Stimm, " Intellectual Property", Cengage Learning
7. http://wtocentre.iift.ac.in/FAQ/english/TRIPS.pdf
8. https://en.wikipedia.org/wiki/Geographical_indication
9. http://www.eaber.org/sites/default/files/documents/CESS_Rao_2004_.pdf
10.http://www.tilj.org/content/journal/45/num1/Baisheng175.pdf
11. http://www.freibrun.com/articles/articl2.htm
12. http://www.softwarecontracts.net/p05_copyright_patent_software.htm
13. http://www.oreilly.com/openbook/osfreesoft/book/

03 CS 7043/6312– COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right	9	25
FIRST INTERNAL EXAM			
II	Introduction to Trade mark – Trade mark Registration Process – Post registration Procedures – Trade mark maintenance - Transfer of Rights - Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trade mark Law	9	25
III	Introduction to Copyrights – – Principles of Copyrights -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copyrights Ownership- Transfer of ownership and duration of copyright – Right to Prepare Derivative Works – Rights of Distribution – Rights of Publicity - Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act	9	25
SECOND INTERNAL EXAM			
IV	The law of patents-patent searches –Patent owner ship and transfer-Patent infringement-Patent Litigation- International Patent Law Introduction to Trade Secret – Maintaining Trade Secret – Physical Security – Employee Limitations - Employee confidentiality agreements - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.	6	25
	TRIPS Agreement, Geographical Indication (GI), IPRs in Information and communication technologies (ICT), Intellectual Property Rights in Software-Copyright and Licensing, Software Patents, Free/Open Source Software Licensing. Copyright and neighbouring rights in Internet.	6	
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7103	Parallel Computing	3-0-0	3	2015

Course Objectives

- The main objective of this course is to provide the students with all the required dexterities for a rigorous and complete theoretical study of parallel architectures, including multi core and massively core structures
- To introduce the concept of parallel languages and parallel algorithms
- To familiarize with parallel computing paradigms and programming models

Syllabus

Introduction to Parallel Computing. Programming Parallel Computers, Parallel Architectures, Interconnection networks, Processor Arrays, Multi Processors, Multi Computers. FLYNN's Taxonomy. Programming Parallel Processes, Parallel languages, Notation for expressing parallel algorithms. Parallel Algorithm Design. Mapping and Scheduling, Dynamic load balancing on multi computers. Elementary Parallel Algorithms. Parallel Computing with MPI and OpenMP, Introduction to GPUs, GPU Computing. GPU visual computing applications: OpenGL and DirectX. Introduction to CUDA Programming Model, Programming GPUs using CUDA. Image Processing Applications with CUDA.

Expected Outcome

- Helps to identify the core concept of parallel computing systems.
- Make the students capable to develop parallel algorithms.
- Gets in depth knowledge in Message passing paradigm and GPU computing

References

1. Michael J Quinn," Parallel Programming in C with MPI and OpenMP "
2. Michael J Quinn , " Parallel Computing –Theory and Practice ", Tata Mc Graw-Hill
3. Ananth Grama, George Karypis, Vipin Kumar, and Anshul Gupta, " Introduction to Parallel Computing", 2nd ed, Addison Wesley, 2003 .
4. David B Kirk, Wen- Mei W Hwu, "Programming Massively Parallel Processes – A hands on approach"
5. Gropp W, E Lusk and A Skjellum, "Using MPI: Portable Parallel Programming with the Message Passing Interface", MIT Press, 1999
6. http://www.mpi-forum.org/ is the MPI Forum
7. www.openmp.org
8. http://www.openmp.org/blog/resources/#Shareware/Freeware
9. https://computing.llnl.gov/tutorials/mpi/
10. http://developer.nvidia.com/cuda-toolkit-sdk (Information on CUDA Toolkit and Guides can be downloaded)

03 CS 7103/6231– COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction to Parallel Computing, A model of serial computation, The PRAM model of parallel computation, PRAM Algorithms: Parallel Reduction, Prefix Sums, Merging two sorted lists, Cost optimal parallel algorithms. Programming Parallel Computers: Extend a Compiler, Extend a sequential programming language, Add a parallel programming layer, and create a parallel language.	4	25
	Parallel architectures: Interconnection networks, Processor Arrays, Multi Processors- Centralized multi processors-UMA, SMP, Distributed Multi Processors-NUMA, Multi Computers- Asymmetrical multi computers, Symmetrical multi computers. FLYNN's Taxonomy. Speedup, Scaled speedup and Parallelizability.	4	
FIRST INTERNAL EXAM			
II	Programming parallel processes, Parallel languages- C*, nCUBE C. A notation for expressing parallel algorithms. Parallel Algorithm Design: The task/channel model, Foster's design methodology. Mapping and Scheduling: Mapping data to processors on processor arrays and multi computers.	5	25
	Dynamic load balancing on multicomputers. Static scheduling on UMA multiprocessors. Elementary Parallel Algorithms: Classifying MIMD Algorithms, Reduction, Broadcast, Prefix Sums. Matrix Multiplication: Sequential, Algorithms for processor arrays, Algorithms for multi processors, Algorithms for multicomputers.	5	
III	Parallel Computing with MPI and OpenMP: Overview of message passing paradigm (MPI) : point-to-point and collective communications, non-blocking communications, communicators and virtual topologies. Shared Memory parallel programming.	5	25
	OpenMP: Thread Creation-Fork & Join model, Compiler directives, Parallel regions, Data scope, Worksharing, Master and synchronization constructs, Environment variables and Runtime library routines. Combining MPI and OpenMP.	6	
SECOND INTERNAL EXAM			
IV	Introduction to GPUs. Architecture of a modern GPU, Evolution of Graphics pipeline, GPU Computing. GPU visual computing applications: OpenGl and DirectX. Introduction to CUDA Programming Model, CUDA Threads, CUDA Memories, Performance Considerations, Floating Point Considerations. Programming GPUs using CUDA-Matrix Multiplication, Merging and Sorting. Image Processing with CUDA-Implementation of Filters-Simple filter, Sobel edge detect filter, Fast box	11	25

03 CS 7103/6231– COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
	filter.		
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7903	Seminar II	0-0-2	2	2015

Course Objectives

To make students,

- Identify a domain of interest
- Identify sufficient number of latest good quality research papers on a particular problem or allied problems
- Do extensive study and analysis of the problem and solution(s)
- Prepare a comprehensive report
- Make a presentation of 30 minutes based on the problem

Seminar Guidelines

- Topic should be relevant to the stream of study with content suitable for M.Tech level Presentation.
- For selection of topics refer internationally reputed transactions/journals. The primary reference should be published during the last two or three years.
- A detailed write-up /synopsis should be prepared in the prescribed format given by the Department and get the topic approved by the PG Coordinator well in advance.
- The seminar shall be of 30 minutes duration and a committee, with the PG Co-ordinator as the chairman and two faculty members from the department as members shall evaluate the seminar based on the technical content, presentation, depth of knowledge and ability to answer the questions put forward by the committee.
- After the completion of the Seminar work the students would be required to submit two copies of the seminar reports prepared by them in the prescribed format.

Expected Outcome

To student

- Gets good exposure to a domain of interest and the research problems in the domain

- Improves his/her writing and presentation skills
- Gets practice in the art of doing literature survey

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7913	Project (Phase I)	0-0-8	6	2015

Course Objectives

Provides each student the opportunity to conduct an extensive literature survey in the area of specialization to identify a specific domain and a problem in that domain for the project work under the guidance of a faculty advisor. The student is expected to analyze the problem in depth, study the feasibility of the problem, prepare detailed design documentation and identify the methodology for implementation. On completion of this, student is expected to continue with the implementation of the project.

Syllabus

Each student shall identify a project related to the curriculum of study.

Expected Outcome

The student is expected to identify a domain in the area of specialization, do enough exploration by reviewing the literature. The student should also identify his problem and objectives. The progress will be assessed by two reviews. First review would highlight the topic, objectives, methodology and expected results and shall be conducted in first half of the semester. Second review comprises of the presentation of the work completed and scope of the work which is to be completed in the forthcoming semester. Progress of the project work is to be evaluated at the end of the semester. The student is also expected to submit a preliminary report at the end of the semester.

Guidelines for Project Progress Evaluation

- **Total Marks : 50**
- Progress evaluation by the Project Supervisor : 20 Marks
- Presentation and evaluation by the committee : 30 Marks

Semester IV

Course No.	Course Name	L-T-P	Credits	Year of Introduction
03 CS 7914	Project (Phase II)	0-0-21	12	2015

Course Objectives

By the first quarter of the semester, the student should compile his/her work by doing the final experimentation and result analysis. Towards the middle of the semester there would be a pre-submission evaluation to assess the quality and quantum of work by the department evaluation committee. The committee can make suggestions/modifications to improve the quality or quantity of the work done. The student has to submit the completed thesis report incorporating all such suggestions/modifications and get approval from the department evaluation committee before final submission. The final evaluation of the thesis would be done by an external examiner.

Syllabus

Each student shall identify a project related to the curriculum of study.

Expected Outcome

The student is expected to publish technical papers related to his/her research in peer reviewed journals/conferences.

Guidelines for Project Progress evaluation

- **Total Marks: 100**
- Project evaluation by the supervisor: 30 Marks
- Evaluation by the External Expert: 30 Marks
- Presentation & Evaluation by the Committee: 40 Marks