

**DEPARTMENT OF COMPUTER SCIENCE**  
**Master of Technology (M.Tech) in Computer Science with**  
**specialization in Digital Image Computing**

**COURSE STRUCTURE**

**CORE COURSES**

<b>SEM</b>	<b>SUB</b>	<b>Title</b>	<b>HliWeek</b> L-T-LR-P	<b>CRD</b>
I	COS611	Mathematical Foundations of Image Processing	4-1-1-0	4
	COS 612	Neural Networks and Fuzzy Systems	4-1-1-0	4
	<i>COS 613</i>	Advanced Computer Graphics	4-1-1-0	4
	COS 614	Engineering Approach to Computer Networking	4-1-1-0	4
	<i>COS 6**</i>	Elective - I	3-0-0-0	3
	<i>COS 615</i>	Laboratory - I	0-0-0-12	2
	<i>COS 616</i>	Seminar	1-0-0-0	1
		<b>TOTAL</b>	<b>40 hrs</b>	<b>22</b>
II	<i>COS 621</i>	Applications of Image Processing	4-1-1-0	4
	COS 622	Software Engineering	4-1-1-0	4
	<i>COS 623</i>	Data Compression	4-1-1-0	4
	COS 624	Knowledge based systems	4-1-1-0	4
	<i>COS 6**</i>	Elective - II	3-0-0-0	3
	COS 625	Laboratory - II	0-0-0-12	2
	COS 626	Seminar	1-0-0-0	1
		<b>TOTAL</b>	<b>40 hrs</b>	<b>22</b>
III	<i>COS 631</i>	Negotiated Studies		3
	COS 632	Industrial Training		1
	<i>COS 633</i>	Dissertation (Part I)		4
		<b>TOTAL</b>		<b>8</b>
IV	COS 641	Dissertation		20
		<b>TOTAL CREDITS</b>		<b>72</b>

**ELECTIVES**

COS 601	Distributed Processing	3-0-0-0	3
COS 602	Internet Technologies	3-0-0-0	3
COS 603	Image Processing Applications in Geographic Information Systems	3-0-0-0	3
COS 604	Medical Image Processing	3-0-0-0	3
COS 605	Advances in Compiler Design	3-0-0-0	3
COS 606	Pattern Recognition	3-0-0-0	3
COS 607	Theory of Fractals and Image Processing	3-0-0-0	3
COS 608	Wavelet Theory	3-0-0-0	3
COS 609	Negotiated Studies	3-0-0-0	3
COS 6010	Modern Programming Paradigms	3-0-0-0	3
COS 6011	Embedded Systems	3-0-0-0	3
COS 6012	Adaptive Processing	3-0-0-0	3
COS 6013	Advances in Computer Architecture	3-0-0-0	3
COS 6014	Relational Database Management Systems	3-0-0-0	3
COS 6015	VHDL and VLSI Design using FPGAs	3-0-0-0	3

## Remarks

### **COS 617 & COS 627: Seminars**

Seminar papers are intended as revision papers on the fundamentals of Computer Science including OS, System Programming, OOD, Theory of Automata, Analysis of Algorithms, Communication etc. and topics of contemporary relevance. Each student will have to offer a few lectures on a topic assigned to him / her by the Faculty. Evaluation shall be based on lecture presentations, lecture notes submitted by the student and components specified below.

### **COS 631 Negotiated Studies:**

In consultation with the M.Tech committee the student shall take a subject of study. The subject should be a good published paper from a leading journal in this discipline. Prepare a review article in the topic and present it. The topic shall be different from the one intended for the dissertation work.

### **COS 632 Industrial Training:**

The student has to undertake training programme in an industry/R&D institution for a period of one month.

#### **Objectives:**

It provides an orientation towards taking up a fruitful work for the dissertation by enhancing the understanding of the student of the nature and quality of work involved in the organization they visit.

#### **Report:**

The student has to submit a report on the training they have undergone and make a presentation of the same.

### **COS 633 Dissertation (Part-I)**

The dissertation work shall be carried out in the department under the guidance of an internal guide. However" any specific request from the student to work in a National Level Institute/High Level Industry can also be considered by the M.Tech Committee and HOD. In such cases, when a student is permitted to work outside the Department, the Department should carry it out under the co-guidance of an approved guide.

The objective of part-I of the dissertation is to help the student to identify a specific topic for dissertation work.

This consists of at least two seminar presentations, and a first level thesis draft. The first level thesis draft shall be submitted towards the end of the 3rd semester and shall contain problem definition, a review of literature, preliminary algorithms and their implementations, elementary results on the investigations.

Evaluation: The part I of the thesis carries 4 credits and the mark allotted is 100 and it is distributed as follows:

- a) Evaluation by the internal guide: 40%
- b) Evaluation by the M.Tech Committee: 60%

### **COS 641 Dissertation (Part -II)**

This is a continuation of dissertation part-I (COS633)

Evaluation:

This is done in two parts.

Part-I carries 80 marks and it is distributed as follows

- (i) 20% (16 marks) will be awarded by the Internal guide.
- (i) 30% (24 marks) will be awarded by the M.Tech Committee based on the

Presentation of the work before submission of the final report

Note: A minimum" of 20 marks required for forwarding the thesis report to external evaluation

- (ii) 60 marks will be awarded by the internal guide, external guide (if any) and the external examiner together.

## **CORE SUBJECTS**

### **COS 611 Mathematical Foundations of Image Computing**

Digital Image Processing: Problems and Applications, Image representation and modeling, Two dimensional systems and mathematical preliminaries, Image perception, Image Sampling and Quantization, Image Transforms, Image representation by stochastic models, Image Enhancement, Image filtering and restoration, Image Analysis and computer vision, Image reconstruction from projections.

References:

A.K. Jain, "Fundamentals of Digital Image Processing", PHI

### **COS 612 Neural Networks and Fuzzy Systems**

Neural modeling - Network paradigms, Hopfield, Boltzmann, BP, Kohonen, ART etc., architectural issues, learning and generalization, applications, fuzziness certainly, fuzzy sets, fuzzy set operators, fuzzy set hedges,

fuzzy reasoning, fuzzy models, fusion of neural & fuzzy systems.

Reference:

Yegnanarayana, "Artificial Neural Networks", PHI.

### **COS 613 Advanced Computer Graphics**

Review of fundamentals of Computer Graphics, 2D & 3D Transformations, wire-frame models for 3D Graphics, advanced algorithms, for hidden line & surface removal, shading, texturing, animation, morphing, warping, hardware for fast graphics, VRAM & controller handling

Reference:

Hearn and Baker, "Computer Graphics", 2<sup>nd</sup> ed., PHI.

### **COS 614 Engineering Approach to Computer Networking**

Use of Computer Networks, Network Hardware, Network Software, Reference models, Data Communication Services, Physical layer, Data link layer, Medium access sub layer, high speed LANs, Network layer, Routing algorithms, Congestion control algorithms, Transport layer, Application layer, Internet facilities.

Reference:

Andrew S. Tanenbaum, "Computer Networks", PHI

### **COS 621 Applications of Image Processing**

Applications in the areas of: Remote Sensed Images, Defense, Synthetic Aperture Radar Images, Computed Tomography, Cardiac Image Processing, Computer Aided detection in Medical Imaging, Finger print classification and Matching Human Face recognition, Pattern Recognition, and classification, Character Recognition.

Reference:

AI Bovik, "Image and Video Processing", Academic Press, 2000.

### **COS 622 Software Engineering**

Software life-cycle, engineering methods, project planning, software structure, software design and implementation, quality & testing, maintenance, specification and verification, delivery and release, CASE tools.

Reference:

R.S. Pressman, "Software Engineering - A Practitioner's Approach", 4th ed., MGH.

### **COS 623 Data Compression**

Information sources and Communication channels, Pixel coding, Predicate Techniques, Transform coding, Hybrid coding Vector DPCM, Interframe coding, Image coding in the presence of channel errors, coding of two tone images, colour and multispectral image coding, fractal and wavelet coding, Hardware implementation of data compression and error control techniques.

Reference:

David Solomon, Data compression, The complete reference.

### **COS 624 Knowledge based Systems**

Reactive machines, stimulus, response agents, neural networks, machine evolution, state machines, Robot Vision, Search in State Spaces, Agents that plan, Uniformed Search, Heuristic search, Planning, Acting and learning, Alternative Search formulations and applications, Adversarial Search, Knowledge Representation and Reasoning, Propositional Calculus, Predicate Calculus, Knowledge based systems, Representing common sense knowledge, reasoning with uncertain information, learning and acting with Bayes Nets, Situation Calculus, Agents Technology.

Reference:

Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 2000.

## **ELECTIVES**

### **COS 601 Distributed Processing**

Centralized Vs Distributed processing, Distributed applications, Distribution of data, Distribution of control, network operating systems, Migrations, Distributed file management, Cache management in distributed.

processing, Client Server Computing.

### **COS 602 Internet Technologies**

Functional introduction to the Internet, modes of connection to the net, Services on the net: Email, WWW, FTP, Telnet, BBS, News groups, etc., useful information sites, business & commerce on the net, emerging technologies

Reference:

Comer, "The Internet Book", 2nd Ed., PHI.

### **COS 603 Image Processing Applications in Geographical Information Systems**

Introduction, Typographical conventions, Grayscale and Color, Surfaces, Scanning, Remote Sensing, Map Projection and Coordinate Systems, Image Rectification, Unsupervised Classification, Supervised Classification, Accuracy Assessment, Grid Management, Clipping and Resampling, Noise Removal with ARCSAN Tools, Filtering and Eliminating Groups of Pixes, System Integration.

Reference:

David Verbyla, Kang- Tsung Chang, Karl Chang, "Processing Digital Images in GIS - A Tutorial Featuring Arc View and ARC / INFO".

### **COS 604 Medical Image Processing**

Introduction to Imaging Science, Image Acquisition Systems, Image representation, Display, Communications and Database, Image Visualization, Image Processing and Analysis, Image modeling, Biomedical Applications, The future.

Reference:

Richard A. Robb, "Biomedical Imaging Visualizations and Analysis" John Wiley & Sons, Nov. 1999.

### **COS 605 Advances in Compiler Design**

Introduction to compiling, Lexical analysis, Syntax analysis, Syntax directed translation, Type checking, Runtime environments, Intermediate code generation, Code generation, Code optimization.

Reference:

Aho, Sethi and Ullman, "Compiler-Principles, Techniques and Tools", Addison Wesley.

### **COS 606 Pattern Recognition**

Patterns and pattern recognition, Non-parametric decision theoretic classification, Non-parametric training of discriminant functions, Statistical discriminant functions, Clustering Analysis, Dimensionality reduction and feature selection.

Reference:

Sing- Tze Bow, "Pattern Recognition and Image Pre-processing", Marcel Dekker Inc., 1992.

### **COS 607 Theory of fractals and Image Processing**

Introduction, Fractal and Texture Analysis, Description of Fractal Geometry, Object Segmentation, Fractal Segmentation, Machine vision, Random Noise Image Creation, Lindermayer Systems, Image Representation.

Reference:

Martin J. Turner, Jonathan M. Blackledge, "Fractal Geometry in Digital Imaging".

### **COS 608 Wavelet Theory**

Introduction, Principle of the Wavelet Transform, Multi resolution Analysis, Wavelets and Digital Filters, Current Topics.

Reference:

Y.T. Chan, "Wavelet Basics", Kluwer Academic Publishers, 1996.

### **COS 6010 Modern Programming Paradigms**

Evolution of Structured programming approach, Object oriented programming, Visual computing, Client/Server computing etc., Basic concepts of object oriented programming methodology, objects and classes, dynamic memory, class inheritance, elements of C++ programming, Case studies.

### **COS 6011 Embedded Systems**

Examples of Embedded Systems, Hardware Fundamentals for the Software Engineer, Advanced

hardware details, Interrupts, Survey of software architectures, Introduction to Real Time Operating Systems, Operating System services, Basic Design using a Real Time Operating System, Embedded Software Development Tools, Debugging Techniques.

Reference:

David E. Simon, "An Embedded Software Primer", Addison Wesley, 2001.

#### **COS 6012 Adaptive Processing**

The LMS theory of adaptive traversal filters, optimal filter, adaptively and recursively implementation, adaptive recursive filters, recursive filtering and prediction in transmission, recursive predictors and adaptive algorithms and stability.

#### **COS 6013 Advances in Computer Architecture**

Fundamentals of Computer Design, Instruction set Principles and Examples, Pipelining, Advanced pipelining and Instruction-Level Parallelism, Memory-Hierarchy Design, Storage Systems, Interconnection Networks, Multiprocessors.

Reference:

John L. Hennessy & David A Patterson, "Computer Architecture - A Quantitative Approach", Harcourt Asia Pvt. Ltd., 2nd ed., 2000.

#### **COS 6014 Relational Database Management Systems**

The entity-relationship model, the relationship model, object oriented data models, design principles, integrity constraints and dependencies, properties of relational schemes, algorithms for design problems, mapping between ER diagrams and relational database schemes, Scheme Transformations.

Reference:

C.J. Date, "Database Management Systems", 6<sup>th</sup> ed., Addison Wesley.

#### **COS 6015 VHDL and VLSI Design using FPGAs**

VHDL concepts, Level of descriptions, methodology and coding style requirements, VHDL types, VHDL object classes, VHDL Design units, Architecture, Compilation, elaboration, simulation, basic language elements, Control structures, Drivers, VHDL timing, Elements of entity/architecture, Subprograms, packages, user defined attributes, specifications and configurations, Design for synthesis, functional models and test benches, VITAL.

Reference:

Ben Cohen, "VHDL Coding Styles and Methodologies", Kluwer Academic.