

## Appendix A



International School of  
Information Management

### M. Tech (Information Systems & Management)

#### A. Syllabus Outline

Semester 1:	
MISM 501	Quantitative Techniques
MISM 541	Knowledge Economy and Information Society
MISM 513	Cognitive approaches to Information
MISM 515	Information Organization
MISM 521	Software systems
Semester 2:	
MISM 542	Management Strategies
MISM 516	Taxonomies, Ontologies and Semantic Web
MISM 532	Content Management and Electronic publishing
MISM 522	Information systems design and development
MISM 524	Internet technologies
Semester 3:	
MISM 611	Knowledge Management
MISM 621	Data mining and data warehousing
MISM 623	Information Retrieval Systems
MISM 625	Human Computer Interactions

	Electives: 651 Bio Informatics 653 Geo Informatics 655 Information assurance and security 657 Natural Language processing 659 Multimedia content management
<b>Semester 4:</b>	
MISM 642	IPR and Cyber laws
Electives	Any two of the following
	652 Information Industry and Entrepreneurship 653 Health Informatics 656 Enterprise Content Management 658 Pattern recognition and image processing 660 Computer Graphics 662 Text Mining 664 Cultural Informatics 666 Multilingual Information Management 668 Emerging trends in content management
MISM 690	Major Project

## **B. Scheme of Examination**

- The students performance is examined based on continuous assessment by the faculty
- The assessment will be based on classroom interaction, tests, quizzes, mid-term review, seminars, projects and other assignments.
- There is no external examiner. All assessments are by the concerned faculty.
- There shall be a Term End Examination. The weightage is 50:50 (Continuous assessment and End of the Term Examination)
- The Project Work will be assessed by a faculty committee.

# M. Tech in Information Systems and Management

## Syllabus Outline

### Semester 1

#### **MISM 501: Quantitative Techniques**

##### **Course Objectives**

The course is an introduction to statistical inference and a survey of the most commonly used inferential procedures, mathematics and statistics especially designed to provide a good grounding in these areas.

##### **Course Outline**

###### 1. Basic Statistics and Mathematics.

Probability theory; Sample space and events; Conditional probability, Independent events, Bayes formula,

Random Variables; distributions. Uniform, Poisson, Normal, Bernoulli and Binomial Distributions; Extreme value statistics and the Gumbel Distribution

Matrix algebra, Review of linear algebra, Operations, determinant, inverse. Solving linear equation. Eigenvalues and eigenvectors.

###### 2. Descriptive Statistics

Numerical description of Data; Measures of Central tendency (the Mean, Median and Mode); Measuring the variation in Data Standard Deviation, Population Variance, Sample Variance, Significance of Standard Deviation. Histograms, Distributions and density.

###### 3. Inferential Statistics

Normal distribution. Exploratory Data Analysis, Bivariate, Correlation. Statistical inference. Hypothesis testing. Classical (t test, F test, Pearson), Nonparametric (Wilcoxon, Spearman) and Robust.

Goodness of Fit, classical (chi square) and nonparametric (Kolmogorov-Smirno) methods. Review of counts and proportions, contingency tables. Analysis of Variance (ANOVA), classical and nonparametric (Kruskal-Wallis and Friedman) methods.

###### 4. Simple Regression Analysis. Bivariate regression. Linear and nonlinear

5. Multivariate regression Least squares multiple regression. Stepwise Polynomial regression.

6. Multivariate analysis eigenvector methods. Principal Components (PCA), factor analysis, correspondence analysis. discriminant analysis, canonical correlation, cluster analysis

### Course Readings

1. Sheldon Ross. A first Course in Probability, Sixth Edition , Pearson Education Asia, 2002.
2. S P Gordon and F.S Gordon, Contemporary Statistics A computer approach, McGraw Hill International Edition, 1994
3. Kerlinger, F. N. (1986). Foundations of Behavioural Research (3rd ed.). New York: Harcourt Brace, Ch. 6.
4. Cook, T. D., & Campbell, D. T. (1979). *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. Rand McNally, Ch. 1, 2, 8 & pp. 95–103.
5. Freedman, D., Pisani, R., Purves, R. and Adhikari, A. (1991). *Statistics* (2nd ed.). New York: W. W. Norton, pp. 159–164.
6. Minium, E. W., Clarke, R. B. and Coladarci, T. (1998). *Statistical Reasoning in Psychology and Education*. John Wiley & Sons, Ch. 13–15 (skip material not presented in class). erlinger, Ch. 11 (skim), Appendix C.
7. Cohen, Jacob. Some Statistical Issues in Psychological Research. In Benjamin B. Wolman (Ed.) *Handbook of Clinical Psychology*. McGraw-Hill, 1965, pp. 95–121. [RC467 W6]
8. Winch, Robert F. & Campbell, Donald T. Proof? No. Evidence? Yes: The Significance of Tests of Significance. *American Sociologist*, 1969, 4, 140–143. [HM9 A713]
9. Kirk, Roger E. *Statistical Issues: A Reader for the Behavioral Sciences*. Brooks/Cole, 1972. [HA29 K55]—by Skipper (pp. 141–145).
10. Altman, Lawrence K. (1986). Negative Results: A Positive View. *New York Times*. April 29. C-1ff.
11. Webb, Eugene J., et al. (1966). *Unobtrusive Measures: Nonreactive Research in the Social Sciences*. Rand McNally, Ch. 1. [H62 W38]
12. Velleman, Paul F. & Wilkinson, Leland. (1993). Nominal, Ordinal, Interval, and Ratio Typologies are Misleading. *The American Statistician*, February, 47(1): 65–72. [HA1.A614]
13. Aronson, Elliot & Carlsmith, J. Merrill. (1968). Experimentation in Social Psychology. In G. Lindzey & E. Aronson (Eds.) *Handbook of Social Psychology* (2nd edition). Vol 2. Addison-Wesley, pp. 1–79. [HM251 L486 v.2].

## MISM 541 Knowledge Economy and Information Society

### Course Objectives

1. To introduce the students to the basic concepts and models of macro and macroeconomics including theories of rational choice-making by consumers and producers of goods and services, and the implications of those choices for market price.
2. Provide a strong grounding in the economics of information infrastructures, goods and services. To impart the ability to analyze strategic issues faced by for-profit and not-for-profit organizations: pricing, bundling, versioning, network externalities and rights management.

3. To introduce the students to the economics of Content Industry – Mass Media, INTERNET and scholarly publishing
4. Provide an understanding of the issues of an Information Society –

### **Course Outline**

- Macroeconomics of information. Introduction to information in the economy; macroeconomics; input-output analysis. The measurement and analysis of the role information plays in the economy.
- Secondary information sector: Information as input and output Economic analysis of the information industry
- Information Economics. Study of information asymmetries and market failures
- The economics of information goods. Analysis of the resources devoted to production, distribution, and consumption of information
- The economics of information technology and Content Industry – mass media, the internet, scholarly publishing
- Information Society – The role of information and information technology in organizations and society. Societal needs and demands, sociology of knowledge and science, diffusion of knowledge and technology, information and culture, and technology and culture. World Summit on Information Society.
- Metrics for the measurement of Information Society – issues and challenges.

### **Course Readings:**

1. F. Machlup, *The Production and Distribution of Knowledge in the United States* (Princeton, 1962, 1972)
2. Jerry L Salvaggio, ed., *The Information Society: Economic, Social and Structural Issues* (Hillsdale, NJ: Lawrence Erlbaum Associate, 1989)
3. D. W. King et al., *Key Papers in the Economics of Information* (White Plains: Knowledge Ind. Publ., 1983)
4. David A. Aaker and Erich Joachimsthaler: *Brand Leadership: Buildig Assets in an Information Economy* (Free Press; 2000)
5. Paul A. Strassmann: *Information Productivity: Assessing Information Management Costs of U. S. Corporations* (The Information Economic Press, 1999)
6. John R. M. Hand and Baruch Lev, Ed: *Intangible Assets Values, Measures and Risks*. Oxford University Press, 2003

## **MISM 513 Cognitive approaches to Information and Information Behaviour**

### **Course Objectives**

1. To familiarize the students to the concepts and theories of cognitive sciences as relevant to information sciences
2. To provide a theoretical construct and a framework for the study of information behaviour
3. To train students in the techniques and methods of studying information behaviour

4. To enable students to apply the concepts and frameworks from the research literature to specific examples and cases
5. To enable students to analyze information seeking behaviours in a context / environment
6. To enable students to design studies for investigating information seeking behaviours in electronic information environments.

### **Course Outline**

- Study the different concepts and notions of information. Understanding theories and paradigms of information sciences and analysis of the cognitive paradigm of information sciences.
- Individuals as Information Processing Systems. Conceptual models of Information needs, seeking and use. Information seeking and use Studies
- Study of information cycles and flows. The transmission and use of information within groups such as work groups and organizations. Information flows in organizations. Organizations as information processors. Collaboration. Computer assisted cooperative work. Influencing strategies. Adoption of innovation. The uses of information for coordination and communication within organizations.
- Quantitative and Qualitative techniques and methods of studying information behaviour. Detailed study and deployment cognitive / psychometrics based tools
- Mini Project – case study of information use and / or conducting an information behaviour study.

## **MISM 515 Information Organization**

### **Course Objectives**

1. To introduce the intellectual foundation of Information organizations and provide an in depth understanding of the organizational principles in different genres of information.
2. Enable students to learn how information organization is carried out by professionals, authors and users; by individuals in association with other individuals, and as part of the business processes in an enterprise and across enterprises.
3. To give strong grounding in the philosophical basis of information organization.
4. To familiarize students to the principles and techniques of information organization – classification, indexing, metadata, meta structures.

### **Course Outline**

- Concepts and notions of organization. Concept of order, structures, symbols and relationships. Language and information representation and Concepts and categories.
- Philosophical basis of information organization – from Aristotle to Dewey to Ranganathan. Trees and hierarchies, categories and facets.
- Representation and organizational categorization, indexing and content analysis. Data structures and databases.

- Case studies of different genres and the principles of organization – document genres – essays, poetry, drama; indexes, databases and secondary information products; blogs and wikis; websites and portals.
- Study of different classification systems, indexing languages and their theoretical basis
- From Ontologies to folksonomies – expert classification to citizen tagging.
- Tools, formats and standards organizing information and information items – metadata and other frameworks.
- Vocabulary control. Codes, formats and standards for data representation and transfer.

### **Course Readings:**

1. Svenonius, Elane. *The Intellectual Foundation of Information Organization*. London : MIT Press, 2000
2. Stock, Oliviero; Zancanaro, Massimo (eds.): *Multimodal Intelligent Information Presentation*, Springer, 2005

## **MISM 521 Foundations of Software Systems**

### **Course Objectives**

1. To introduce students to the concepts, methods and current practice of software engineering.
2. To enable the students to systematically study of large-scale software systems.
3. To provide a good foundation in the development of software for different applications

### **Course Outline**

- Fundamental concepts and techniques for analysis, design and implementation of software systems. Survey of the software engineering processes, tools, and techniques used in software development and quality assurance. Life-cycle models, process modeling, requirements analysis and specification techniques, quality assurance techniques, verification and validation, testing, project planning, and management.
- Software production; software life cycle models as an organizing structure; principles and techniques appropriate for each stage of production.
- Transition from basic programming skills to a rigorous process of software development. Familiarization with higher programming techniques (recursion, generic programming and constructs (object-orientation, lists, stacks, queues, searching, sorting). Understanding the connection between mathematical / algorithmic thought (logic, sets, functions, number bases) and implementation.
- Data structures and algorithms: abstract data types and data structures, efficiency of algorithms, binary tree representations and traversals, searching (dictionaries, priority queues, hashing), directed graphs and graph algorithms, language grammars.
- Object-Oriented Languages: language and development / execution environment difference, including data types, control structures, arrays and I/O; addressing

and memory management issues including pointers, references, functions and their passing conventions; object-oriented design specifics related to structured data and classes.

- Knowledge and skills for effective software project management, including project planning and tracking and people management. Risk analysis, project scope, scheduling, resource allocation, cost estimation, negotiation, monitoring and controlling schedule, software metrics, quality management, process improvement, staffing, leadership, motivation and team building.

## **Semester 2**

### **MISM 542 Management Strategies**

#### **Course Objectives**

The course is designed to equip students with Strategic Management skills in the technology environment.

#### **Course outline**

- Strategic Management, Strategy and Environment
- Corporate Strategy
- E-Business Models and Strategies
- Strategic thinking for management – introduction to game theory
- Technology Competition and Business, Managing innovation – technology strategy in theory and practice, Use of IT to gain competitive advantage.
- Strategic Technology Management. Information Technology's strategic role in organizations

### **MISM 516 Taxonomies, Ontologies and Semantic Web**

#### **Course Objective**

The course is designed to equip students with the latest developments in the Semantic Web scenario. The course aims at developing skills in the areas of building ontologies and ontology-based knowledge management systems. The focus is laid on development of ontologies and application of ontology languages.

#### **Course Outline**

1. Knowledge Organization Systems – Term Lists; Classification and categorization systems; Relationship Models
2. Taxonomy – Descriptive taxonomies; Navigational taxonomies; Data management vocabulary; Role of taxonomies in content management; Building and maintaining taxonomies
3. The Semantic Web Vision
4. Ontology Languages for the Semantic Web – RDFS, OWL, OIL and DAML+OIL
5. Ontology Query Languages – RDQL, SeRQL

6. Ontology Editing Tools
7. Ontology – Inference and Reasoning
8. Ontology – Application and techniques

### **Course Readings**

1. Building Taxonomies (Chapter 6) in *Unlocking Knowledge Assets*. Susan Conway and Char Sligar, Microsoft Press
2. Antoniou, Grigoris and Frank van Harmelen. *A Semantic Web Primer*. The MIT Press, London. 2004.
3. Davis, John et al (eds.). *Towards the Semantic Web: Ontology-driven Knowledge Management*. John Wiley & Sons, New York. 2005
4. Gomez-Perez A.; Mariano Fernandez-Lopez, Oscar Corcho.: *Ontological Engineering*. London: Springer-Verlag. (2003).
5. W3C: Ontology Web Language (OWL) Guide. <http://www.w3.org/TR/owl-guide/>. (2004).
6. Beck, H. and Pinto, H.S.: *Overview of Approach, Methodologies, Standards and Tools for Ontologies*. UN: The Agricultural Ontology Service, FAO. (2002).
7. Fensel, Dieter et al. *Spinning the Semantic Web: Bringing the World Wide Web to its full potential*. The MIT Press, England. 2003

## **MISM 532 Content Management and Electronic Publishing**

### **Course Objectives**

The course is oriented across creation and management of e-content. The course discusses information architecture and mark-up languages as a means to design, relate and compose documents for the web. The course equips students to (a) plan and design web-based content based on information architecture (b) utilize mark-up languages for text and graphic presentation (c) manage content formatting with style sheets. The electronic publishing focus on (a) Understanding the fundamental concepts of XML and related technologies (b) Acquire knowledge on how XML is currently being used in various application areas. (c) Understand the syntactic and semantical aspects of XML documents (d) Know how to parse and transform XML documents via tools and through programming APIs (e) Have some exposure on XML activities in e-publishing areas.

### **Course Outline**

- Content types. Document genres. Digital document genres. Case study of different digital content genres.
- Information Architecture – Organization, labeling, navigation, searching metadata
- Information Architecture – Process and Methodology – Research, strategy, design, documentation
- Markup Languages: HTML, SGML, XHTML; Web Design; Web Page Content vs. Appearance
- Beyond Text Content: Images, color, multimedia objects; Hypertext; Lists,

Tables and Frames; Cascading Style Sheets – styles, syntax, properties, tag-less styles

- Forms – tags, layout, contents, targeting
- Executable Content – Applets and Java, Embedded content, JavaScript, JavaScript Style Sheets, Tools – Macromedia Flash
- Overview of XML Technologies
- XML Fundamentals
- XML Programming in Java
- XML in Enterprise Application
- XML in e-commerce (Web Services)
- Open Source XML Projects
- XML Tools

## **MISM 522 Information Systems Design and Development**

### **Course Objectives**

The course is designed to equip students with essential skills required in information systems design and development.

### **Course Outline**

- Introduction to Information Systems – Fundamentals of information systems; Technical and organizational foundations of information systems, building information systems, managing information systems resources.
- E-Business System Development – key e-business enabling information technologies.
- Database Management – Database design, development and administration.
- Database Systems and Applications – Logical data models, relational database systems, structured query language (SQL), conceptual modeling, database design, web-connected databases,
- Systems Analysis and Design – Analysis phase of systems development. Development life cycle, feasibility studies, analysis of user requirements, development of logical system models.
- Systems Implementation – software project management, system / database design, GUI, Software testing, integrating web and business environments.
- Information Systems Development – user requirement analysis, logical and physical system models, system implementation and maintenance, project valuation and management.

## **MISM 524 Internet Technologies**

### **Course Objectives**

The objective is to provide state of the art knowledge and specialist skills on a broad range of Internet technologies and systems.

### **Course Outline**

- Network technologies – The techniques of telecommunication networks and the management of information technologies and networks. Internet architectures, technologies, applications, and protocols. Baseline Internet technologies such as TCP/IP, routing, switching, address and domain name management, email, and the World Wide Web (HTTP). Design and delivery of data and voice over networks. Setting up local area Networks and Wireless Networks. Network architectures; design and analysis of efficient LAN protocols; state-of-the-art local area networks, including multi-access networks, token passing networks, and optical local area networks; Internet communications.
- Design and development object-oriented web applications. The client-server model and 3-tier architecture. The interrelationship of back-end and front-end systems.
- Object-Oriented methodology, Enterprise Software Application Architecture, Design Patterns, Enterprise Java Beans, Database Connectivity, and Web Application Server Development and technologies such as Servlets, JSP, XML, HTML, Security, JDBC, RMI and Multithreading.
- Programming for the Internet – JAVA Programming.
- ASP and PHP Fundamentals.

### **Semester 3**

#### **MISM 611 Knowledge Management**

##### **Course Objectives**

The course teaches the essential principles of Knowledge Management.

##### **Course Outline**

- Introduction to Knowledge Management (KM) – Evolution of KM, Defining KM; objectives to knowledge management, Knowledge management perspectives, KM and the e-Business Space, Significance of KM.
- Knowledge and Learning – Defining Knowledge, Defining Learning, KM and Learning in Organizations, The Knowledge Hierarchy, Knowledge as a Strategic Resource, Types of Organizational Knowledge, Types of Knowledge acquired, KM and Individual Learning, E-Learning Characteristics, Essentials of E-Learning, Strategic Importance of E-Learning, Effectiveness of E-Learning
- Organizational Learning and Learning Organizations – Defining Organizational Learning, Organizational Learning Types, Levels of Organizational Learning, Motivation for Organizational Learning, Learning Organizations, Learning Strategies, Relationship of IT, IM and KM, Knowledge Sharing, Types of Knowledge Shared, Capturing and Sharing Knowledge, Examples from Private and Public Sector, Organizational Challenges
- Organizational Culture, Change Management and Communities of Practice
- Enabling Technologies – Requirements of Knowledge Workers, Mapping KM Technology to Transfer Modes, Technology issues, Layers of a KM Platform, Technology aspect of KM, Introducing the Intranet, Differentiating Intranet, Internet and Extranet, Intranet – Business Issues, Intranet - Technology Issues,

Intranet - Components, Benefits of Intranet, Challenges and Opportunities of Corporate Intranet, Introducing Portals, Technology requirements of Portals, Enterprise Knowledge Portals, Content Management, Architecture of a CMS, Technology Challenges, KM Deployment Phases, Top 100 KM companies.

- Knowledge Management Framework and Processes – Knowledge Management Framework, Basics and requirements of Knowledge Framework, Knowledge Processes, Modes of Knowledge Generation, Knowledge Creation, IT Application for Knowledge Creation, Knowledge Storage / Retrieval, Knowledge Repositories, Knowledge Transfer, Knowledge Harvesting
- Knowledge Strategy – Importance and Essentials of Knowledge Management Strategies, Codification, Personalization, Best Practices
- Knowledge Management Assessment and Planning – Knowledge Auditing, Need for Auditing Knowledge, Knowledge Audit Methods, Challenges for Auditing Knowledge
- Knowledge Management Measurements and Methodologies – Significance of KM Measurement, Types of Metrics, Analysis and Interpretation, The Measurement Process, Qualitative and Quantitative Measures, Balanced Scorecard.
- Building a Business Case for Knowledge Management

## **MISM 621 – Data Mining and Data Warehousing**

### **Course Objectives**

Data Mining and Data Warehousing are powerful computational tools developed over the last decade for extracting strategic information from massive repositories of enterprise data. This course will introduce the basic concepts, techniques and applications of Data Mining and Data Warehousing.

### **Course Outline**

#### **Data Mining:**

Overview; Types of Patterns; Algorithms for Classification, Clustering, Association Rules, Outliers, Privacy Preservation; Data Preprocessing (Feature Selection, Discretization, Sampling); Web Mining; Applications and Case Studies

#### **Course Readings:**

1. Data Mining: Concepts and Techniques. Jiawei Han and Micheline Kamber Morgan Kaufmman Publishers, 2000
2. Data Mining: Practical Machine Learning Tools and Techniques with JAVA. Ian H. Witten and Eibe Frank Morgan Kaufmman Publishers, 2000
3. Introduction to Data Mining. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Pearson Addison Wesley, 2005
4. Data Mining: Introductory and Advanced Topics. Margaret H. Dunham, Prentice Hall, 2003

#### **Data Warehousing**

Overview; Data Cubes; On-line Analytical Processing; Warehouse Architectures; Data Visualization; Data Preparation; Applications and Case Studies

### **Course Readings**

1. Data Warehousing Fundamentals. Paulraj Ponniah, Wiley, 2001
2. The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling  
Ralph Kimball and Margy Ross, Wiley, 2002.

## **MISM 623 – Information Retrieval Systems**

### **Course Objectives**

This course examines information retrieval within the context of full-text datasets. The students should be able to understand and critique existing information retrieval systems and to design and build information retrieval systems themselves. The course will introduce students to traditional methods as well as recent advances in information retrieval (IR), handling and querying of textual data. The focus will be on newer techniques of processing and retrieving textual information, including hyertext documents available on the World Wide Web.

### **Course Outline**

Topics covered include:

- IR Models
  - Boolean Model
  - Vector Space Model
  - Relational DBMS
  - Probabilistic Models
  - Language Models
- Web Information Retrieval
  - citation network analysis
  - social collaboration (PageRank and HITS algorithms)
- Term Indexing
  - Zipf's Law
  - term weighting
- Searching and Data Structures
  - Inverted files to support Boolean and Vector Models
  - Clustering
    - non-hierarchical
      - single pass
      - reallocation
    - hierarchical agglomerative
  - String Searching
  - Tries, binary tries, binary digital tries, suffix trees, etc.

- Retrieval Effectiveness Evaluation
  - Recall, Precision, Fallout
  - Comparing systems using average precision

### **Course Readings:**

1. Modern Information Retrieval / by Ricardo Baeza-Yates and Berthier Ribeiro-Neto, 2001
2. Readings in Information Retrieval Edited by Karen Sparck Jones and Peter Willett
3. Mining the Web: Discovering Knowledge from Hypertext Data / Soumen Chakrabarti, Morgan-Kaufmann Publishers, 2003.
4. Managing Gigabytes: Compressing and Indexing Documents and Images by Ian H. Witten, Alistair Moffat, and Timothy C. Bell.
5. Introduction to Information Retrieval / Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, (Due for publication by Cambridge University Press in 2007)
6. TREC Volumes

## **MISM 625 Human Computer Interactions**

### **Course Objectives**

The course objective is to introduce the concepts, issues, methods and challenges of improving the interaction between users and computers by making computers more user-friendly and receptive to the user's needs. The course is concerned with

- Methodologies and processes for designing interfaces
- Methods for implementing interfaces
- Techniques for evaluating and comparing interfaces
- Developing new interfaces and interaction techniques
- Developing descriptive and predictive models and theories of interaction

### **Course Outline**

1. Principles of HCI. History and interacting disciplines: Psychology, Cognitive Science, Ergonomics, Computer Graphics and Visualization, Artificial Intelligence, Design, Notable Systems and Prototypes – Dynabook, Knowledge Navigator, Project Looking Glass, The Humane Environment
2. Hardware for improving Human Computer Interaction: Input Devices, Output Devices
3. Usability: Usability Testing, User Testing, Heuristic Evaluation, Cognitive Walkthrough, Cognitive Dimensions of Notation, Usability Lab
4. Models and Laws: Hick's Law, Fitt's Law, GOMS – Goals, Operators, Methods and Selection Rules, Keystroke-level Modeling

5. Interaction Styles: Command line interface, Graphical user interface, WIMP, Point-and-click, Drag-and-drop, Cursor, Widget, Direct manipulation interface, Desktop, WYSIWYG (What you see is what you get), Zooming User Interface

6. Interaction Paradigms: Hypertext, Hypermedia and Hyperlinks, Speech recognition, speech synthesis, natural language processing, non-speech audio input, Mouse gestures and Handwriting recognition, Haptics, telehaptics, Computer mediated reality, Computer Supported Collaborative Work (CSCW), Ubiquitous Computing, Wearable Computers and cyborgs, Direct mind-computer interface

7. Interface Design Methods: User-Centered Design, Participatory Design, Value-sensitive Design, Rapid Prototyping, Iterative Design, User Scenario, Affordance Analysis, Scenario Based Design, Task Analysis / Task Modeling,

8. User Interface Engineering and Usability Engineering: Phases and Processes in User Interface Design – Functionality requirements gathering, User analysis, Information architecture, Prototyping, Usability testing, Wireframing, Layout and Graphic design,

## **Course Readings**

### **Journals**

1. ACM Journal of Human Computer Interaction

### **Academic Conference**

- HCI International (<http://www.hci-international.org/>)

Annual held ACM's Conference on Human Factors in Computing Systems, usually referred to by its short name CHI (pronounced as kai, or khai).

- CHI 2007 (<http://www.chi2007.org/>)
- CHI 2006 (<http://www.chi2006.org/>)
- CHI 2005 (<http://www.chi2005.org/>)
- CHI 2004 (<http://www.chi2006.org/>)

### **Electives:**

## **651 Bio Informatics**

### **Course Objectives**

In this course, students will be introduced to the nature of biological data, its collection, curation, and analysis. Many of the tools required are common to other areas of analysis such as sampling, linguistics, classification. Some mathematical and statistical background is necessary as well.

## **Course Outline**

### 1. Genomic information.

Prokaryotic and eukaryotic genomes, structure, organization and function; Molecular Evolution, Gene Structure, Genetic Codes and Mutation.

Biological Databases: Primary sources of sequence and structure data. Secondary databases.

Derived Databases

Large scale Gene Expression Data

### 2. Bioinformatics Basics

Sequence Analysis for Molecular biology. Overview of DNA and protein primary sequence analysis. Sequence Alignment – Scoring matrices. Local and Global alignment concepts – dynamic programming methodology. Statistics of alignment scores. Heuristic methods for database searching. BLAST and its statistical significance.

### 3. Pattern recognition and classification

Markov models for pattern detection. Hidden Markov models. Repeats.

Phylogenetic analysis: Methods for Phylogenetic estimation: Maximum parsimony, Distance Matrix Methods and Maximum Likelihood Methods.

Clustering methodologies: UPGMA, k-means, hierarchical clustering. Data imputation.

## **Course Readings:**

1. David W. Mount (2001) Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Press

2. Warren Ewens and Gregory R. Grant. (2001) “Statistical Methods in Bioinformatics: An Introduction” Springer-Verlag

3. Waterman MS (1995) Introduction to computational biology: Maps, sequences and Genomes. Chapman Hall

## **653 Geo Informatics**

### **Course Objectives**

The course equips students to handle complex and powerful computerized geographical information systems (GIS). The course provides knowledge about the technologies supporting the processes of acquiring, analyzing and visualizing spatial data. The focus is laid on understanding of data collection, the ability to structure spatial databases and command of visualization techniques to display data output, as well as sound organizational infrastructure for managing and accessing the data.

## **Course Outline**

Fundamentals: Principles of data capture, and use of aerial photographs and satellite imagery; Handling, integration, maintenance and geometric aspects of geodata; Methods of representing geodata, including the principles of internet application

Digital Photogrammetry and Remote Sensing: advances in airborne and spaceborne sensor systems; global positioning; digital photogrammetry; integrated up-to-date-capturing techniques

Digital photogrammetric workstations: primary data acquisition and sensors, and the perception of colour and depth; linear algebra and the theory of observations; photogrammetric systems and scanners; image processing platforms; orientation of images, and digital image enhancement; aerotriangulation and the use of GPS for control point positioning and field completion

GIS Operation: principles of computer programming; database concepts and development and DBMS Software tools; Creating and implementing databases; Managing and administering databases and the use of query languages; GIS Theory, Spatial analysis (network, raster and surface operations); Developing a GIS application

Cartography and Geo-Visualization: The cartographic communication process, including commercial and management aspects; map type, symbol and typographical design and use of color; cartographic generalization and map protection; concepts and technical constraints of the cartographic production line; topographic mapping, and the production of large-scale maps and photo and image maps; thematic mapping, including socio-economic and physical environmental mapping, tourist maps, statistics and data classification; the visualization of multimedia ad web mapping applications.

## **655 Information assurance and security**

### **Course Objectives**

Information Security is becoming increasingly important in today's networked world and is impacting every aspect of society including finance, healthcare, government, education, arts and entertainment. The objective of this course is to teach the basic principles of information security from the perspective of providing security awareness and its best practices for the real world. Topics include motivation for security, tools and techniques used by adversaries to gather information and launch attacks, virus protection, secure credit card and bank transactions, wireless security, computer forensics, identity theft and protection, anti-phishing and biometric security.

### **Course Outline**

- Fundamental Concepts: Motivation for security, Basics of computer networks, Internet, Network tools and utilities.
- Introduction to Security Concepts: Threats and vulnerabilities in today's digital world; Security terminology, Common attacks.  
Hacker techniques: Gathering information, becoming part of a network, launching

attacks, hacker tools.

Securing a system: Firewalls, Safe web surfing

Securing a transaction: Encryption, digital signatures, virtual private networks

Cyber Crime: Internet fraud, Identity theft, Industrial espionage, Cyber terrorism

Tools and Techniques for Security: Security hardware and software, intrusion detection systems, security standards.

Emerging Areas: Wireless security, anti-virus and anti-phishing tools, computer forensics, biometrics, establishing security plans and risk mitigation.

### **Course Readings**

Computer Security Fundamentals by Chuck Easttom, Pearson- Prentice Hall

Publishers, 2006 edition, ISBN 0-13-171129-6

Additional references and web sites of interest will be given as and when appropriate.

## **657 Natural Language processing**

### **Course Objectives**

This course aims at introducing students to the area of Natural Language Processing that operates at the level of the large amount of text on the web. Statistical and probabilistic methods will be emphasized - along with the NLP fundamentals.

### **Course Outline**

Words, Lexicon Design and Processing, Lexical Semantics Syntax, Parsing Techniques (Chart, ATN etc.), Probabilistic Parsers

Semantics, Knowledge Representation, Frames, Semantic Nets, Noisy Channel

Metaphor, Hidden Markov Model and Associated Algorithms, Word Level

Processing, Part of Speech Tagging, Parsing Techniques, Probabilistic Parsing, IR and Language Modeling, Corpus Technology, Lexical Knowledge Networks (Wordnet, Conceptnet, Framenet etc.), Machine Translation, question answering and Information Extraction, Indian Language Computing.

### **Course Readings**

#### Books

1. Allen, James. 1995. Natural Language Understanding. Benjamin/Cummings, 2ed.
2. Charniak, Eugene 1996. Statistical Language Learning, MIT Press.
3. Jurafsky, Dan and James Martin. 2000. Speech and Language Processing. Prentice Hall.
4. Manning, Christopher and Heinrich Schtze. 1999. Foundations of Statistical Natural Language Processing. MIT Press.
5. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- A Pananian Perspective. Prentice Hll India, Eastern Economy Edition.

#### Journals

1. Natural Language Engineering, Computational Linguistics, Journal of IR, Journal of MT, IEEE Trans. on Data and Knowledge Engineering.

Conferences: SIGIR, ICML, ACL, EMNLP, HLT

## **659 Multimedia content management**

### **Course Objective**

The course focuses on developing and delivering multimodal content via digital media. The focus is on the principles of database design, interface development, usability testing and collaborative content management within technical communication settings.

### **Course Outline**

- Introduction to Multimedia: Concepts of Multimedia, Multimedia Applications, Advantages of Digital Multimedia, Multimedia System Architecture, Objects of Multimedia
- Computer Graphics; Digital Audio; Digital Video
- Animation Theory and Drawing Basics
- Story Boarding and Script Writing
- Digital Compositing
- 2D Animation 3D Graphics Modeling Animation
- Creating Special Effects
- Designing Interactive Multimedia Applications
- Integrating Architectural Drawings with 3D
- Special Effects using Combustion
- Media Streaming
- Multimedia Databases

## **Semester 4**

### **MISM 642 IPR and Cyber Laws**

#### **Course Objectives**

The course is designed with an objective of providing students an understanding of Intellectual Property Rights and Cyber laws.

#### **Course Outline**

- Scope of Cyber Laws – Nature of Cyber Space, Cyber Property, Cyber Personality, Cyber Transactions
- Cyber Jurisprudence – Concepts of Historical, Analytical and Ethical Jurisprudence, Relationship between Meta Society Laws and Cyber Laws, How Cyber Laws need to be developed.
- Law of Digital Contracts – Digital Contract – Definition; Formation of Digital

- Contracts, System of Digital Signature, Role and Function of Certifying Authorities, The Science of Cryptography
- Intellectual Property Issues in Cyber Space – Domain Names and Related Issues, Copyright in the Digital Media, Patents in the Cyber World,
- Information Technology Act, 2000
- International Scenario in Cyber Laws
- Cyber Law Issues for Management – issues in E-business management, cyber evidence management, cyber law compliancy audit
- IPR Policies. WIPO, National IPR Policy

## **Electives**

### **652 Information Industry and Entrepreneurship**

#### **Course Objective**

Prepares students to start businesses in the information industry or to work effectively in new start-up businesses. Discusses aspects of creating a business and expects students to develop an idea into a business plan that could be used to either guide the creation of the business or secure funding for a new business

#### **Course Outline**

- Characteristics of an Entrepreneur. The Idea of an Entrepreneurial Venture.
- The Business Plan.
- Accounting for Business Plans. Projecting revenues, expenses and cash-flows.
- Financing the Business.
- Starting a Web / Software Business – E-Business.
- Competitive Analysis.
- Marketing and product development – Developing a marketing plan. High-tech marketing theories. The unique problems of marketing in a small business.

### **653 Health Informatics**

#### **Course Objective**

This class introduces students to the discipline of health informatics: its world context, its origins, its purposes and the nature of its current body of knowledge.

Areas of focus include:

- the role and use of ICT in health, healthcare and health related organizations;
- healthcare data and information;
- how healthcare information is currently captured, converted to machine language, stored and accessed.
- medical vocabularies and vocabulary systems such as the Unified Medical Language System
- standards for Electronic Health Records, such as Health Level 7 and the Good

## Electronic Health Record

Students will be exposed to various current applications of ICT to health information in areas such as e-health and telemedicine. Through case studies of working systems, students will gain an introductory understanding of health informatics.

## 656 Enterprise Content Management

### Course Objective

The course aims at providing solid understanding of ECM technologies and components to manage information through its lifecycle. The course covers technologies that helps you to capture, store, manage, preserve and / or deliver information in support of a business process.

### Course Outline

- **What is ECM:** Definitions of ECM. Business Drivers – Costs, growth and risks. Current technologies. The ECM Roadmap – Capture, Store, Manage, Preserve, Deliver
- **Capture:** Structured and unstructured. Information sources. Information types.
- **Store:** Business model options. Security issues. Audit trails. Storage technologies. Repositories. Retention and disposal
- **Manage:** IM principles. Managing information. Managing content.
- **Preserve:** Preservation needs. Digital preservation techniques. Problems and Solutions
- **Deliver:** Browsing. Searching. Rendering. XML and personalization. Security aspects. Delivery channels. Publishing
- **Repurposing:** Content re-use. Challenges of re-purposing. Interoperability. Web publishing.
- **Metadata and Indexing:** Metadata. Standards and guidelines. Metadata types. Metadata sources. Metadata usage. Auto-classification and auto-indexing.
- **Classification:** Approaches. Classification schemes. Documents vs. Records.
- **Controls and Security:** Administration. Integrity. Authenticity. Access to sensitive records. Interoperability and openness. Compliance requirements. Virus protection.
- **Interfaces and legacy systems:** Linking systems. Interfacing. Migration. Delivery channels.
- **Success Factors:** User awareness. People roles. Supplier capability. Timescales and planning.

## 658 Pattern Recognition and Image Processing

### *Pattern recognition systems*

### Course Objective

The course is designed to introduce students to theoretical concepts and practical issues associated with pattern recognition.

## Course Outline

- **Model based pattern recognition** : Mathematical models of the three-dimensional recognition from depth images, three-dimensional recognition from intensity images and two-dimensional recognition from intensity images. Model based recognition problems. Computational strategies.
- **Structural pattern recognition** : Features selection and extraction. Constraints. Model and scene representation. The exact matching. Search space. Exhaustive matching methods: Graph isomorphism methods. Relaxation methods. Transforms classifications. Search space reduction methods: Tree search. Hypothesis generation and checking.
- **Intermediate representation.**
- **Inexact matching.**
- **Knowledge based recognition**

## Textbooks and references

1. Richard O. Duda, Peter E. Hart , David G . Stork, "Pattern Clasification", John Wiley and Sons, 2001
2. W.E. Grimson, " Object Recognition by Computer: The Role of Geometric Constraints", MIT Press, 1990.
3. S. Nedeveschi, "Prelucrarea imaginilor si recunoasterea formelor", Ed. Microinformatica, Cluj, 1997.

## *Image processing*

### Course Objective

The course is designed to introduce students to theoretical concepts and practical issues associated with pattern recognition.

### Course Outline

- **Computer vision and applications.** Vision systems structure and functions.
- **Image acquisition systems.** Image formation and sensing. Camera model.
- **Stereo-vision basics.** Epipolar geometry. Depth computation.
- **Image data representation.**
- **Binary image processing** : Single object: geometric properties from image, geometric properties from run-lengths encoding, Multiple objects: connected components, labeling algorithms, contour tracking, and contour approximation. Mathematical image morphology, distance transform, medial axis, thinning.
- **Grayscale image processing** : Mathematical methods for grayscale image processing: Convolution, Fourier transform. Statistic features of the grayscale images. Histogram processing. Noise in grayscale images. Image enhancement:

spatial domain methods, frequency domain methods, geometric transformations. Image blurring and sharpening.

- **Grayscale image segmentation** : Region based segmentation: threshold methods, texture based methods. Region growing, region splitting and merging, Watershedding. Edge based segmentation: first order differential methods, second order differential methods. Edge linking, contour closing, contour approximation by straight lines. Hough transform.
- **Color images.** Color models. Color based segmentation.

### **Textbooks and references**

1. R.C.Gonzales, R.E.Woods, "Digital Image Processing-Second Edition", *Prentice Hall, 2002.*
2. E. Trucco, A. Verri, "Introductory Techniques for 3-D Computer Vision", *Prentice Hall, 1998*
3. R. Haralik, L. Shapiro, "Computer and Robot Vision", *Addison Wesley, 1993.*  
I. Pitas, "Digital Image Processing Algorithms", *Prentice Hall, 1993.*  
Y. Shirai, "Three-dimensional Computer vision", *Springer-Verlag, 1987.*
4. S. Nedeveschi, "Pre lucrarea imaginilor si recunoasterea formelor", *Ed. Microinformatica, 1997.*

## **660 Computer Graphics**

### **Course Objective**

Computer Graphics is a study of the hardware and software principles of interactive raster graphics. Topics include an introduction to the basic concepts, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques, graphical software packages and graphics systems. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms.

### **Course Outline**

- The graphics pipeline: Getting with OpenGL. Interactive Graphics.
- Graphics Primitives: Lines, Circles, Polygon Filling, Windows and viewports
- Clipping: Line Clipping. Polygon Clipping.
- Affine Transformations
- Scan conversion algorithms
- Hidden object detection
- Illumination and shading models
- Color concepts
- Graphics APIs and hardware
- The effects of graphics on society

## **662 Text Mining**

### **Course Objectives**

This course aims to give students an understanding, both at the conceptual and the technical level of the development of NLP applications in the text mining / information extraction area. At the conceptual level, the course introduces machine learning as a powerful generic toolbox for automatically learning NLP modules from data. At the technical level, the course offers hands-on training and experience in building an actual text mining application in which NLP modules contribute to extracting information from text.

## Course Outline

1. Introduction to Text Mining and Computational Linguistics, Machine Language algorithms and language data: The nature of unstructured and semi-structured text. Text Classification. Exploiting text-specific features. Feature selection. Evaluation of classification. Part of Speech tagging. Micro and macro-averaging.
2. The process of structuring the text. Parsing. Derivation of linguistic features. Text categorization. Text Clustering. Concepts / entity extraction. Sentiment analysis. Document summarization and entity relation modeling.
3. Text encoding: tokenization, stemming, lemmatization, stop words, phrases. Further optimizing indices for query processing. Proximity and phrase queries. Positional indices.
4. Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Blocking. Extreme compression.
5. Index construction. Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, real-world issues.
6. Probabilistic models for text problems. Classical probabilistic IR. Language models. Naïve Bayes models. Spam filtering.
7. Clustering. Introduction to the problem. Partitioning methods. k-means clustering. Mixture of Gaussians model. Clustering versus classification. Hierarchical agglomerative clustering. Clustering terms using documents. Labeling cluster. Evaluating clustering. Text specific issues. Reduced dimensionality / spectral methods. Latent semantic indexing (LSI). Applications to clustering. Text categorization.
8. Text Mining Software: PreText (<http://www.icmc.usp.br/edsontm/retext/>) An environment for pre-processing text for Text Mining; UMIA standard (<http://www.research.ibm.com/UIMA/>) - integration framework for text technologies including text mining; The "Ultimate Research Assistant" (<http://www.hoskinson.net/ultimate.research.assistant/>) - an online text mining tool; GATE (General Architecture for Text Engineering) (<http://gate.ac.uk/>) - freely available open-source Java library for text engineering and a leading toolkit for text mining, information extraction, and other natural language processing tasks; YALE (Yet Another Learning Environment (<http://yale.sf.net/>)) - freely available integrated open source software environment for knowledge discover, data mining including text

mining, machine learning, visualization (e.g. of text clustering); Bow (<http://www.cs.c.u.edu/mccallum/bowl/>) - freely available open source toolkit for statistical language modeling, text retrieval, classification, and clustering; Topicalizer (<http://www.topicalizer.com/>) - an online text analysis tool for generating text analysis statistics of web pages and other texts; Textalyser (<http://textalyser.net/>) - an online text analysis tool for generating text analysis statistics of web pages and other texts.

## **664 Cultural Informatics**

### **Course Objectives**

The course aims at promoting scientific knowledge and research in the field of Cultural Informatics

### **Course Outline**

- Digitization of Collections. Museum Information Systems. Virtual Exhibitions. 3D Modeling and Animation.
- Museum Education: Digital Media in Museopedagogics.
- Digital Applications for the Display of Exhibits. Cultural Heritage Topics. Digital Art Topics and Modern Identity Perspectives. Cultural Economics. Cultural Representation. Graphic Design. Interface Design. Cultural Design.

## **666 Multilingual Information Management**

### **Course Objective**

This course is a logical sequel to MIS657 (which is the prerequisite for this course) and aims to take into account the special requirement of processing textual information in the Indian context which has tremendous language diversity. The main focus of the course will be cross lingual information retrieval and shallow processing of Indian languages.

### **Course Outline**

Morphology of Indo-Aryan and Dravidian Language Streams, Stemmers and Morphology Analysers, Part of Speech Tagging for Indian Languages, Local Word Grouping, Machine Translation Overview, Indian Language Wordnets

IR overview, Cross Lingual Information Retrieval (shallow semantics), CLIR (deep semantics), Indian Language Search Engines

Summarization, Question Answering, Natural Language Generation

### **Course Readings**

This area is a very upcoming domain. Papers from IR, NLP and MT journals and conferences will be used. Some noteworthy fora are ACL, SIGIR, CLEF, TREC, CoNLL, MT Summit, Journal of MT, Journal of IR etc.

## **668 Emerging Trends in Content Management**

### **Course Objective**

This course is designed to provide an overview and understanding of the major trends and new technologies in the area of Content Management including new genres and techniques such as wikis, blogs and such other tools and trends. The objective is to introduce the students to the cutting edge technologies and software tools both in open source domain as well as proprietary systems.