SRINIVAS UNIVERSITY
COLLEGE OF ENGINEERING AND TECHNOLOGY
Department of Computer Science & Engineering

Scheme and the Subjects of Ph.D. Course Work

S. No.	Subject Code	Subject Title	Credits	Marks
1	18SPHDRM	Research Methodology	4	100
2	20SPHDCS01	Data Warehousing and Mining	4	100
3	20SPHDCS02	Digital Image Processing	4	100
4	20SPHDCS03	Advanced Networking	4	100
Total			**16**	**400**

Scheme of Examination

Continuous Internal Assessment: 50 Marks	Assignment (Minimum 30 pages, Hand written)
End Semester Examination: 50 Marks (5 x 10 = 50)	One question from each module with internal choice. Each question carries 10 marks.

2. DATA WAREHOUSING AND MINING
20SPHDCS01

Module 1: Data Warehousing Introduction – Definition - Architecture - Warehouse Schema - Warehouse server OLAP operations. Data Warehouse technology – Hardware and operating system - Warehousing Software - Extraction tools – Transformation tools – Data quality tools – Data loaders – Data Access and retrieval tools – Data Modeling tools – Fact tables and dimensions. Data warehousing case studies: Data warehousing in Government, Tourism, Industry, Genomics data. Information Retrieval - Introduction – Role of IR – Information Retrieval systems - IR Applications Areas – IR Algorithms – Retrieval algorithms – Filtering algorithms – Indexing algorithms - Evaluation in Information Retrieval.

Module 2: Data Mining definition – DM Techniques – current trends in data mining - Different forms of Knowledge – Data selection, cleaning, Integration, Transformation, Reduction and Enrichment. Data: Types of data - Data Quality - Data Preprocessing – Measures of similarity and dissimilarity. Exploration: Summary statistics – Visualization.

Module 3: Association rules: Introduction – Methods to discover association rule – Apriori algorithm Partition Algorithm – Pincher search algorithm – Dynamic Item set algorithm – FP Tree growth algorithm. Classification: Decision Tree classification – Bayesian Classification- Classification by Back Propagation.

Module 4: Clustering Techniques: Introduction – Clustering Paradigms – Partitioning Algorithms – K means & K Mediod algorithms – CLARA – CLARANS – Hierarchical clustering – DBSCAN – BIRCH – Categorical Clustering algorithms – STIRR – ROCK – CACTUS. Introduction to machine learning – Supervised learning – Unsupervised learning – Machine learning and data mining. Neural Networks: Introduction – Use of NN – Working of NN Genetic Algorithm: Introduction – Working of GA.

Module 5: Web Mining: Introduction – Web content mining – Web structure mining – Web usage mining – Text mining – Text clustering, Temporal mining - Spatial mining – Visual data mining – Knowledge mining – Case Studies using R and Python - Analysis and Forecasting of House Price Indices, Customer Response Prediction and Profit Optimization, Predictive Modeling of Big Data with Limited Memory, Twitter Information Diffusion.

Reference Books:

1. C.Charu Agarwal, "Data Mining : The Text Book ", Springer, 2015.
2. Han, Jiawei, Jian Pei, and Micheline Kamber, “Data mining: concepts and techniques”, 3rd Edition, Elsevier, 2011.
3. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2012.
4. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Content, and Usage Data”, 2nd Edition, Springer, 2011.
5. Christopher D.Manning, Prabhakar Raghavan and Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press. 2008.
6. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, 2007.
7. Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press, 2010.

3. DIGITAL IMAGE PROCESSING
20SPHDCS02

Module 1: Digital Image Processing: Origins of Digital Image Processing, Steps in Digital Image Processing, Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships between Pixels, Mathematical Tools used in Digital Image Processing.

Module 2: Image Transformation & Filters: Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filter, Sharpening Spatial Filters, Combining Spatial Enhancement methods, Fuzzy techniques for Intensity Transformation and Spatial Filtering. Fuzzy Similarity Measure, Measure of Fuzziness, and Entropy, Thresholding Detection in Fuzzy Images, Fuzzy Match-based Region Extraction, Fuzzy Edge Detection, Fuzzy Content-Based Image Retrieval. Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transforms of Sampled Functions, The Discrete Fourier Transform (DFT), Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Sharpening using Frequency Domain Filters, Selective Filtering.

Module 3: Image Restoration, Reconstruction and Image Segmentation: Image Degradation/ Restoration process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Functions, Inverse Filtering, Wiener Square Error Filtering, Constrained Least Square Filtering, Geometric Mean Filter, Image Reconstruction from Projections. Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation.

Module 4: Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Full Color Image Processing, Color Transformation, Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images. Wavelets and Multiresolution Processing: Multiresolution Expansion, Wavelet Transforms in One Dimension, The Fast Wavelet Transforms, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Basic Compression Methods, Digital Image Watermarking.

Module 5: Morphological Image Processing: Erosion and Dilation, Opening and Closing, The Hit-Or-Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology. Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Relational Descriptors. Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

Reference Books:

1. Rafael C Gonzalez and Richard E. Woods, *Digital Image Processing*, PHI, 2005.
2. S. Sridhar, *Digital Image Processing*, Oxford University Press India, 2011.
3. A.K. Jain, *Fundamentals of Digital Image Processing*, Pearson, 2004.
4. Scott E. Umbaugh, *Digital Image Processing and Analysis*, CRC Press, 2014.
5. S. Jayaraman, S. Esakkirajan, T. Veerakumar, *Digital Image Processing*, McGrawHill, 2013.
6. Anthony Scime, *Web Mining Applications and Techniques*, Idea Group Publishing, 2005.

4. ADVANCED NETWORKING
20SPHDCS03

Module 1: Telecommunication systems: GSM services – subsystem – system architecture - Handover - DECT system architecture – TETRA – UMTS system architecture – UTRAN – CDMA2000 - GPRS : system architecture – 802.11 system architecture - Bluetooth system architecture – IrDa protocol – ZigBee architecture – HSPA.

Module 2: ADHOC Wireless Network : Ad Hoc Wireless Network –MAC protocol – issues in MAC protocol – Routing protocols – issues in Routing protocol - Transport Layer Protocol -issues in transport protocol - QOS – Energy Management – Security in Adhoc network.

Module 3: Wireless Sensor Network : Architecture and Design – Medium Access Control – Routing – Transport Layer – power management – sensor localization – clock synchronization - Energy model Issues in wireless sensor network.

Module 4: LTE and Advanced LTE pro – network architecture and interface – FDD air interface and radio network TD LTE air interface – network sharing – MOCN – MORAN - LTE security architecture – scheduling - VoLTE –VoWifi – Mission critical communication.

Module 5: 5G Technologies – overview – Non Orthogonal Multiple Access for 5G Systems Millimeter Wave Communications for 5G Networks – Visible Light Communication in 5G – Massive MIMO Scheduling Protocols – Cellular 5G Access for Massive Internet of things.

Reference Books:

1. Jochen Schiller , *Mobile Communication*, Pearson, Second Edition, 2009.
2. Fei Hu and Xiaojun Cao, *Wireless Sensor Networks Principles and Practice*, CRC Press, 2010.
3. C. Siva Ram Murthy and B.S. Manoj, *Ad Hoc Wireless Networks – Architectures and Protocols*, Pearson Education, Second Edition
4. Martin Sauter, *From GSM to LTE Advanced PRO and 5G – An Introduction to Mobile Network and Mobile Broadband*, Third edition, Wiley, 2017.
5. Vinod W Wrong , Robert Schober, Derrick Wing Kwanng mLi Chun Wang, *Key Technologies for 5G Wireless Systems*, Cambridge University Press, 2017