OPERATIONS RESEARCH

Subject Code	
:	
	06CS661
IA Marks	
:	
25	
No. of Lecture Hrs./ Week	
:	
04	
Exam Hours	
:	

03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

UNIT - 1

INTRODUCTION, LINEAR PROGRAMMING – 1: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation.

Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

6 Hours

UNIT - 2

LP – 2, SIMPLEX METHOD - 1: Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; The simplex method in tabular form; Tie breaking in the simplex method.

7 Hours

UNIT - 3

SIMPLEX METHOD - 2: Adapting to other model forms; Post optimality analysis; Computer im plementation.

Foundation of the simplex method.

6 Hours

UNIT - 4

SIMPLEX METHOD - 2, DUALITY THEORY: The revised simplex method, a fundamental insight. The essence of duality theory; Economic interpretation of duality. Primal dual

relationship; Adapting to other primal forms.

7 Hours

PART - B

UNIT - 5

DUALITY THEORY AND SENSITIVITY ANALYSIS, OTHER ALGORITHMS FOR LP: The role of duality in sensitive analysis; The essence of sensitivity analysis; Applying sensitivity analysis. The dual simplex method; parametric linear programming; The upper bound technique.

7 Hours

UNIT - 6

TRANSPORTATION AND ASSIGNMENT PROBLEMS: The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.

7 Hours

UNIT - 7

GAME THEORY, DECISION ANALYSIS: Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions. Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

6 Hours

UNIT - 8

METAHEURISTICS: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

6 Hours

TEXT BOOK:

1. **Introduction to Operations Research** – Frederick S. Hillier and Gerald J. Lieberman – 8th Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. **Operations Research Applications and Algorithms** – Wayne L. Winston – 4th Edition, Thomson Course Technology, 2003.

2. **Operations Research: An Introduction** – Hamdy A Taha – 8th Edition, Prentice Hall India, 2007.

SIGNALS AND SYSTEMS

Subject Code		
:		
	06CS662	

IA Marks
:

25

No. of Lecture Hrs./ Week

:

04

Exam Hours

:

03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

UNIT - 1

INTRODUCTION: Definitions of a signal and a system; Classification of signals; Basic operations on signals; Elementary signals.

7 Hours

UNIT - 2

SYSTEMS, TIME-DOMAIN REPRESENTATIONS – 1: Systems viewed as interconnections of operations; Properties of systems; Convolution; Impulse response representation; Properties of impulse response representation.

7 Hours

UNIT - 3

TIME DOMAIN REPRESENTATION – 2: Differential and difference equation representations; Block diagram representations.

6 Hours

UNIT - 4

FOURIER REPRESENTATION – 1: Fourier representation: Introduction; Fourier representations for four signal classes; Orthogonality of complex sinusoidal signals.

6 Hours

PART - B

UNIT - 5

FOURIER REPRESENTATION –2: DTFS representations; Continuous-tine Fourier-series representations; DTFT and FT representations; Properties of Fourier representations.

6 Hours

UNIT - 6

APPLICATION OF FOURIER REPRESENTATIONS – 1: Frequency response of LTI systems; Solution of differential and difference equations using system function.

7 Hours

UNIT - 7

APPLICATIONS OF FOURIER REPRESENTATIONS – 2: Z-TRANSFORMS – 1: Fourier transform representations for periodic signals; Sampling of continuous time signals and signal reconstruction. Introduction to Z-transform; Properties of ROC; Properties of Z-transforms; Inversion of Z-transforms.

7 Hours

UNIT - 8

Z – TRANSFORMS – 2□□□□ : Transforms analysis of LTI systems; Transfer function; Stability and causality; Unilateral Z-transforms and its application to solve difference equations.

6 Hours

TEXT BOOK:

1. **Signals and Systems** – Simon Haykin and Barry Van Veen:, John Wiley and Sons, 2001, Reprint 2002.

REFERENCE BOOKS:

1. **Signals and Systems** – Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab – Pearson Education Asia, 2nd edition, 1997, Indian reprint 2002.
2. **Signals and Systems** – Dr. D.ganesh Rao and Satish Tunga – A Simplified Approach, Sanguine Technical Publishers, 2003-04.

DATA COMPRESSION

Subject Code		
:		
	06CS663	

IA Marks	
:	

25

No. of Lecture Hrs./ Week

:

04

Exam Hours

:

03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

UNIT - 1

INTRODUCTION, LOSSLESS COMPRESSION –1: Compression techniques; Modeling and coding. Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle. Huffman coding: Overview; The Huffman coding algorithm, Minimum variance

Huffman codes; Application of Huffman coding for text compression.

7 Hours

UNIT - 2

LOSSLESS COMPRESSION – 2: Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42. Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresoution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

6 Hours

UNIT - 3

BASICS OF LOSSY CODING: Some mathematical concepts: Overview; Introduction; Distortion criteria; Models.Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.

6 Hours

UNIT - 4

VECTOR QUANTIZATION, DIFFERENTIAL ENCODING: Vector quantization: Overview; Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm. Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.

7 Hours

PART - B

UNIT - 5

SOME MATHEMATICAL CONCEPTS, TRANSFORM CODING: Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z-transform. Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT.

7 Hours

UNIT - 6

SUBBAND CODING, AUDIO CODING: Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression. Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.

6 Hours

UNIT - 7

WAVELET-BASED COMPRESSION: Overview; Introduction; Wavelets; Multiresolution and the scaling function; Implementation using Filters; Image compression; Embedded zerotree coder;

Set partitioning in hierarchical trees; JPEG 2000.

6 Hours

UNIT - 8

VIDEO COMPRESSION: Overview; Introduction; Motion compensation; Video signal representation; H.261; Model-based coding; Asymmetric applications; MPEG-1 and MPEG-2; H.263; H.264, MPEG-4 and advanced video coding; Packet video.

7 Hours

TEXT BOOK:

1. **Introduction to Data Compression** – Khalid Sayood:, 3rd Edition, Elsevier, 2006.

REFERENCE BOOK:

1. **The Complete Reference** – D. Salomon: Data Compression:, Springer, 1998.

PATTERN RECOGNITION

Subject Code		
:		
	06CS664	

IA Marks
:
25

No. of Lecture Hrs./ Week
:
04

Exam Hours
:
03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

UNIT - 1

INTRODUCTION: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

6 Hours

UNIT - 2

BAYESIAN DECISION THEORY: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

7 Hours

UNIT - 3

MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

7 Hours

UNIT - 4

NON-PARAMETRIC TECHNIQUES: Introduction; Density Estimation; Parzen windows; k_n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

6 Hours

PART - B

UNIT - 5

LINEAR DISCRIMINANT FUNCTIONS : Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

7 Hours

UNIT - 6

STOCHASTIC METHODS: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

6 Hours

UNIT - 7

NON-METRIC METHODS: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

6 Hours

UNIT - 8

UNSUPERVISED LEARNING AND CLUSTERING: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

7 Hours

TEXT BOOK:

1. **Pattern Classification** – Richard O. Duda, Peter E. Hart, and David G.Stork:, 2nd Edition, Wiley-Interscience, 2001.

REFERENCE BOOK:

1. **Pattern Recognition and Image Analysis** – Earl Gose – Richard Johnsonbaugh, Steve Jost – Pearson Education, 2007.

STOCHASTIC MODELS AND APPLICATIONS

Subject Code

:

	06CS665	

IA Marks

:

25

No. of Lecture Hrs./ Week

:

04

Exam Hours

:

03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

UNIT - 1

INTRODUCTION - 1: Axioms of probability; Conditional probability and independence; Random variables; Expected value and variance; Moment-Generating Functions and Laplace Transforms; conditional expectation; Exponential random variables.

6 Hours

UNIT - 2

INTRODUCTION - 2: Limit theorems; Examples: A random graph; The Quicksort and Find algorithms; A self-organizing list model; Random permutations.

6 Hours

UNIT - 3

PROBABILITY BOUNDS, APPROXIMATIONS, AND COMPUTATIONS: Tail probability inequalities; The second moment and conditional expectation inequality; probability bounds via the Importance sampling identity; Poisson random variables and the Poisson paradigm; Compound Poisson random variables.

7 Hours

UNIT - 4

MARKOV CHAINS: Introduction; Chapman-Kologorov Equations; Classification of states; Limiting and stationary probabilities; Some applications; Time-Reversible Markov Chains; Markov Chain Monte Carlo methods.

7 Hours

PART - B

UNIT - 5

THE PROBABILISTIC METHOD: Introduction; Using probability to prove existence; Obtaining bounds from expectations; The maximum weighted independent set problem: A bound and a ranom algorithm; The set covering problem; Antichains; The Lovasz Local lemma; A random algorithm for finding the minimal cut in a graph.

6 Hours

UNIT - 6

MARTINGALES: Martingales: Definitions and examples; The martingale stopping theorem; The Hoeffding-Azuma inequality; Sub-martingales.

6 Hours

UNIT - 7

POISSON PROCESSES, QUEUING THEORY - 1: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times. Queuing Theory: Introduction; Preliminaries; Exponential models.

7 Hours

UNIT - 8

QUEUING THEORY - 2: Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

7 Hours

TEXT BOOK:

1.□□□□□□ Probability Models for Computer Science – Sheldon M. Ross:, Elsevier, 2002.

REFERENCE BOOKS:

1. **Stochastic Models Analysis and Applications** – B. R. Bhat:, New Age International, 2000.

2. **Probability and Random Processes with Applications to Signal Processing and Communications** – Scott L. Miller, Donald G. Childers:, Elsevier, 2004.