UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)
(Uttarakhand Act No. 11 of 2013)
Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced Information Security Systems		

Objectives of the Course: After the completion of the course, the students will be able to-:

1. To develop basic understanding of security, cryptography, system attacks and defenses against them.
2. Will gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath

UNIT 1	**Cryptography**	**Total Topics- 10 and Hours**: **8 L**

Basic Concepts, Cryptosystems, Crypto-Analysis, Ciphers & Cipher Modes, DES, AES, RSA algorithm, Key Management Protocols, Diffie Hellmann Algorithm, Digital Signatures, Message Digest, Secure Hash Algorithms, Public Key Infrastructure.

UNIT II	**Information Theory**	**Total Topics- 10 and Hours**: **8 L**

Basic of Probability & Statistics, Shannon Characteristics, Perfect Secrecy, Confusion and Diffusion, Information Theoretic Tests, Unicity Distance, Entropy, Floating Frequency, Histogram, Autocorrelation, Periodicity, Random Analysis Tests, Zero Knowledge Technique.

UNIT- III	**Mathematical Security**	**Total Topics- 10 and Hours**: **8 L**

Basic Number Theory, Congruence, Chinese Remainder Theorem. Finite Fields, Discrete Logarithm, Bit Commitment, Random Number Generation, Inverses, Primes, Greatest Common Divisor, Euclidean Algorithm, Modular Arithmetic, Properties of Modular Arithmetic, Computing the inverse, Fermat's Theorem, Algorithm for Computing Inverses, NP-Complete Problems, Characteristics of NP- Complete Problems, Meaning of NP-Completeness, NP-Completeness and Cryptography.

UNIT-IV	**Network Security**	**Total Topics- 10 and Hours**: **8 L**

Network Threats, Authentication & Access Control Mechanism, Secured Communication Mechanisms, Biometric, Secured Design for LAN, Firewall, Intrusion Detection System, Virtual Private Network, Email and Web Security. WEP, Access Controls, Secure Socket Layer, IPSEC, WAP Security, Security Issues, Challenges &Defense Mechanisms for Bluetooth, GSM, CDMA, GPRS, Wi-Fi, Wi- Max & IEEE Standards.

- **CS-104 (1).CO1**: To understand the crypto system and concept of crypto analysis.
- CS-104(1).CO2: To implement the use of probability &statistics in Information Systems
- CS-104(1).CO3: To understand the number theory.
- CS-104(1).CO4: To be familiar with prevalent network and distributed system attacks, defences

against them and forensics to investigate.

Reference Books:

1. Security in Computing, Charles P. Pfleeger, Prentice- Hall International, Inc.,
2. Applied Cryptography Protocols, Algorithms, and Source Code in C, Bruce Schneier, John Wiley & Sons, Inc., 1995.
3. Digital Certificates Applied Internet Security", Jalal Feghhi, JalliFeghhi and PeterWilliams, Addison Wesley Longman.
4. Introduction to Cryptography with Coding heory, Wade Trppe, Lawrence C., Washington, Pearson Education.
5. Network Security, Compete Reference, Tata Mc-Graw Hill.

Course Outcomes:

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (i)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Digital Image Processing		

Objectives of the Course: After the completion of the course, the students will be able to-:
1.Enhance the quality of images using frequency and spatial domain techniques.
2. Represent image using chain codes, linear signature, shape number, Fourier, moments, regional, texture, relational descriptors**.**

UNIT 1	**Introduction and Fundamentals**	**Total Topics- 10 and Hours**: **8 L**

The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Components of an Image Processing Systems, Image Acquisition, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

UNIT II	**Image Enhancement in Spatial Domain & Frequency Domian**	**Total Topics- 10 and Hours**: **8 L**

Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Introduction to Fourier Transform and the frequency Domain, Properties of 2-D Fourier Transform, Smoothing and Sharpening Frequency Domain Filters,

UNIT- III	**Image Restoration & Compression**	**Total Topics- 10 and Hours**: **8 L**

A model of The Image Degradation / Restoration Process, Noise Models, Mean Filters, Order-Statistics Filters, Adaptive Filters, Bandreject Filters, Bandpass Filters, Notch Filters, Minimum Mean Square Error (Wiener) Filtering, geometric mean Filter, Inverse Filtering, Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free compression, Lossy compression, Image compression standards.

UNIT-IV	**Image Segmentation & Object Recognition**	**Total Topics- 10 and Hours**: **8 L**

Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation. Patterns and Pattern Classes, Minimum Distance Classifier, matching by Correlation, Bayes Classifier

Course Outcomes:

- CS-104(2):CO1: To understand the origins of Digital Image Processing

- CS-104(2):CO2: To understand and implement the Image Enhancement in Spatial Domain & Frequency Domain
- CS-104(2):CO3: To understand and implement Image Restoration & Compression
- CS-104(2):CO4: To understand and implement Image Segmentation & Object Recognition

Reference Books :

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003
3. RosefieldKak, "Digital Picture Processing". 199

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (ii)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Neural Network		

Objectives of the Course: After the completion of the course, the students will be able to-:

1. Grasp the neural networks for pattern classification and association.

2. Acquire the basic concepts of competition-based neural nets.

UNIT 1	**Neuron Model and Network Architectures**	**Total Topics- 10 and Hours: 8 L**

Objectives, History, Applications, biological inspiration, Neuron Model, Transfer Functions, Network Architectures.

UNIT II	**Learning Rules**	**Total Topics- 10 and Hours: 8 L**

Perception Learning: Learning Rules, Perceptron Architecture, Perceptron Learning Rule, Training Multiple Neuron Perceptrons. Unsupervised Learning. Supervised Hebbian Learning: The Hebb Rule, Performance Analysis, Application, Variations of Hebbian Learning.

UNIT- III	**Transformations & Optimization**	**Total Topics- 10 and Hours: 8 L**

Linear Vector Spaces, Spanning a Space, Inner Product, Norm, Orthogonality, Vector Expansions, Linear Transformations, Matrix Representations, Change of Basis, Eigenvalue and Eigenvectors. Performance surfaces and Optimization: Taylor Series, Directional Derivatives, Necessary Condition for Optimality, Quadratic Functions, Optimization Techniques; Steepest Descent, Newton's method, Conjugate Gradient Method.

UNIT-IV	**Back propagation & Competitive Networks**	**Total Topics- 10 and Hours: 8 L**

The Backpropagation Algorithm; Performance Index, Chain Rule, Example, Drawbacks of Backpropagation, Heuristic Modifications; Momentum, Conjugate Gradient, Levenberg-Marquardt Algorithm. Associative Learning and Competitive Networks: Simple Associative Network, Unsupervised Hebb Rule, Kohonen Rule, Competitive Learning Rule, Self Organizing Feature Maps.

Course Outcomes:

- CS-104(3):CO1:To understand and implement the Neuron Model and Network Architectures
- CS-104(3):CO2:To understand and implement the Learning Rules
- CS-104(3):CO3:To understand and implement the Transformations & Optimization
- CS-104(3):CO4:To design and implement the Back propagation & Competitive Networks

Reference Books

1. M.T.Hagan, H.B.Demuth and M.Beale, "Neural Network Design" Thomson Learning, 2002
2. Simon Haykin, "Neural Networks – A Comprehensive Foundation," 2nd Edition, Pearson Education, 1999.

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (iii)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advance Topics In Database Systems		

Objectives of the Course: After the completion of the course, the students will be able to-:

1. To provide students with knowledge of database transaction processing, concurrency control and recovery from database failure.
2. To expose students to advance topics and techniques those have promising research directions.

UNIT 1	**Indexing**	**Total Topics- 10 and Hours**: **8 L**

Types of Single-Level Ordered Indexes, Multilevel Indexes, Dynamic Multilevel Indexes Using B-trees and B+-trees

UNIT II	**Concurrency control**	**Total Topics- 10 and Hours**: **8 L**

Locking Techniques for Concurrency Control, Concurrency Control Techniques Based on Timestamp Ordering

UNIT- III	**Transactions Processing**	**Total Topics- 10 and Hours**: **8 L**

Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules.

UNIT-IV	**Parallel & Distributed databases**	**Total Topics- 10 and Hours**: **8 L**

I/O parallelism, inter query parallelism, intra-query parallelism, interoperation parallelism, Design of parallel systems, Distributed data storage, Network transparency, Distributed query processing, Distributed transaction model, commit protocols, coordinator selection, concurrency control, deadlock handling.

Reference Books:

1. Database System Concepts by A. Silberschatz, H.F.Korth and S.Sudarshan, 3rd edition, 1997, McGraw-Hill and International Edition.
2. Fundamentals of Database Systems by R.Elmasri and S.B.Navathe, 3rd edition.
3. An Introduction to Database Systems by C.J.Date, 7th edition, Addison-Wesley, Low Priced Edition, 2000
4. Database Management and Design by G.W Hansen, 2nd edition, 1999, Prentice- Hall of India,

Eastern Economy Edition.
5. Database Management Systems by A,.K.Majumdar and P.Bhattacharyya.5th edition, 1999, Tata McGraw-Hill Publishing.

Course Outcomes:

- CSE-104(4):CO1: To provide the students with knowledge of advanced databases for transaction processing, concurrency control and recovery.
- CSE-104(4):CO2: To expose students to advance topics and techniques those have promising research directions in area of advanced database systems.
- CSE-104(4):CO3: To understand and implement the Concurrency control in database.
- CSE-104(4):CO4:To understand and implement the Transactions Processing in Parallel & Distributed databases