Master of Technology - Network & Cyber Security

Syllabus - First Semester

ADVANCED DATA STRUCTURES&ALGORITHMS

Course Code: NCE4101   **Credit Units: 03**

Course Objective:
The objective to this course is to equip students with advanced concepts of data structures like Huffman trees, Self organizing trees, different types of heaps and their time complexity. Advanced topics and graphs and graph algorithms, geometric algorithms and parallel algorithms.

Course Contents:
Module-I:ADVANCED TREES: Definitions Operations on Weight Balanced Trees (Huffman Trees), 2-3 Trees and Red- Black Trees, Splay Tree.Augmenting Red-Black Trees to Dynamic Order Statistics and Interval Tree Applications. Operations on Disjoint sets and itsunion-find problem Implementing Sets. Dictionaries, Priority Queues and Concatenable Queues using 2-3 Trees.

Module-II: MERGEABLE HEAPS: Mergeable Heap Operations, Binomial Trees Implementing Binomial Heaps and itsOperations, 2-3-4. Trees and 2-3-4 Heaps. Amortization analysis and Potential Function of Fibonacci HeapImplementing Fibonacci Heap. SORTING NETWORK: Comparison network, zero-one principle, bitonic sorting andmerging network sorter.

Module-III: GRAPH THEORY DEFINITIONS: Definitions of Isomorphic Components. Circuits, Fundamental Circuits, Cut-sets. Cut-Vertices Planer and Dual graphs, Spanning Trees, Kuratovski's two Graphs.

Module-IV: GRAPH THEORY ALGORITHMS: Algorithms for Connectedness, Finding all Spanning Trees in a Weighted Graph andPlanarity Testing, Breadth First and Depth First Search, Topological Sort, Strongly Connected Components and ArticulationPoint. Single Min-Cut Max-Flow theorem of Network Flows. Ford-Fulkerson Max Flow Algorithms

Module-V: Geometric algorithms: Point location, convex hulls and Voronoi diagrams, Arrangements. Parallelalgorithms: Basic techniques for sorting, searching, merging

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
• RivestCormen, "Introduction to Algorithms";PHI
References:
• Tammasia, "Algorithm Design", Willey

ADVANCED DATABASE MANAGEMENT SYSTEMS

Course Code: NCE4102   **Credit Units: 03**

Course Objective:
The objective of this course is to expose the students to the implementation techniques of database system. This course explains techniques for query processing and optimization with transaction and concurrency control techniques

Course Contents:

Module I: Relational Databases
Integrity Constraints revisited, Extended ER diagram, Relational Algebra & Calculus, Functional, Muiltivalued and Join Dependency, Normal Forms, Rules about functional dependencies.

Module II: Query Processing and Optimization
Valuation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.
Objected Oriented and Object Relational Databases
Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Module III: Parallel and Distributed Databases
Distributed Data Storage – Fragmentation & Replication, Location and Fragment
Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.
Advanced Transaction Processing
Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors.

Module IV
Multimedia databases,Databases on the Web and Semi–Structured Data
Case Study: Oracle Xi

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

*Text***:**
- Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4th Edition, Pearson Education, 2007
- Garcia, Ullman, Widom, "Database Systems, The complete book", PearsonEducation, 2007
- R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998

*References***:**

- Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
- Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
- Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
- W. Kim, "Modern Database Systems", 1995, ACM Press, Addision – Wesley,
- D. Maier, "The Theory of Relational Databases", 1993, Computer Science Press, Rokville, Maryland
- Ullman, J. D., "Principals of database systems", Galgotia publications, 1999
- Oracle Xi Reference Manual
- Dietrich, and Urban, "An Advanced Course in Database Systems", Pearson, 2008.

DIGITAL COMPUTER ORGANIZATION

Course Code: NCE4103   **Credit Units: 03**

Course Objective:
The Objective of this course is to expose the students to the fundamentals and the concepts of Digital & Computer Organization and Representation of Information and Basic Building Blocks, Basic Organization, Memory Organization, Input-Output Organization, Processor Organization etc. This course is designed to understand the concepts of Computer Organization for Research & Development as well as for application.

Course Contents:
Module I: Representation of Information and Basic Building Blocks
Overview of Computer hardware generation, Number Systems, Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC), Logic gates, Boolean algebra, K-map Simplification, Half adder, Full adder, Decoders, Multiplexes, Binary Counters, Flip/Flops, Registers, Counters (Synchronous & Asynchronous), ALU, Micro-Operation, ALU-chip, Faster Algorithm and Implementation (multiplication & Division).

Module II: Basic Organization
Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired and Micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing Modes, Instruction Formats, Data transfer & Manipulation, I/O organization, Bus Architecture, Programming Registers.

Module III: Memory Organization
Memory hierarchy, Main Memory (RAM/ROM chips), Auxiliary memory, Associative memory, Virtual memory, Cache memory, Memory management hardware, hit/miss ratio, Magnetic disk and its performance, Magnetic Tapes etc.

Module IV: Input-Output organization
Peripheral devices, I/O interface, Direct memory access, Modes of transfer, Priority Interrupt, I/O Processors, Serial Communication, Asynchronous data transfer, Strobe Control, Handshaking, I/O Controllers.

Module V: Processor Organization
Basic Concept of 8/16-bit microprocessor (8085/8086), Assembly Instruction Set, Assembly Language Program of 8085/8086: Addition of two numbers, Subtraction, Block Transfer, Find greatest number, Table search, Numeric manipulation, Introductory Concept of pipeline, Flynn's Classification, Parallel Architectural classification.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- Computer System Architecture: M. Mano (PHI Publication)
- William Stalling, "Computer Organization & Architecture", Pearson education Asia.
- B. Ram, "Computer Fundamental Architecture & Organization" New Age.

References:
- Computer Organization: Vrarsie, Zaky&Hamacher (TMH Publication).
- Tannenbaum, "Structured Computer Organization", PHI.

ADVANCED COMPUTER NETWORKS

Course Code: NCE4104   **Credit Units: 03**

Course Objective:
The objective of the course is to provide thorough understanding & in-depth knowledge of concepts in computer networks Such as Internet protocols and routing, local area networks, wireless communications and networking, performance analysis, congestion control, TCP, network address translation, multimedia over IP, switching and routing, mobile IP, multicasting, IPv6. Peer-to-peer networking, network security, and other current research topics. A focus will be placed on wireless networking, reflecting rapid advances in this area. This course motivates the students to explore current research areas in the same field.

Course Contents:

Module I
Uses computer networks, Reference Models, TCP/IP suite of protocols, MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)Fast access technologies. (For example, ADSL, Cable Modem, etc.)

Module II:
Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, Internet Working, Network Layer in Internet.
IPv6 basic protocol, extensions and options, support for QoS, security, etc., Changes to other protocols, Application Programming Interface for IPv6.

Module III
Mobile IP, IP Multicasting. Multicast routing protocols, address assignments, session discovery, etc.

Module IV
The Transport Protocol: The Transport Service, Elements of transport protocol, a simple Transport Protocol, Internet Transport Protocols UDP, Internet Transport Protocols TCP, TCP extensions for high-speed networks, transaction-oriented applications Performance Issues.
The Application Layer: DNS-(Domain Name System), Electronic Mail, World Wide Web Multimedia.

Module V
Overview of network security, Secure-HTTP, SSL, ESP, Key distribution protocols. Digital signatures, digital certificates-mail Security, Web security, Social Issues.

Examination Scheme:

Components	A	CT	H	V/S/Q	EE
Weightage (%)	5	10	7	8	70

Text & References:

Text:
- Computer Networks - Andrew S Tanenbaum,4th Edition. Pearson Education/PHI
- Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

*References***:**
- Computer Communications and Networking Technologies –Michael A.Gallo, WilliamM .Hancock - Thomson Publication.
- W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition,Prentice Hall, 1998.
- W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
- C. E. Perkins, B. Woolf, and S. R. Alpert. Mobile IP: Design Principles and Practices,Addison Wesley, 1997.

ADVANCE DATA STRUCTURE& ALGORITHMS LAB

Course Code: NCE4105   **Credit Units: 01**

Programs based on Implementation of Graphs using Adjacency Matrix, Linked List , implementation of graph algorithms like BFS,DFS, Minimum Spanning Tree, Binary Search Tree, Knapsack Problem using Greedy Algorithm, Dynamic Programming, Shortest Path Algo (Dijkstra's), Implementing B-Tree,AVL Tree ,Red Black Tree. Implementing Sets, Dictionaries, Priority Queue using Heap.

Recommended Software: Java/C++/C/Python

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

MATLAB

Course Code: NCE4108   **Credit Units: 02**

Understanding The MATLAB Environment, Using the Help System in MATLAB, MATLAB Basics,Linear Algebra; Vectors and Matrices and various operations on them,   M files; Scripts and User-defined functions, Plotting, Flow Control and Loops; For and While Loops, If and Case statements, structures, writing basic programs using the above, study of various toolboxes available in matlab and case study of any one tool box.

Recommended Software: MATLAB/Octave

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

PYTHON PROGRAMMING LAB

Course Code: NCE4109   **Credit Units: 01**

1. Setting up python on Windows/Linux/Mac
2. First program in python
3. Programs related to basic input/ouput.
4. Programs related to variables,strings,numbers
5. Programs related to Lists and Tuples
6. Programs related to.Functions
7. Programs related toIf Statements
8. Programs related toWhile Loops and Input
9. Programs related toBasic Terminal Apps
10. Programs related toDictionaries
11. Programs related toClasses
12. Programs related to Exceptions
13. Programs related to GUI programming
14. Using Word, Excel, PDF files in python.
15. Web programming in python,
16. Case study of application areas of python.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ADVANCE DATABASE MANAGEMENT SYSTEMS LAB

Course Code: NCE4106   **Credit Units: 01**

Programs should be based on following topics:
Quick Review of Simple SQL Statements, SQL Built-in Functions ,Primary Key, Foreign Key,Normalization,Joins   View, Union. **Emphasis** on PL/SQL ,Cursors 8. Exception handling ,Procedure, Functions ,Trigger, concurrency control, transaction processing. Introduction to SQLite.
Recommended Software: PostGreSQL,MySQL, Oracle.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ADVANCED COMPUTER NETWORK LAB

Course Code: NCE4107   **Credit Units: 01**

1. Study of different types of networking cables, and implement cross and straight cable using clamping tool
2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
3. Study of Socket Programming and Client

4. Write a code simulating ARP /RARP protocols.

5. Write a code simulating PING and TRACEROUTE commands

6. Create a socket for HTTP for web page upload and download.

7. Write a program to implement RPC (Remote Procedure Call)

8. Implementation of Subnetting

9. Applications using TCP Sockets like Echo client and echo server, Chat Server, File Transfer, Applications using TCP and UDP Sockets ,DNS,SNMP

10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS.

11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer Link State routing, Flooding, Distance vector.

Recommend Software: C/C++ on Linux/Unix, NS, Packet Tracer

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

MATHEMATICAL FOUNDATIONS FOR CYBER SECURITY

Course Code: NCE4201   **Credit Units: 03**

Course Contents:

Module-I: Integer arithmetic, modular arithmetic, matrices,Linear Congruence: Definition – Basic properties of congruence,Divisibility - Greatest common divisor, equivalence classes, residue classes.

Module-II: Primes, primality testing, factorization, Chinese remainder theorem, quadratic congruence, exponentiation and logarithm.

Module-III: Algebraic structures: groups, fields, rings, Modulo groups - Primitive roots - Discrete logarithms. Finite fields – GF (p), $GF(2^n)$ – polynomial arithmetic

Module-IV: SHANNON'S THEORY: Introduction, Elementary Probability Theory, Perfect Secrecy, Entropy, Properties of Entropy, Spurious Keys & Unicity distance, Product Cryptosystems

Module-V: PSEUDORANDOM NUMBER GENERATION: Introduction and examples Indistinguishability ofProbability Distributions - Next Bit Predictors - The Blum-Blum-Shub Generator – Security of theBBS Generator.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- "Cryptography & Network Security", William stallings,PHI,4th Edition.
- "Cryptography & Network Security", Behrouz A. Forouzan, PHI,2nd Edition.
- "Cryptography Theory & Practice", Douglas R. Stinson, Chapman & Hall, 3rd Edition

NETWORK AND WIRELESS SECURITY

Course Code: NCE4202   **Credit Units: 03**

Course Contents:

Module-I: INTRODUCTION: Network concepts – Threats in networks – Network security controls – Importance ofsecurity – Threat models – Security concepts – Common mitigation methods
Why is Wireless Different? Introduction ,Protecting the Means Of Communication Protecting Privacy, Promoting Safety ,The Personal and the Public ,Shaking Up the Status Quo ,Understanding Wireless Forecasts ,Reasonable Degrees of Security, Regulatory Environments and Issues ,Security-Related Regulations ,Security Related Market Factors, Guidelines for Security Measures, Cellular Networks and Bearer Technologies ,First-Generation Wireless (1G), Second-Generation Wireless (2G), Spread Spectrum ,Code Division Multiple Access (CDMA) ,Time Division Multiple Sccess (TDMA) ,Global System for Mobile Communications (GSM) ,Third-Generation Wireless (3G) ,Short Message Service (SMS) ,Fourth-Generation Wireless (4G)

Module-II: The Wireless Local Area Network (WLAN) : Wireless Transmission Media ,Infrared Systems ,Narrowband Radio Systems ,Wideband Radio Systems: SpreadSpectrum ,Frequency-Hopping Spread Spectrum (FHSS) ,Direct-Sequence Spread Spectrum (DSSS) ,WLAN Products and Standards— Today's Leaders? ,802.11 Security? ,IEEE 802.11b ,Securing WLANs ,Eavesdropping ,Unauthorized Access ,Interference and Jamming ,Physical Threats ,Countermeasures ,Frequency-Hopping Spread Spectrum (FHSS), Direct-Sequence Spread Spectrum (DSSS) ,Infrared (IR) ,Narrowband ,The Infamous WEP ,Encryption ,Authentication ,Wired Equivalency Protocol Flaws Too Public ,Other Authentication Techniques ,Physical Security.

Module-III: Wireless Application Protocol(WAP): Comparison of the TCP/IP, OSI, and WAP Models, How WAP Works ,The Security Status of WAP ,Viruses ,Authorization ,Non-repudiation ,Authentication ,Secure Sessions ,Security Products ,Securant Technologies ClearTrust Control ,WAP Security Architecture ,Marginal Security ,Wireless Access to the Internet ,Wireless Middleware

Module-IV: Wireless Transport Layer Security (WTLS): Secure Socket Layer, Record Protocol, SSL Handshake Protocol ,Transport Layer Security, Advantages and Disadvantages of SSL/TLS ,Netscape ,Microsoft ,Entrust ,EAP-TLS ,Alternatives to SSL/TLS ,IP Security (IPSec) ,Authentication Header Protocol (AH) ,Encapsulating Security Payload (ESP) ,Transport and Tunnel Modes, Secure Shell (SSH) ,SSH Transport Layer Protocol ,SSH Versus TLS Implementations ,Light Extensible Authentication Protocol (LEAP) ,Wireless Transport Layer Security and WAP ,Understanding Wireless Transport Layer Security ,WTLS Handshake Protocol ,WTLS Alert Protocol ,WTLS Change Cipher Protocol ,Pros and Cons of WTLS ,WTLS Vulnerabilities ,Implementations of WTLS

Module-V: Bluetooth Security: Bluetooth Basic Specifications ,Bluetooth Technology, Bluetooth Specification Development ,Design Decisions ,Piconets ,Bluetooth Security Architecture ,Scatternets ,The Bluetooth stack ,Security Functions at the Baseband Layer ,Security Functions of the Service Discovery Protocol ,Security Functions at the Link Layer ,Frequency-Hopping ,Channel Establishment ,Security Manager ,Authentication,Authentication with the SAFER1 Block Cipher ,Encryption ,Encryption Modes ,Key Length Negotiation ,Encryption With the E0 Stream Cipher ,Threats to Bluetooth Security ,Jamming ,Bluetooth holes

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- Nichols and Lekka, "Wireless Security-Models, Threats and Solutions", Tata McGraw – Hill, New Delhi, 2006.
- Charles P. Fleeger, "Security in Computing", Prentice Hall, New Delhi, 2009
- Merritt Maxim and David Pollino, "Wireless Security", Osborne/McGraw Hill, New Delhi, 2005.

CYBER CRIME AND IT LAW

Course Code: NCE4203   **Credit Units: 03**

Course Contents:

Module-I: Power of Arrest Without Warrant Under the IT Act, 2000: A Critique
Crimes of this Millennium, Section 80 of the IT Act, 2000 – A Weapon or a Farce, Forgetting the Line Between Cognizable and Non-Cognizable Offences, Necessity of Arrest without Warrant from Any Place, Public or Otherwise, Checks and Balances Against Arbitrary Arrests, Arrest for "About to Commit" an Offence Under the IT Act: A Tribute to Draco, Arrest, But No Punishment!

Module-II: Unit 2: Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000
Concept of 'Cyber Crime' and the IT Act, 2000, Hacking, Teenage Web vandals, Cyber Fraud and Cyber cheating, Virus on the Internet, Defamation, Harassment and E-mail Abuse, Cyber Pornography, Other IT Act Offences, Monetary Penalties, Adjudication and Appeals Under IT Act, 2000, Network Service Providers, Jurisdiction and cyber Crimes, Nature of Cyber Criminality, Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications on Cyber Crime.

Module-III: Jurisdiction in the Cyber World
Questioning the Jurisdiction and Validity of the Present Law of Jurisdiction, Civil Law of Jurisdiction in India, Cause of Action, Jurisdiction and the Information Technology Act,2000, Foreign Judgments in India, Place of Cause of Action in Contractual and IPR Disputes, Exclusion Clauses in Contracts, Abuse of Exclusion Clauses, Objection of Lack of Jurisdiction, Misuse of the Law of Jurisdiction, Legal Principles on Jurisdiction in the United States of America, Jurisdictional Disputes W.R.T. the Internet in the United States of America.

Module-IV: Battling Cyber Squatters and copyright Protection in the Cyber World
Concept of Domain Name and Reply to Cyber Squatters, Meta-Tagging, Legislative and Other Innovative Moves Against Cyber Squatting, The Battle Between Freedom and Control on the Internet, Works in Which Copyright Subsists and Meaning of Copyright, Copyright Ownership and Assignment, Licence of Copyright, Copyright Term and Respect for Foreign Works, Copyright Infringement, Remedies and Offences, Copyright Protection of Content on the Internet; Copyright Notice, Disclaimer and Acknowledgement, Downloading for Viewing Content on the Internet, Hyper-linking and Framing, Liability of ISPs for Copyright violations in the Cyber World: Legal Developments in the US, Napster and its Cousins: A Revolution on the Internet but a Crisis for Copyright Owners, Computer Software Piracy.

Module-V: Protection of Cyber Consumers in India
Are Cyber consumers Covered Under the Consumer Protection Act, Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices, Instances of Unfair Trade Practices, Reliefs Under CPA, Beware Consumers, Consumer Foras, Jurisdiction and Implications on Cyber Consumers in India, Applicability of CPA to Manufacturers, Distributors, Retailers and Service Providers Based in Foreign Lands Whose Goods are Sold or Services Provided to a consumer in India.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- **"**Cyber Law Simplified" , VivekSood, TMH, 2001
- "Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives" Raghu Santanam, M. Sethumadhavan, Information Science Reference
- Cyberlaw – The Indian Perspective ByPavanDuggal, Saakshar Law Publications.
- Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997

CYBER CRIME INVESTIGATON & FORENSICS

Course Code: NCE4204   **Credit Units: 03**

Course Contents:

Module-I: Computer Forensics and Investigations as a Profession, Understanding : Computer Forensics ,Computer Forensics Versus Other Related Disciplines ,A Brief History of Computer Forensics, Understanding Case Law ,Developing Computer Forensics Resources ,Preparing for Computer Investigations, Understanding Law Enforcement Agency Investigations, Following the Legal Processes, Understanding Corporate Investigations, Establishing Company Policies, Displaying Warning Banners ,Designating an Authorized Requester, Conducting Security Investigations, Distinguishing Personal and Company Property ,Maintaining Professional Conduct.

Module-II: Understanding Computer Investigations: Preparing a Computer Investigation, An Overview of a Computer Crime ,An Overview of aCompanyPolicy Violation ,Taking a Systematic Approach ,Assessing the Case ,Planning Your Investigation ,Securing Your Evidence ,Procedures for Corporate High-Tech Investigations, Employee Termination Cases,InternetAbuse Investigations-mail Abuse Investigations, Attorney-Client Privilege Investigations, Media Leak Investigations, Industrial Espionage Investigations, Interviews and Interrogations in High-Tech Investigations ,Understanding Data Recovery Workstations and Software, Setting Up Your Workstation for Computer Forensics ,Conducting an Investigation, Gathering the Evidence ,Understanding Bit-stream Copies ,Acquiring an Image of EvidenceMedia,UsingProDiscoverBasic to Acquire a USB Drive ,Analyzing Your Digital Evidence, Completing the Case, Critiquing the Case

Module-III: Data Acquisition: Understanding Storage Formats for Digital Evidence, Raw Format, Proprietary Formats,Advanced Forensic Format ,Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions ,Using Acquisition Tools ,Windows XP Write-Protection with USB Devices, Acquiring Data with a Linux Boot CD,Capturing an Image with ProDiscover Basic ,Capturing an Image with Access Data FTK Imager ,Validating Data Acquisitions ,Linux Validation Methods, Windows Validation Methods ,Performing RAID Data Acquisitions ,Understanding RAID ,Acquiring RAID Disks ,Using Remote Network Acquisition Tools ,Remote Acquisition with ProDiscover,Remote Acquisition with EnCase Enterprise , Remote Acquisition with R-Tools R-Studio ,Remote Acquisition with WetStone Livewire, Remote Acquisition with F-Response ,Remote Acquisition with Runtime Software ,Using Other Forensics Acquisition Tools,SnapBackDatArrest ,NTI SafeBack,DIBS USA RAID ,Look Investigator I imager ,ASRData SMART ,Australian Department of DefencePyFlag,

Module-IV: Processing Crime and Incident Scenes : Identifying Digital Evidence, Understanding Rules of Evidence ,Collecting Evidence in Private-Sector Incident Scenes, Processing Law Enforcement Crime Scenes ,Understanding Concepts and Terms Used in Warrants ,Preparing for a Search ,Identifying the Nature of the Case, Identifying the Type of Computing System, Determining Whether You Can Seize a Computer, Obtaining a Detailed Description of theLocation,Determining Who Is in Charge, Using Additional Technical Expertise ,Determining the Tools You Need ,Preparing the Investigation Team, Securing a Computer Incident or Crime Scene ,Seizing Digital Evidence at the Scene ,Preparing to Acquire Digital Evidence, Processing an IncidentorCrime Scene ,Processing Data Centers with RAID Systems ,Using a Technical Advisor, Documenting Evidence in the Lab,Processing and Handling Digital Evidence ,Storing Digital Evidence, Evidence Retention and Media Storage Needs, Documenting Evidence ,Obtaining a Digital Hash, Reviewing a Case ,Sample Civil Investigation ,Sample Criminal Investigation ,Reviewing Background Information for a Case ,Identifying the Case Requirements, Planning the Investigation ,Conducting the Investigation: Acquiring Evidence withAccessData FTK

Module-V: Current Computer Forensics Tools: Evaluating Computer Forensics Tool Needs ,Types of Computer Forensics Tools ,Tasks Performed by Computer Forensics Tools, Tool Comparisons ,Other Considerations for Tools ,Computer Forensics Software Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools ,Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations,Using a Write-Blocker, Recommendations for a Forensic Workstation,Validating and Testing Forensics Software ,Using National Institute of Standards and Technology (NIST) Tools ,Using Validation Protocols

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
- Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw -Hill, New Delhi, 2006.
- Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.
- Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
- "Understanding Forensics in IT", NIIT Ltd, 2005.

INTRUSION DETECTION AND PREVENTION SYSTEM

Course Code: NCE4205   **Credit Units: 03**

Course Contents:

Module-I: Network Attacks: Attack Taxonomies,Probes: IPSweep and PortSweep, NMap , MScan, SAINT , Satan Privilege Escalation Attacks:Buffer Overflow Attacks, Misconfiguration Attacks , Race-condition Attacks , Man-in-the-Middle Attacks.Social Engineering Attacks**.** Denial of Service (DoS) and Distributed Denial of Service(DDoS) Attacks: Detection Approaches for DoS and DDoS Attacks **,** Prevention and Response for DoS and DDoS Attacks **,** Examples of DoS and DDoS Attacks. Worms Attacks **:**Modeling and Analysis of Worm Behaviors, Detection and Monitoring of Worm Attacks **,** Worms Containment**,** Examples of Well Known Worm Attacks. Routing Attacks:OSPFAttacks,BGP Attacks.

Module-II: Detection Approaches: Misuse Detection: Pattern Matching,Rule-based Techniques, State-based Techniques,Techniques based on Data Mining Anomaly Detection:Advanced Statistical Models,Rule based Techniques,BiologicalModels,Learning Models Specification-based Detection, Hybrid Detection

Module-III: Theoretical Foundation of Detection: Taxonomy of Anomaly Detection Systems, Fuzzy Logic, Bayes Theory, Artificial Neural Networks, Support Vector Machine (SVM), Evolutionary Computation, Association Rules, Clustering, Signal Processing Techniques Based Models, Comparative Study of Anomaly Detection Techniques.

Module-IV: Architecture and Implementation: Centralized, Distributed, Cooperative Intrusion Detection,Alert Management and Correlation: Data Fusion, Alert Correlation, Cooperative Intrusion Detection

Module-V: Evaluation Criteria & Intrusion Response: Accuracy, Performance, Completeness, Timely Response, Adaptation and Cost-Sensitivity, Intrusion Tolerance and Attack Resistance, Test, Evaluation and Data Sets.Response Type, Response Approach, Survivability and Intrusion Tolerance, case study of any commercial IDS.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques",Springer, 2010.
- Carl Enrolf, Eugene Schultz, Jim Mellander, "Intrusion detection and Prevention", McGraw Hill, 2004
- Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.
- AnkitFadia and MnuZacharia, "Intrusiion Alert", Vikas Publishing house Pvt., Ltd, 2007.
- Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

RESEARCH METHODOLOGY AND TECHNICAL REPORT WRITING

Course Code: NCE4206   **CreditUnits : 02**

Course Objectives:
The course will enhance scientific , technical and research writing skills and impart knowledge about various stages of research process, statistical analysis, statistical tests and their applications in statistical decision making.

Course Contents:

Module I: Introduction to research: Definition, motivation, need, objectives, significance and characteristics of research; types of research; steps in research process; planning a research proposal; literature review, web searching.

Module II: Population and sample, parameter and statistic, sampling and data collection, sampling design: steps, types, sample size, sampling methods, large and small samples, primary and secondary data, data processing and analysis. Sample surveys and questionnaire designing, scaling techniques.

Module III: Dependent and independent variables, univariate, bivariate and multivariate analysis, means-arithmetic, geometric and harmonic; measure of dispersion of data, standard deviation, variance, coefficient of variation and degree of freedom. Hypothesis testing: null hypothesis and alternate hypothesis, errors in hypothesis testing, significance and confidence levels, parametric tests and non-parametric tests, one-tailed and two-tailed tests, analysis of variance. Regression analysis and curve fitting, method of least-squares, explained and unexplained variations, coefficient of correlation, coefficient of determination**.**

Module IV: Technical/scientific/research report writing: structure and components of scientific reports, formats of dissertations, research report, report writing skills, report preparation, referencing , bibliography and footnotes. Making presentation-use of visual aids and PPTs. Publication of research papers, citations,. Intellectual property rights and copy rights, plagiarism, patents and patent laws, commercialization and ethical issues.

Examination Scheme:

Attendance	Assignment/Library consultation / Thesis writing	Class test	Final Exam	Total
5	15	10	70	100

Text Books:
- Blake, G. and Bly, R.W. 1993, The Elements of Technical Writing. MacMillan, New York
- Booth, V. 1981. Writing a Scientific Paper and Speaking at Scientific Meetings. The Biochemical Society, London
- Chawla,D and Sondhi, N. 2016, Research Methodology- Concepts and Cases. Vikas Publishing House Pvt Ltd. New Delhi
- Kothari, C.R.2008. Research Methodology- Methods and Techniques, 2nd.ed. New Age International Publishers, New Delhi.

Reference Books:

- Geode, Millian J.& Paul K. Hatl, Methods in Research, McGraw Hills, New Delhi.
- Montomery, Douglas C.(2007), 5th Ed. Design and Analysis of Experiments, Wiley India.
- Panneerselvam, R.2009. Research Methodology, PHI Learning Pvt.Ltd., New Delhi-110001
- Ranjit Kumar 2009. Research Methodology- A step –by- step Guide for beginners; 2nd ed. Dorling Kindersley (India) Pvt. Ltd. Patpargang, Delhi- 110092

BIG DATA SYSTEMS

Course Code: NCE4210   **Credit Units: 03**

Course Contents:
Module-I: A NEW PARADIGM FOR BIG DATA : Scaling with a traditional database NoSQL is not a panacea, First principles, Desired properties of a Big Data system , The problems with fully incremental architectures, Lambda Architecture, Recent trends in technologyExample application: SuperWebAnalyticscom, data model for big data: , data model for big data: illustration

Module-II: Hadoop&MapReduce: Data! ,Data Storage and Analysis ,Comparison with Other Systems ,RDBMS ,Grid Computing ,Volunteer Computing ,A Brief History of Hadoop ,Apache Hadoop and the Hadoop Ecosystem , Hadoop Releases ,A Weather Dataset, Data Format ,Analyzing the Data with Unix Tools , Analyzing the Data with Hadoop ,Map and Reduce ,Java MapReduce ,Scaling Out ,Data Flow , Combiner Functions ,Running a Distributed MapReduce Job , Hadoop Streaming ,Ruby ,Python, Hadoop Pipes ,Compiling and Running.

Module-III: The Hadoop Distributed Filesystem: The Design of HDFS ,HDFS Concepts ,Blocks ,Namenodes and Datanodes ,HDFS Federation ,HDFS High-Availability ,The Command-Line Interface ,Basic Filesystem Operations ,HadoopFilesystems , Interfaces ,The Java Interface ,Reading Data from a Hadoop URL ,Reading Data Using the FileSystem API ,Writing Data ,Directories ,Querying the Filesystem ,Deleting Data ,Data Flow ,Anatomy of a File Read ,Anatomy of a File Write ,Coherency Model ,Parallel Copying with distcp ,Keeping an HDFS Cluster Balanced ,Hadoop Archives ,Using Hadoop Archives ,Limitations ,

Module-IV: Hadoop I/O: Data Integrity ,Data Integrity in HDFS ,LocalFileSystem ,ChecksumFileSystem ,Compression ,Codecs ,Compression and Input Splits ,Using Compression in MapReduce ,Serialization ,The Writable Interface ,Writable Classes ,Implementing a Custom Writable ,Serialization Frameworks ,Avro ,File-Based Data Structures ,SequenceFile ,MapFile.

Module-V: Developing a MapReduce Application: The Configuration API ,Combining Resources ,Variable Expansion ,Configuring the Development Environment ,Managing Configuration ,GenericOptionsParser, Tool, and ToolRunner ,Writing a Unit Test ,Mapper ,Reducer ,Running Locally on Test Data ,Running a Job in a Local Job Runner , Testing the Driver ,Running on a Cluster ,Packaging ,Launching a Job ,The MapReduce Web UI ,Retrieving the Results ,Debugging a Job ,Hadoop Logs ,Remote Debugging ,Tuning a Job ,Profiling Tasks ,MapReduce Workflows ,Decomposing a Problem into MapReduce Jobs ,JobControl ,Apache Oozie.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended books:
- "Big Data: Principles and best practices of scalable realtime data systems",NathanMatz, Manning Publications, 2015
- "Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale" Tom White, Oreilly.
- "High-Performance Big-Data Analytics, Computing Systems and Approaches" Raj, P., Raman, A., Nagaraj, D., Duggirala, S.,Springer

DISTRIBUTED SYSTEMS SECURITY

Course Code: NCE4211   **Credit Units: 03**

Course Contents:

Module-I:
Introduction – Distributed Systems, Distributed Systems Security. Security in Engineering: Secure Development Lifecycle Processes - A Typical Security Engineering Process – Security Engineering Guidelines and Resources. Common Security Issues and Technologies: Security Issues, Common Security Techniques.

Module-II:
Host-level Threats and Vulnerabilities: Transient code Vulnerabilities - Resident Code Vulnerabilities - Malware: Trojan Horse – Spyware - Worms/Viruses – Eavesdropping – Job Faults. Infrastructure-Level Threats and Vulnerabilities: Network-Level Threats and Vulnerabilities - Grid Computing Threats and Vulnerabilities – Storage Threats and Vulnerabilities – Overview of Infrastructure Threats and Vulnerabilities.

Module-III:
Application-Level Threats and Vulnerabilities: Application-Layer Vulnerabilities –Injection Vulnerabilities - Cross-Site Scripting (XSS) - Improper Session Management - Improper Error Handling - Improper Use of Cryptography - Insecure Configuration Issues - Denial of Service - Canonical Representation Flaws - Overflow Issues. Service-Level Threats and Vulnerabilities: SOA and Role of Standards - Service-Level Security Requirements - Service-Level Threats and Vulnerabilities - Service-Level Attacks – Services Threat Profile.

Module-IV:
Host-Level Solutions: Sandboxing – Virtualization - Resource Management - Proof-Carrying Code - Memory Firewall – Antimalware. Infrastructure-Level Solutions: Network-Level Solutions - Grid-Level Solutions - Storage-Level Solutions. Application-Level Solutions: Application-Level Security Solutions.

Module-V:
Service-Level Solutions: Services Security Policy - SOA Security Standards Stack – Standards in Dept - Deployment Architectures for SOA Security - Managing Service-Level Threats - Compliance in Financial Services - SOX Compliance - SOX Security Solutions – Multilevel Policy-Driven Solution Architecture - Case Study: Grid - The Financial Application – Security Requirements Analysis. Future Directions – Cloud Computing Security – Security Appliances - Usercentric Identity Management - Identity-Based Encryption (IBE) - Virtualization in Host Security.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:

- AbhijitBelapurakar, AnirbanChakrabarti and et al., "Distributed Systems Security: Issues. Processes and solutions", Wiley, Ltd., Publication, 2009.
- AbhijitBelapurkar, AnirbanChakrabarti, HarigopalPonnapalli, NiranjanVaradarajan, Srinivas
- Padmanabhuni and SrikanthSundarrajan, "Distributed Systems Security: Issues, Processes and Solutions", Wiley publications, 2009.
- RachidGuerraoui and Franck Petit, "Stabilization, Safety, and Security of Distributed Systems", Springer, 2010.

CRYPTOGRAPHY FOUNDATION LAB

Course Code: NCE4207   **Credit Units: 01**

Course Contents:

- Program to implement division theorem
- checking number is prime or composite using simple logic
- Implement Miller Rabin Primality Algorithm
- Implement Euclid and Extended Algorithm.
- Implement Chinese Remainder Theorem
- Implement Baby Step Giant Step Algorithm.
- Implement at least 2 algorithms for random number generation. One is Blum BlumShub.
- Implement Modular Exponentiation Algorithm
- Implement algorithm for modular linear equation solver.
- Implement Fermat's and Euler's theorem.
- Implement Fermat's Factorization method.
- Few programs based on Probability Theory and theorems

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

WEB SECURITY LAB

Course Code: NCE4208   **Credit Units: 01**

Course Contents:

Exercises related to SQL injection attacks, XSS attacks, writing java script files for launching and preventing XSS attacks, Stored and Reflected XSS Attacks,URLinterpretation attack, input validation attack, buffer overflow attacks, impersonation attacks, password-based attacks, denial of service attacks, session hijacking
Use Apache Web Server or Xamp Server and create a temporary site for performing attacks.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

NETWORK SECURITY LAB

Course Code: NCE4209   **Credit Units: 01**

Course Contents:
- Learn to install wine / virtual box/vmware or any other equivalent software on the host os.
- Perform an experiment to grab a banner with telnet and perform the task using netcat utility.
- Banner grabbing is a technique to determine which application or service is running on the specified port by attempting to make a connection to this host.
- Perform an experiment for port scanning with nmap, superscan or any other software.
- Using nmap 1)find open ports on a system 2) find the machines which are active 3)find the version of remote os on other systems 4)find the version of s/w installed on other system
- Perform an experiment on active and passive fingerprinting using xprobe2 and nmap.
- Performa an experiment to demonstrate how to sniff for router traffic by using the tool wireshark
- Perform an experiment how to use dumpsec.
- Perform an wireless audit of an access point / router and decrypt wep and wpa.
- Perform an experiment to sniff traffic using arp poisoning.
- Generating password hashes with openssl

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

BIOMETRIC SYSTEMS AND BIOMETRIC IMAGE PROCESSING

Course Code: NCE4301   **Credit Units: 03**

Course Contents:

Module-I: Introduction: Biometric fundamentals – Biometric technologies – Biometrics Vs traditional techniques –Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes:verification, identification and biometric matching – Performance measures in biometric systems, FAR,FRR, FTE rate, EER and ATV rate, Applications of Biometric Systems, Security and Privacy Issues.
Physiological Biometrics : Leading technologies : Finger-scan – Facial-scan – Iris-scan – Voice-scan – components, working principles, competing technologies, strengths and weaknesses – Other physiological biometrics : Hand-scan, Retina-scan – components, working principles, competing technologies, strengths and weaknesses – Automated fingerprint identification systems.

Module-II: Behavioral Biometrics: Leading technologies: Signature-scan – Keystroke scan – components, workingprinciples, strengths and weaknesses.
Privacy and Standards in Biometrics: Assessing the Privacy Risks of Biometrics – Designing Privacy-Sympathetic Biometric Systems – Need for standards – different biometric standards.

Module-III: Fundamentals of Image Processing: Digital Image representation - Fundamental steps in ImageProcessing Image Enhancement: The Spatial Domain Methods, The Frequency Domain Methods – ImageSegmentation: Pixel Classification by Thresholding, Histogram Techniques, Smoothing and Thresholding- Gradient Based Segmentation: Gradient Image, Boundary Tracking, Laplacian Edge Detection.

Module-IV: Fingerprint Biometrics: Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width betweentwo ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: FingerprintClassification, Matching policies.

Module-V: Iris Biometrics: Iris System Architecture, Definitions and Notations - Iris Recognition: Iris location,Doubly Dimensionless Projection, Iris code, Comparison - Coordinate System: Head Tilting Problem,Basic Eye Model, Searching Algorithm, Texture Energy Feature.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- Anil K Jain, Patrick Flynn, Arun A Ross, "Handbook of Biometrics", Springer, 2008
- Anil K Jain, Arun A Ross, KarthikNandakumar, "Introduction to Biometrics", Springer, 2011
- Rafael C.Gonzalez, Richard E.Woods, Steven L.Eddins, "Digital Image Processing", Pearson Education, New Delhi, 2009

SOFTWARE VULNERABILITY ANALYSIS

Course Code: NCE4302   **Credit Units: 04**

Course Contents:

Module-I: Introduction to Software Security: It's All about the Software, Dealing with Widespread Security Failures, Bugtraq, CERT Advisories, RISKS Digest, Technical Trends Affecting Software Security, The ilities, What is Security?, Isn't That Just Reliability?, Penetrate and Patch Is Bad, On Art and Engineering, Security Goals, Prevention, Traceability and Auditing, Monitoring, Privacy and Confidentiality, Multilevel Security, Anonymity, Authentication, Integrity, Know Your Enemy: Common Software Security Pitfalls, Software Project Goals, Conclusion. **Managing Software Security Risk:** An Overview of Software Risk Management for Security, The Role of Security Personnel, Software Security Personnel in the Life Cycle, Deriving Requirements, Risk Assessment, Design for Security, Implementation, Security Testing, A dose of Reality, Getting People to Think about Security, Software Risk management in Practice, When Development Goes Astray, When Security Analysis Goes Astray, The Common Criteria.

Module-II: On Open Source and Closed Source: Security by Obscurity, Reverse Engineering, Code Obfuscation, Security for Shrink-Wrapped Software, Security by Obscurity Is No Panacea, The Flip Side: Open- Source Software, Is the "Many-Eyeballs Phenomenon" Real?. Why Vulnerability Detection Is Hard, Other Worries, On Publishing Cryptographic Algorithms, Two More Open-Source Fallacies, The Microsoft Fallacy, The Java Fallacy, An Example: GNU Mailman Security, More Evidence: Trojan Horses, To Open Source or Not to Open Source, Another Security Lesson from Buffer Overflows, Beating the Drum.
Guiding Principles for Software Security: Principle1: Secure the Weakest Link, Principle 2: Practice Defense in Depth, Principle 3: Fail Securely, Principle 4: Follow the Principle of Least Privilege, Principle 5: Compartmentalize, Principle 6: Keep It Simple, Principle 7: Promote Privacy, Principle 8: Remember That Hiding Secrets is Hard, Principle 9: Be Reluctant to Trust, Principle 10: Use Your Community Resources Conclusion.

Module-III: Buffer Overflows & Access Control: What Is a Buffer Overflow?, Why Are Buffer Overflows a Security Problem?, Defending against Buffer Overflow, Major Gotchas, Internal Buffer Overflows, More Input Overflows, Other Risks, Tools That Can Help, Smashing Heaps and Stacks, Heap Overflows, Stack Overflows, Decoding the Stack, To Infinity … and Beyond!, Attack Code, A UNIX Exploit, What About Windows?The UNIX Access Control Model, How UNIX Permissions Work, Modifying File Attributes, Modifying Ownership, The unask, The Programmatic Interface, Setuid Programming, Access Control in Windows NT, Compartmentalization, Fine-Grained Privileges.

Module-IV: NETWORKING: OSI Model, Sockets, Socket Functions, Socket Addresses, Network Byte Order, Internet Address Conversion, A Simple Server Example, A Web Client Example, A Tinyweb Server, Peeling Back the Lower Layers, Data-Link Layer, Network Layer, Transport Layer , Network Sniffing, Raw Socket Sniffer, libpcap Sniffer, Decoding the Layers, Active Sniffing, Denial of Service, SYN Flooding, The Ping of Death, Teardrop, Ping Flooding, Amplification Attacks, Distributed DoS Flooding, TCP/IP Hijacking, RST Hijacking, Continued Hijacking, Port Scanning, Stealth SYN Scan, FIN, X-mas, and Null Scans, Spoofing Decoys, Idle Scanning, Proactive Defense (shroud), Reach Out and Hack Someone, Analysis with GDB, Almost Only Counts with Hand Grenades, Port-Binding Shellcode.

Module-V: SHELLCODE: Assembly vs. C, Linux System Calls in Assembly, The Path to Shellcode, Assembly Instructions Using the Stack, Investigating with GDB, Removing Null Bytes, Shell-Spawning Shellcode, A Matter of Privilege, And Smaller Still, Port-Binding Shellcode, Duplicating Standard File Descriptors, Branching Control Structures, Connect-Back Shellcode.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- "Building Secure Software: How to Avoid Security Problems the Right Way" John Viega, Gary R. Tata McGraw Hill
- Michael Howard, David LeBlanc, John Viega: 19 Deadly Sins of Software Security: Programming Flaws and How to Fix Them (Security One-off) (Addison-Wesley Professional Computing Series)
- Richard Sinn " Software Security , Theory Programming and Practice" Cengage Learning

APPLIED CRYPTOGRAPHY

Course Code: NCE4303   **Credit Units: 03**

Course Contents:

Module-I:
Introduction to security attacks, services and mechanism, Classical encryption techniques: substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES

Module-II:
Advanced Encryption Standard (AES) encryption and decryption, Analysis, Principals of public key crypto systems, RSA algorithm, security of RSA. Rabin cryptosystem, Elgamal cryptosystem, Elliptical Curve cryptography,

Module-III:
Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, Random Oracle Model , hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA),SHA-512, Whirlpool, Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS).

Module-IV:
Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Entity authentication, Authentication Applications: Kerberos,

Module-V:
IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET).

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended books:
- "Cryptography & Network Security", William Stallings, PHI
- "Cryptography & Network Security", Behrouz A. Forouzan, TMH
- "Cryptography & Network Security", AtukKahate, PHI

WEB APPLICATION & PENETRATION TESTING

Course Code: NCE4306   **Credit Units: 03**

Course Contents:

Module-I: Introduction to Web Applications and Security: The Web Application Architecture ,A Brief Word about HTML ,Transport: HTTP ,The Web Client ,The Web Server,The Web Application ,The Database ,Complications and Intermediaries ,The New Model: Web Services ,Potential Weak Spots ,The Methodology of Web Hacking ,Profile the Infrastructure ,Attack Web Servers ,Survey the Application,Attack the Authentication Mechanism ,Attack the Authorization Schemes , Perform a Functional Analysis,Exploit the Data Connectivity,Attack the Management Interfaces,Attack the Client,Launch a Denial-of-Service Attack Profiling: Server Discovery,Intuition ,Internet Footprinting, DNS Interrogation Ping,Discovery Using Port Scanning , Dealing with Virtual Servers, Service Discovery , Server Identification,Dealing with SSL.

Module-II: Hacking Web Servers: Common Vulnerabilities by Platform ,Apache,Microsoft Internet Information Server (IIS), Attacks AgainstIIS Components, Attacks Against IIS, Escalating Privileges on IIS, Netscape Enterprise Server , Other Web Server Vulnerabilities , Miscellaneous Web Server Hacking Techniques , Automated Vulnerability Scanning Software ,Whisker, Nikto , twwwscan/arirang , Stealth HTTP Scanner, Typhon , WebInspect , AppScan, FoundScan Web Module , Denial of Service Against Web Servers,

Module-III: Surveying the Application: Documenting Application Structure , Manually Inspecting the Application , Statically and Dynamically Generated Pages, Directory Structure , Helper Files , Java Classes and Applets , HTML Comments and Content ,Forms, Query Strings , Back-End Connectivity , Tools to Automate the Survey, lynx , Wget,TeleportPro,Black Widow, WebSleuth, Common Countermeasures , A Cautionary Note, Protecting Directories,Protecting Include Files, Miscellaneous Tips. Authentication: Authentication Mechanisms, HTTP Authentication: Basic and Digest, Forms-Based Authentication, Microsoft Passport, Attacking Web Authentication,Password Guessing, Session ID Prediction and Brute Forcing, Subverting Cookies,Bypassing SQL-Backed Login Forms,Bypassing Authentication.

Module-IV: Authorization: The Attacks, Role Matrix, The Methodology , Query String, POST Data , Hidden Tags, URI,HTTP Headers,Cookies, Final Notes,Case Study: Using Curl to Map Permissions, Apache Authorization, IIS AuthorizationAttacking Session State Management:Client-Side Techniques, Hidden Fields, The URL,HTTP Headers and Cookies, Server-Side Techniques, Server-Generated Session IDs, Session Database, SessionID Analysis, Content Analysis, Time Windows.

Module-V: Input Validation Attacks: Expecting the Unexpected, Input Validation EndGame, Where to Find Potential Targets,Bypassing Client-Side Validation Routines , Common Input Validation Attacks , Buffer Overflow, Canonicalization (dot-dot-slash),Script Attacks , Boundary Checking, Manipulating the Application , SQL Injection and DatastoreAttacks,Command Execution, Common Side Effects,Common Countermeasures. Attacking Web Datastores: A SQL Primer,SQL Injection, Common Countermeasures. Web Client Hacking :The Problem of Client-Side Security,Attack Methodologies ,Active Content Attacks ,Java and JavaScript ,ActiveX,Cross-Site Scripting,Cookie Hijacking ,Case Study #: From the URL to the Command Line and Back,Case Study #: The Cross-Site Scripting Calendar

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:

- "Hacking Exposed Web Applications", 3rd edition, JOEL SCAMBRAY, VINCENT LIU, CALEB SIMA.
- "The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws" DafyddStuttard, Marcus Pinto
- Rich Bowen, Ken Coar, "Apache Cookbook", O'Reilly

MALWARE ANALYSIS IN NETWORK SECURITY

Course Code: NCE4307   **Credit Units: 03**

Course Contents:

Module-I: BASIC STATIC TECHNIQUES : Antivirus Scanning: A Useful First Step, Hashing: A Fingerprint for Malware, Finding Strings, Packed and Obfuscated Malware, Packing Files, Detecting Packers with PEiD, Portable Executable File Format, Linked Libraries and Functions, Static, Runtime, and Dynamic Linking, Exploring Dynamically Linked Functions with Dependency Walker, Imported Functions, Exported Functions , Static Analysis in Practice, PotentialKeyloggerexe: An Unpacked Executable, PackedProgramexe: A Dead End, The PE File Headers and Sections, Examining PE Files with PEview, Viewing the Resource Section with Resource Hacker, Using Other PE File Tools, PE Header Summary

Module-II: VIRTUAL MACHINES & DYNAMIC ANALYSIS: The Structure of a Virtual Machine, Creating Your Malware Analysis Machine, Configuring VMware, Using Your Malware Analysis Machine, Connecting Malware to the Internet, Connecting and Disconnecting Peripheral Devices, Taking Snapshots, Transferring Files from a Virtual Machine, The Risks of Using VMware for Malware Analysis, Record/Replay: Running Your Computer in Reverse, Sandboxes: The Quick-and-Dirty Approach Using a Malware Sandbox , Sandbox Drawbacks, Running Malware, Monitoring with Process Monitor, The Procmon Display, Filtering in Procmon, Viewing Processes with Process Explorer, The Process Explorer Display, Using the Verify Option, Comparing Strings, Using Dependency Walker, Analyzing Malicious Documents, Comparing Registry Snapshots with Regshot, Faking a Network, Using ApateDNS, Monitoring with Netcat, Packet Sniffing with Wireshark, Using INetSim, Basic Dynamic Tools in Practice,

Module-III: RECOGNIZING C CODE CONSTRUCTS IN ASSEMBLY : Overview of working with IDA Pro, Global vs Local Variables, Disassembling Arithmetic Operations, Recognizing if Statements, Analyzing Functions Graphically with IDA Pro, Recognizing Nested if Statements, Recognizing Loops, Finding for Loops, Finding while Loops, Understanding Function Call Conventions, Cdecl, Stdcall, fastcall , Push vs Move,Analyzing switch Statements,If Style ,Jump Table ,Disassembling Arrays ,Identifying Structs,Analyzing Linked List Traversal,

Module-IV: ANALYZING MALICIOUS WINDOWS PROGRAMS : The Windows API, Types and Hungarian Notation, Handles, File System Functions, Special Files, The Windows Registry, Registry Root Keys, Regedit , Programs that Run Automatically, Common Registry Functions, Analyzing Registry Code in Practice, Registry Scripting with reg Files , Networking APIs , Berkeley Compatible Sockets, The Server and Client Sides of Networking, The WinINet API , Following Running Malware, DLLs , Processes, Threads ,Interprocess Coordination with Mutexes , Services , The Component Object Model , Exceptions: When Things Go Wrong ,Kernel vs User Mode , The Native API ,

Module-V: MALWARE BEHAVIOR & COVERT MALWARE LAUNCHING : Downloaders and Launchers, Backdoors, Reverse Shell, RATs, Botnets, RATs and Botnets Compared, Credential Stealers, GINA Interception, Hash Dumping, Keystroke Logging, Persistence Mechanisms, The Windows Registry, Trojanized System Binaries, DLL Load-Order Hijacking, Privilege Escalation, Using SeDebugPrivilege, Covering Its Tracks—User-Mode Rootkits, IAT Hooking, Inline Hooking, Launchers, Process Injection, DLL Injection, Direct Injection, Process Replacement, Hook Injection , Local and Remote Hooks, Keyloggers Using Hooks, Using SetWindowsHookEx, Thread Targeting, Detours, APC Injection, APC Injection from User Space, APC Injection from Kernel Space .

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- "Practical Malware Analysis" by Michael Sikorski and Andrew Honig
- "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition by Reverend Bill Blunden
- "Rootkits: Subverting the Windows Kernel" by Jamie Butler and Greg Hoglund
- "Practical Reverse Engineering" by Dang, Gazet, Bachaalany

WEB SECURITY

Course Code: NCE4308   **Credit Units: 03**

Course Contents:

Module-I: The E-Commerce Playground: Web Languages: The Babylon of the 21st Century, Languages of the Web, HTML, Dynamic HTML (DHTML).XML,XHTML,Perl,PHP,ColdFusion,Active Server Pages,CGI,Java. Web and Database Servers: Web Servers,Apache,Microsoft's Internet Information Server (IIS),Database Servers,Microsoft SQL Server,Oracle.

Module-II: Shopping Carts and Payment Gateways: Evolution of the Storefront,ElectronicShopping,Shopping Cart Systems,Scope and Lifetime of an Electronic Shopping Cart,Collecting, Analyzing, and Comparing Selected Components,Keeping Track of the Total Cost,Change of Mind,Processing the Purchase,Implementation of a Shopping Cart Application,ProductCatalog,SessionManagement,DatabaseInterfacing,Integration with the Payment Gateway,Examples of Poorly Implemented Shopping Carts,Carello Shopping Cart,DCShop Shopping Cart,Hassan Consulting's Shopping Cart,Cart32 and Several Other Shopping Carts,ProcessingPayments,Finalizing the Order,Method of Payment,Verification and Fraud Protection,Order Fulfillment and Receipt Generation,Overview of the Payment Processing System,Innovative Ways to Combat Credit Card Fraud,Order Confirmation Page,Payment Gateway Interface,Transaction Database Interface,Interfacing with a Payment Gateway—An Example,Payment System Implementation Issues,Integration,TemporaryInformation,SSL,Storing User Profiles,Vulnerabilities Caused by Poor Integration of Shopping Cart and Payment Gateway,PayPal—Enabling Individuals to Accept Electronic Payments,

Module-III: HTTP and HTTPS: The Hacking Protocols,Protocols of the Web,HTTP,HTTPS (HTTP over SSL).
URL: The Web Hacker's Sword: URL Structure,Web Hacker Psychology,URLs and Parameter Passing.
URL Encoding, Meta-Characters,Specifying Special Characters on the URL String.,Meta-Characters and Input Validation,UnicodeEncoding,The Acme Art, Inc. Hack,Abusing URL Encoding,Unicode Encoding and Code Red's Shell Code,UnicodeVulnerability,The Double-Decode or Superfluous Decode Vulnerability,HTMLForms,Anatomy of an HTML Form,InputElements,Parameter Passing Via GET and POST,Case Study: Reconnaissance Leaks Corporate Assets.

Module-IV: Web: Under (the) Cover: The Components of a Web Application,The Front-End Web Server,The Web Application ExecutioEnvironment. The Database Server,Wiring the Components,The Native Application Processing Environment.,Web Server APIs and Plug-Ins,URL Mapping and Internal Proxying,Proxying with a Back-End Application Server.Examples. Connecting with the Database,The Craftiest Hack of Them All,Using Native Database APIs.Examples.
Using ODBC,UsingJDBC,Specialized Web Application Servers,Identifying Web Application Components from URLs,The Basics of Technology Identification,Examples,MoreExamples,Advanced Techniques for Technology Identification,Examples,Identifying Database Servers,Countermeasures, Rule 1: Minimize Information Leaked from the HTTP Header,Rule 2: Prevent Error Information from Being Sent to the Browser.

Module-V: Reading Between the Lines: Information Leakage Through HTML,What the Browsers Don't Show You,Netscape Navigator—View | Page Source,Internet Explorer—View | Source,Clues to Look For,HTMLComments,RevisionHistory,Developer or Author Details,Cross-References to Other Areas of the Web Application,Reminders and Placeholders, Comments Inserted by Web Application

Servers,Old "Commented-Out" Code,Internal and External Hyperlinks,E-mail Addresses and Usernames,UBE, UCE, Junk Mail, and Spam,Keywords and Meta Tags,HiddenFields,Client-Side Scripts,Automated Source Sifting Techniques,Usingwget,Usinggrep,Sam Spade, Black Widow, and Teleport Pro.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- McClure, Stuart, Saumil Shah, and Shreeraj Shah. Web Hacking:attacks and defense. AddisonWesley. 2003.
- Garms, Jess and Daniel Somerfield. Professional Java Security. Wrox. 2001.

DIGITAL WATERMARKING & STAGENOGRAPHY

Course Code: NCE4309   **Credit Units: 03**

Course Contents:

Module-I: IntroductionApplications and Properties
Information Hiding, Steganography, and Watermarking , History of Watermarking , History of Steganography , Importance of Digital Watermarking , Importance of Steganography ,Applications of Watermarking , Applications of Steganography   Steganography for Dissidents, Steganography for Criminals, Properties of Watermarking Systems, Evaluating Watermarking Systems, Properties of Steganographic and Steganalysis Systems , Evaluating and Testing Steganographic Systems

Module-II: Models of Watermarking: Notation , Communications ,Communication-Based Models of Watermarking , Geometric Models of Watermarking , Modeling Watermark Detection by Correlation Watermarking with side information: Informed Embedding, Watermarking Using Side Information, Dirty-Paper Codes

Module-III: Practical Dirty-Paper Codes: Practical Considerations for Dirty-Paper Codes   , Broad Approaches to Dirty-Paper Code Design, Implementing DM with a Simple Lattice Code , Typical Tricks in Implementing Lattice Codes Coding with Better Lattices   ,Making Lattice Codes Survive Valumetric Scaling   Dirty-Paper Trellis Codes
Watermark Security: Security Requirements**,**Watermark Security and CryptographySome Significant Known Attacks

Module-IV: Steganography: Steganographic Communication , The Channel , The Building Blocks , Notation and Terminology, Information-Theoretic Foundations of Steganography ﹐ Cachin's Definition of Steganographic Security ,Practical Steganographic Methods , Statistics Preserving Steganography , Model-Based Steganography , Masking Embedding as Natural Processing , Minimizing the Embedding Impact,Matrix Embedding , Nonshared Selection Rule,

Module-V: Steganalysis: Steganalysis Scenarios , Detection ,   Forensic Steganalysis , The Influence of the Cover Work on Steganalysis , Some Significant Steganalysis Algorithms , LSB Embedding and the Histogram Attack , Sample Pairs Analysis , Blind Steganalysis of JPEG Images Using Calibration, Blind Steganalysis in the Spatial Domain.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Recommended Books:
- "Digital Watermarking and Steganography"Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, , Margan Kaufmann Publishers, New York, 2008.
- "Digital Watermarking", Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, MarganKaufmannPublishers, New York, 2003.
- "Techniques and Applications of Digital Watermarking and Contest Protection", Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, Artech House, London, 2003.

BIOMETRIC IMAGE PROCESSING LAB

Course Code: NCE4304   **Credit Units: 01**

List of Exercises

Basic exercises on image loading, manipulation, edge finding, features extraction, face recognition, segmentation, fingerprint, iris, signature recognition.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

APPLIED CRYPTOGRAPHY LAB

Course Code: NCE4305   **Credit Units: 02**

Course Contents:
- Program to implement Ceaser Cipher.
- Program to implement Ceaser Cipher for any value of shift parameter.
- Programs to implement Playfair cipher, affine cipher, vegnere cipher.
- Program to implement Vernam Cipher.
- Program to implement Hill Cipher.
- Program to implement Rail fence and Columnar transposition cipher.
- Program to implement DES/AES/IDEA algorithm
- Program to implement RSA algorithm
- Program to implement Rabin Cryptosystem and ElgamalCryptsystem.
- Program to implement Digital Signature using RSA/Elgamal.
- Implementation study of MD5/SHA-1.
- Programs to implement ECB/CBC/OFB modes of operation.

Software: C/C++/Python/Java

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

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SUMMER INTERNSHIP EVALUATION

Course Code: NCE4335   **CreditUnits: 06**

GUIDELINES FOR PROJECT FILE AND PROJECT REPORT
Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

PROJECT FILE
The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period where the researcher is not working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department
The Project File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the File should be comprehensive and include:
A short account of the activities that were undertaken as part of the project;
A statement about the extent to which the project has achieved its stated objectives;
A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
Any problems that have arisen and may be useful to document for future reference.

Project Report
The Project Report is the final research report that the student prepares on the project assigned to him. In case of sponsored project the lay out of the project could be as prescribed by the sponsoring organization. However, in other cases the following components should be included in the project report:

Title or Cover Page
The title page should contain Project Title; Student's Name; Programme; Year and Semester and Name of the Faculty Guide.

Acknowledgement(s)
Acknowledgment to any advisory or financial assistance received in the course of work may be given. It is incomplete without student's signature.

Abstract
A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an

entire summary of the project, but rather a concise summary of the scope and results of the project. It should not exceed more than 1000 words.

Table of Contents
Titles and subtitles are to correspond exactly with those in the text.

Introduction
Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods
This section should aim at experimental designs, materials used (wherever applicable). Methodology should be mentioned in details including modifications undertaken, if any. It includes organization site(s), sample, instruments used with its validation, procedures followed and precautions.

Results and Discussion
Present results, discuss and compare these with those from other workers, etc. In writing this section, emphasis should be laid on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary, do not write in "point" form.

While presenting the results, write at length about the the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be in congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion rather, it should lead to generalization of data on the chosen sample.

Results and its discussion should be supporting/contradicting with the previous research work in the given area. Usually one should not use more than two researches in either case of suporing or contradicting the present case of research.

Conclusion(s) & Recommendations
A conclusion should be the final section in which the outcome of the work is mentioned briefly.
Check that your work answers the following questions:
- Did the research project meet its aims (check back to introduction for stated aims)?
- What are the main findings of the research?
- Are there any recommendations?
- Do you have any conclusion on the research process itself?

Implications for Future Research
This should bring out further prospects for the study either thrown open by the present work or with the purpose of making it more comprehensive.

Appendices

The Appendices contain material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References

References should include papers, books etc. referred to in the body of the report. These should be written in the alphabetical order of the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, 8 (suppl 1): 116–117.

For book

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), 7: 63-67

The Layout Guidelines for the Project File & Project Report

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

ASSESSMENT OF THE PROJECT FILE AND THE PROJECT REPORT

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following *assessment objectives*

- Range of Research Methods used to obtain information
- Execution of Research
- Data Analysis (Analyze Quantitative/ Qualitative information)
- Quality Control
- Conclusions

Assessment Scheme:

Continuous Evaluation:40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

PROJECT-DISSERTATION-I

Course Code: NCE4337   **CreditUnits: 05**

GUIDELINES FOR DISSERTATION
Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include
A short account of the activities that were undertaken as part of the project;
A statement about the extent to which the project has achieved its stated goals.
A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
Any activities planned but not yet completed as part of the DISSERTION, or as a future initiative directly resulting from the project;
Any problems that have arisen that may be useful to document for future reference.

➢ **Report Layout**
The report should contain the following components:

➢ **Title or Cover Page**
The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

➢ **Acknowledgements** (optional)
Acknowledgment to any advisory or financial assistance received in the course of work may be given.

➢ **Abstract**
A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

➢ **Table of Contents**
Titles and subtitles are to correspond exactly with those in the text.

➢ **Introduction**
Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➢ **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ **Results and Discussion**
Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ **Conclusion**
A conclusion should be the final section in which the outcome of the work is mentioned briefly.
➢ **Future prospects**

➢ **Appendices**
The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ **References / Bibliography**
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article
Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic*Escherichia coli* O157: H7. *ClinMicrobiol Infect*, **8** (suppl 1): 116–117.

For book
Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

ASSESSMENT OF THE DISSERTATION FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following *assessment objectives:*

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation	50
Viva Voce	50
Total	**100**

ata, leading to production of a structured report.

Selecting the Dissertation Topic
It is usual to give you some discretion in the choice of topic for the dissertation and the approach to be adopted. You will need to ensure that your dissertation is related to your field of specialization.

Deciding this is often the most difficult part of the dissertation process, and perhaps, you have been thinking of a topic for some time.

It is important to distinguish here between 'dissertation topic' and 'dissertation title'. The topic is the specific area that you wish to investigate. The title may not be decided until the dissertation has been written so as to reflect its content properly.

Few restrictions are placed on the choice of the topic. Normally we would expect it to be:
- relevant to business, defined broadly;
- related to one or more of the subjects or areas of study within the core program and specialisation stream;
- clearly focused so as to facilitate an in-depth approach, subject to the availability of adequate sources of information and to your own knowledge;
- of value and interest to you and your personal and professional development.

Planning the Dissertation
This will entail following:
- Selecting a topic for investigation.
- Establishing the precise focus of your study by deciding on the aims and objectives of the dissertation, or formulating questions to be investigated. Consider very carefully what is worth investigating and its feasibility.
- Drawing up initial dissertation outlines considering the aims and objectives of the dissertation. Workout various stages of dissertation
- Devising a timetable to ensure that all stages of dissertation are completed in time. The timetable should include writing of the dissertation and regular meetings with your dissertation guide.

The Dissertation plan or outline
It is recommended that you should have a dissertation plan to guide you right from the outset. Essentially, the dissertation plan is an outline of what you intend to do, chapter wise and therefore should reflect the aims and objectives of your dissertation.

There are several reasons for having a dissertation plan
- It provides a focus to your thoughts.
- It provides your faculty-guide with an opportunity, at an early stage of your work, to make constructive comments and help guide the direction of your research.
- The writing of a plan is the first formal stage of the writing process, and therefore helps build up your confidence.
- In many ways, the plan encourages you to come to terms with the reading, thinking and writing in a systematic and integrated way, with plenty of time left for changes.
- Finally, the dissertation plan generally provides a revision point in the development of your dissertation report in order to allow appropriate changes in the scope and even direction of your work as it progresses.

Keeping records
This includes the following:

- Making a note of everything you read; including those discarded.
- Ensuring that when recording sources, author's name and initials, date of publication, title, place of publication and publisher are included. (You may consider starting a card index or database from the outset). Making an accurate note of all quotations at the time you read them.
- Make clear what is a direct a direct quotation and what is your paraphrase.

Dissertation format
All students must follow the following rules in submitting their dissertation.
- Front page should provide title, author, Name of degree/diploma and the date of submission.
- Second page should be the table of contents giving page references for each chapter and section.
- The next page should be the table of appendices, graphs and tables giving titles and page references.
- Next to follow should be a synopsis or abstract of the dissertation (approximately 500 words)
- Next is the 'acknowledgements'.
- Chapter I should be a general introduction, giving the background to the dissertation, the objectives of the dissertation, the rationale for the dissertation, the plan, methodological issues and problems. The limitations of the dissertation should also be hinted in this chapter.
- Other chapters will constitute the body of the dissertation. The number of chapters and their sequence will usually vary depending on, among others, on a critical review of the previous relevant work relating to your major findings, a discussion of their implications, and conclusions, possibly with a suggestion of the direction of future research on the area.
- After this concluding chapter, you should give a list of all the references you have used. These should be cross - references with your text. For articles from journals, the following details are required e.g.

  Draper P and Pandyal K. 1991, The Investment Trust Discount Revisited, Journal of Business Finance and Accounting, Vol18, No6, Nov, pp 791-832.

  For books, the following details are required:
  Levi, M. 1996, International Financial Management, Prentice Hall, New York, 3rd Ed, 1996

- Finally, you should give any appendices. These should only include relevant statistical data or material that cannot be fitted into the above categories.

The Layout Guidelines for the Dissertation
- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5

- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Guidelines for the assessment of the Dissertation
While evaluating the dissertation, faculty guide will consider the following aspects:

1. Has the student made a clear statement of the objective or objective(s).
2. If there is more than one objective, do these constitute parts of a whole?
3. Has the student developed an appropriate analytical framework for addressing the problem at hand.
4. Is this based on up-to-date developments in the topic area?
5. Has the student collected information / data suitable to the frameworks?
6. Are the techniques employed by the student to analyse the data / information appropriate and relevant?
7. Has the student succeeded in drawing conclusion form the analysis?
8. Do the conclusions relate well to the objectives of the project?
9. Has the student been regular in his work?
10. Layout of the written report.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on Abstract, Regularity,
Adherence to initial plan, Records etc.)

Final Evaluation: Based on,   60%
Contents & Layout of the Report,   20
Conceptual Framework,   05
Objectives & Methodology and   05
Implications & Conclusions   10
Viva & Presentation   20

PROJECT-DISSERTATION-II

Course Code: NCE4437   **CreditUnits: 15**

GUIDELINES FOR DISSERTATION
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- Make clear what is a direct a direct quotation and what is your paraphrase.

Dissertation format
All students must follow the following rules in submitting their dissertation.
- Front page should provide title, author, Name of degree/diploma and the date of submission.
- Second page should be the table of contents giving page references for each chapter and section.
- The next page should be the table of appendices, graphs and tables giving titles and page references.
- Next to follow should be a synopsis or abstract of the dissertation (approximately 500 words)
- Next is the 'acknowledgements'.
- Chapter I should be a general introduction, giving the background to the dissertation, the objectives of the dissertation, the rationale for the dissertation, the plan, methodological issues and problems. The limitations of the dissertation should also be hinted in this chapter.
- Other chapters will constitute the body of the dissertation. The number of chapters and their sequence will usually vary depending on, among others, on a critical review of the previous relevant work relating to your major findings, a discussion of their implications, and conclusions, possibly with a suggestion of the direction of future research on the area.
- After this concluding chapter, you should give a list of all the references you have used. These should be cross - references with your text. For articles from journals, the following details are required e.g.

  Draper P and Pandyal K. 1991, The Investment Trust Discount Revisited, Journal of Business Finance and Accounting, Vol18, No6, Nov, pp 791-832.

  For books, the following details are required:
  Levi, M. 1996, International Financial Management, Prentice Hall, New York, 3rd Ed, 1996

- Finally, you should give any appendices. These should only include relevant statistical data or material that cannot be fitted into the above categories.

The Layout Guidelines for the Dissertation
- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

Guidelines for the assessment of the Dissertation
While evaluating the dissertation, faculty guide will consider the following aspects:

Has the student made a clear statement of the objective or objective(s).
If there is more than one objective, do these constitute parts of a whole?
Has the student developed an appropriate analytical framework for addressing the problem at hand.
Is this based on up-to-date developments in the topic area?
Has the student collected information / data suitable to the frameworks?
Are the techniques employed by the student to analyse the data / information appropriate and relevant?
Has the student succeeded in drawing conclusion form the analysis?
Do the conclusions relate well to the objectives of the project?
Has the student been regular in his work?
Layout of the written report.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on Abstract, Regularity,
Adherence to initial plan, Records etc.)

Final Evaluation: Based on,   60%
Contents & Layout of the Report,   20
Conceptual Framework,   05
Objectives & Methodology and   05
Implications & Conclusions   10
Viva & Presentation   20