

**Revised**

# ITC 229: Computer Security and Cyber Law

## **Module Objectives**

This module aims to introduce the fundamental knowledge of computer security and the recent development in the enactment of cyber laws.

## **Contents**

Introduction to Computer Security, Network Security, Cryptographic Algorithms, Web and Internet Security, Digital Signatures and Authentication Protocols, Malicious Logic, Intrusion Detection System(IDS), Unix systems Security and Security Evaluation Criteria, E-mail Security, Cyber Laws.

## **Detailed Course**

### **Introduction to computer security**

**LH 5**

Basic components of security (Confidentiality, Integrity and Availability), Security threats (Snooping, Modification, Masquerading, repudiation of origin, denial of receipt, Delay, Denial of service), Policy and mechanism, goal of security, protection state, Assumption and trust, Assurance (specification, design and implementation), Issues with security (Operational issues, human issues), Security Policies, Type of security policy, Access control, Type of access control (Introduction to MAC, DAC, Originator Controlled Access Control, Role Based Access Control) Overview of the Bell-LaPadula Model and Biba integrity model.

### **Cryptography and Cryptographic Algorithms**

**LH 5**

Cryptography, classical cryptosystem (Transposition ciphers, Substitution cipher, Vigenere cipher (introduction, one-time pad), Data Encryption Standard, Triple DES), Symmetric key Cryptography(Block and stream ciphers), Asymmetric key Cryptography, Public key Cryptography (RSA), Message Digest 5, Hash Function, Message Authentication Code (MAC).

### **Introduction to Network Security**

**LH 5**

Fundamentals of Network security, Preventing disruption, Destruction and Disaster on networks, Principal methods of protecting Network (Encryption, Decryption, Encryption in network), Network organization (Firewalls and proxies, Analysis of the network infrastructure), DMZ, Types of Firewalls(Packet Filtering, State-full Packet Filtering Circuit Level Gateway, Application level/proxy), IPSec, VPN, Concept of trusted system.

### **Digital Signature and Authentication**

**LH 6**

Authentication Basic , Password (Attacking a password system, countering password guessing, Password aging), Challenge Response, Biometrics, Location, Multiple Methods, ,Mutual (Symmetric, Public Key), One-way (Symmetric, Public Key) Digital Signature, Direct Digital Signature, Arbitrated Digital Signature, Digital Certificate, X.509 Certificate, Authentication Protocols, Authentication Services, Kerberos V4, Digital Signature Standards (DSS) , DSS approach Vs RSA approach

### **Design Principles and Common Security related programming problems**

**LH 3**

Eight principles for the design and implementation of security mechanisms, Common Security related programming problems (Improper choice of initial protection domain, Improper Isolation of implementation detail,

Improper change, Improper Naming, Improper de-allocation or deletion, Improper validation, Improper indivisibility, Improper Sequencing, Improper choice of operand or operation)

### **Malicious Logic and Defenses**

**LH 3**

Trojan Horses, Computer Viruses, Computer Worms, Rabbits and Bacteria, Logic bombs, Defenses (Sandboxing, Information flow metrics, reducing the rights, malicious logic altering files, proof carrying code and notion of trust). Introduction to Virtual Machine (Virtual Machine structure, Virtual machine monitor)

### **Intrusion Detection**

**LH 5**

Intruders, Intrusion techniques, Intrusion detection (statistical anomaly detection, rule-based detection), Architecture (Agent (Host based information gathering, Network based information gathering, combining sources), Director, Notifier), Organization of intrusion detection system (Monitoring Network traffic for Intrusions(NSM), combining host and network monitoring (DIDS), Autonomous Agents(AAFID)), Intrusion Response (Incident prevention, Intrusion Handling (Containment Phase, Eradication Phase, Follow-up Phase))

### **Web security and Email Security**

**LH 5**

Web security, Threats, SSL(Architecture, Handshake protocol, Handshake protocol action), overview of TLS and HTTPS, Secure Electronic Transaction overview, Dual Signature, Payment Processing, E-Mail, SMTP, PEM, PGP, MIME and SMIME, Concept of Secure Email.

### **Unix Systems security and security evaluation criteria**

**LH 2**

Overview of UNIX, Flavors and versions of UNIX, Open source vs proprietary software, security evaluation criteria, Ten general security rules

### **Policy and Procedures**

**LH 6**

Computer Crime and Categories, Cyber Crime, Digital Forensics ( overview of (Digital Evidence, Investigation Procedures, Categories of evidence (Impressions, Bioforensics, Trace evidence, Material evidence)), Intellectual Property Rights, Copyrights, Trademarks, Patents Licenses, Agreements, Plagiarism, Digital rights management, Privacy protection, Cyber Law, Electronic Transaction Act, Electronics Transaction Rules, IT Policy, Information Security and policies, Introduction to E-government, Introduction to electronic contracts.

### **References**

- Bishop M, Venkatramanayya S. S, Introduction to Computer Security
- Stallings W. Cryptography and Network Security
- Bishop M, Computer Security Art and Science
- Pfleeger C. P., Pfleegar S. L., Security in computing.
- Kaufman C., Perlman R., Speciner M.: Network Security: Private Communication in a Public World.
- Electronic Transaction Act(ETA), Government of Nepal.
- Electronic transaction Rule (ETR), Government of Nepal.
- IT policy Of Nepal.
- Copyrights Acts, Government of Nepal.
- Eoghan Casey Handbook of Digital Forensics and Investigation, Academic Press, 2010, 2e.
- Katz J., Lindell Y. Introduction to Modern Cryptography. CRC Press, 2007.

# ITC: 230 Economics of Information and Communications

## **Module Objectives**

This module aims to examine information as an economic commodity and a public good especially in relation to pricing, provision and regulation.

## **Contents**

Managerial Economics Basic, Markets for Information Goods, The Role of Information in an Economy, Strategies for Pricing Information, Rights Management, Market Strategies: Switching costs and Lock-in, Networks and Positive Feedback, Strategies for Information Industries, Antitrust and Information Policy, Thriving in a new economy, The knowledge-based new Economy.

## **Detailed Course**

- 1. Managerial Economics Basic** **LH 3**
  - 1.1 Defining moments of economics: from Industrial revolution to Information revolution
  - 1.2 Technological change in a global economy
  - 1.3 Market failure, Externalities and Public goods
  
- 2. Markets for Information Goods** **LH 4**
  - 2.1 Foundations of the Information economy
  - 2.2 Introduction to Information economy
    - 2.2.1 Definition of information good
    - 2.2.2 The cost of producing information
    - 2.2.3 Managing intellectual property
    - 2.2.4 Economic and public good
    - 2.2.5 The economics of attention
  - 2.3 Technology
    - 2.3.1 Systems competition
    - 2.3.2 Lock-in and switching costs
    - 2.3.3 Positive feedback, network externalities, and standards
  - 2.4 Policy
  
- 3. The Role of Information in an Economy** **LH 4**
  - 3.1 Transaction costs and Information costs
  - 3.2 The economy of search
  - 3.3 Information problems**
    - 3.3.1 The moral hazard problem
    - 3.3.2 The Adverse-Selection Problem
  - 3.4 Speculation and Risk Bearing
  - 3.5 The Futures Market
  
- 4. Strategies for Pricing Information** **LH 6**
  - 4.1 Pricing Information Goods
    - 4.1.1 Cost of producing information
    - 4.1.2 Costs and competition
    - 4.1.3 Product Personalization
    - 4.1.4 Product pricing
    - 4.1.5 Personalized pricing
    - 4.1.6 Versioning
    - 4.1.7 Group pricing- Price sensitivity, Network effects, Lock-in, Sharing

- 4.2 Versioning Information
  - 4.2.1 Types of versioning
  - 4.2.2 Value-subtracted versions
  - 4.2.3 Avoiding pitfalls in versioning
  - 4.2.4 On-line and off-line versions
  - 4.2.5 Goldilocks pricing
  - 4.2.6 Customizing the browser
  - 4.2.7 Bundling
  - 4.2.8 Promotional pricing
  
- 5. Rights Management LH 3**
  - 5.1 Production and distribution costs
  - 5.2 Lower distribution costs
  - 5.3 Lower reproduction costs
  - 5.4 Trusted systems
  - 5.5 Historical examples - Growing the market
  - 5.6 Choosing terms and conditions
  
- 6. Market Strategies: Switching costs and Lock-in LH 5**
  - 6.1 Recognizing Lock-In
    - 6.1.1 Examples of lock-in
    - 6.1.2 Valuing an installed base of customers
    - 6.1.3 Classification of lock-in
    - 6.1.4 Suppliers and partners face lock-in, too
    - 6.1.5 The lock-in cycle
  - 6.2 Managing Lock-In
    - 6.2.1 Lock-in strategy for buyers
    - 6.2.2 Lock-in strategy for sellers
    - 6.2.3 Investing in an installed base
    - 6.2.4 Encouraging customer entrenchment
    - 6.2.5 Leveraging your installed base
  
- 7. Networks and Positive Feedback LH 7**
  - 7.1 Positive feedback
  - 7.2 Demand-side economies of scale
  - 7.3 Network externalities
  - 7.4 Collective Switching Costs
  - 7.5 Igniting positive feedback: performance vs. compatibility
  - 7.6 Revolution: offer compelling performance
  - 7.7 Igniting positive feedback: openness vs. control
  - 7.8 Generic strategies in network markets
  - 7.9 Historical examples of positive feedback- Telephone networks and interconnection
  
- 8. Strategies for Information Industries LH 4**
  - 8.1 Cooperation and Compatibility
    - 8.1.1 How standards change the game
    - 8.1.2 Winners and Loser from standards
    - 8.1.3 Tactics in formal standard-setting
    - 8.1.4 Managing open standards
      - 8.1.4.1 Case Study- Linux Adoption in the Public Sector: An Economic Analysis
  - 8.2 Waging a Standards War
    - 8.2.1 Classification of standards wars
    - 8.2.2 Information-age standards wars

- 8.2.3 Key assets in network markets
- 8.2.4 Two basic tactics in standards wars
- 8.2.5 Capstone case: Microsoft vs. Netscape,
- 9. **Antitrust and Information Policy** **LH 2**
  - 9.1 Policy overview
  - 9.2 Price differentiation
  - 9.3 Competition policy
  - 9.4 Telecommunications regulation and policy in brief (Nepalese context)
- 10. **Thriving in a new economy** **LH 2**
  - 10.1 The components of Digital Economics
  - 10.2 Twelve theme of the new economy
  - 10.3 The ten technology shift
  - 10.4 The Internet Economy and its Indicators
  - 10.5 E-commerce and Digital Economy
- 11. **The knowledge-based new Economy** **LH 5**
  - 11.1 Defining knowledge management
  - 11.2 10-steps road map to KM Implementations- a brief description
  - 11.3 Case Study on any Information Industry for the implementation of KM Strategy

## References

- Robert S. Pindyck and Daniel S. Rubinfeld. *Microeconomics*, 5<sup>th</sup> Edition, PHI.(ISBN: 81-203-2336-X )
- H. Craig Petersen and W. Cris Lewsi. *Managerial economics*. (ISBN: 81-203-0963-4)
- Carl Shapiro and Hal R. Varian. *Information Rules: A Strategic Guide for the Network Economy*. Harvard Business School Press, Cambridge, MA, 1998.
- Roy J. Ruffin and Paul R. Gregory: *Principles of economics*. 7<sup>th</sup> edition, Addison Wiley Pub, 2000.
- Don Tapscott. *The digital economy: Promise and peril in the age of networked intelligence*. McGraw-Hill. (ISBN : 0-07-063342-8)
- Amrit Tiwana. *The knowledge Management Toolkit: Practical techniques for building a knowledge Management System*. Pearson Education . (ISBN 981-405-873-4)
- Efraim Turban, Jae Lee, David King, H. Michael Chung. *Electronic Commerce- A managerial Perspective*. Pearson Education. (ISBN: 81-7808-362-0)
- Niraj K Gupta. *The Business of telecommunication- Networking in the New Millennium*. Tata McGraw-Hill. (ISBN: 0-07-463497-6)
- Pete Moulton. *The telecommunications survival guide*. Pearson Education. (ISBN: 81-7808-302-7)
- *Information Technology for development. IT Policy and Strategy papers for Nepal*. HMG of Nepal, NPC Secretariat, Kathmandu, Nepal.
- An Introduction to the Economics of Information 2nd Edition Oxford –Ines Macho-Stadler and J.David Tiz Castrillo

## ITC 301: System Administration - Win NT

### **Module Objectives**

This module aims to provide students with the necessary skills to perform administrative tasks in Win NT.

### **Contents**

Windows NT environment with Server and Work Station. File server. Services, Domain. Clients. Management. User defining and user rights. Directories, printing resources, and remote access. Trouble shooting, configuration and installation. Managing accounts. Auditing, security directory and file resources. Securing the system. Networking environment and communication. Networking browsing and booting Windows NT. Supporting applications.

### **Detailed Course**

- 1. Introduction to Microsoft Networking** **LH 3**  
The Windows Family of Operating Systems, Computer Network, Types of Networks, Network Scope, Network Operating Systems, Network Models, Network Media, Network Topologies, Physical Network Components and Network Design.
- 2. Installing, Configuring windows Server 2003, Windows XP and Windows 2000 professional** **LH 4**  
Features of Windows Server 2003, XP and 2000 professional, Windows Server 2003 family features, Hardware Requirement, installing Windows Server 2003, XP and 2000 professional, Automated installation, Examining the hoof process.
- 3. Microsoft Windows Server 2003 Environment** **LH 6**  
Managing User Logons: Create local accounts, modify local accounts, setting logon method-workgroup, set local logon security policies, Local Security and Account Policy, Managing Users and Groups Accounts, Managing file and print resources, File Systems FAT, NTFS, File Compression, Encryption, File sharing and permissions, NTFS permissions, File Security and permissions, Disk Quota, Shadow Copies, Network Printing, Distributed File System, Remote Desktop Connection, Remote Assistance, Internet Connection Sharing (ICS)
- 4. Microsoft Windows Server 2003 Directory Service and Administration** **LH 4**  
Using Active Directory, introduction, working with Domain Structures, Active Directory (AD) Domain, Core Active Directory Administration, tools for managing Active Directory managing Domain Controllers and Organizational Units, understanding User and Group accounts, managing existing user and Group accounts, Group policy management, working with group policies, user and computer script management managing applications, processes, performances, system services, event logging and viewing.
- 5. Microsoft Windows Server 2003 Environment Network Administration** **LH 6**  
Understanding TCP/IP, IP Addressing, Subnetting and Supernetting, IP networks, installing and configuring TCP/IP, Configuring Additional network components, Troubleshooting TCP/IP connections.  
Understanding DHCP, installing, configuring and managing a DHCP server, Backing up and restoring the DHCP database.

Maintaining WINS (Windows Internet Name Service): Understanding WINS and NetBIOS over TCP/IP, using WINS console, copying managing WINS server and databases.  
Optimizing DNS: Understanding DNS, installing managing and configuring DNS server, managing DNS records, updating zone properties and SOA record.

**6. Routing and Remote Access (R & RAS) LH 4**

Remote Access Overview, Configuring Routing by using R&RAS, installing and configuring R&RAS, installing a Virtual Private Network (VPN), installing and configuring R&RAS as VPN server, Configuring a RAS of VPN client.

**7. Managing IP Security LH 4**

Understanding how IP Security works, IP Sec Fundamentals, installing IP sec, Configuring R&RAS, installing a Virtual Private Network (VPN), installing and configuring R&RAS as VPN server, Configuring a RAS of VPN client.

**8. Managing Web Services LH 4**

Benefits of using IIS, Key IIS Services, Installing IIS, configuring and administering IIS, creating a new website, configuring website, IIS backup.

**9. Implementing and Managing Microsoft Exchange Server 2003 LH 4**

Installing Microsoft Exchange Server 2003, installing and configuring SMTP service, enabling POP3/IMAP service, Configuring email clients to send and receive mails.

**10. Backup and Restore LH 3**

Crate a Backup plan, selecting backup devices and media, Backing up your data, Restore backup data.

**11. Microsoft Windows Server 2003 Data Administration LH 3**

Managing file systems and drives, adding Hard Disk drives, working with Basic and Dynamic Disk, Using Basic disk and partition, managing existing partition and drives, administering volume sets and RAID arrays using volumes and volumes sets, improve performance and fault tolerance with RAID 0, 1 and 5 on windows server 2003, managing RAID and recovery from failure.

**References**

- Robert Williams, Mark Walla, *The Ultimate Windows Server 2003 System Administrator's Guide*
- Mark Minasi, Christa Anderson, Michele Beveridge, C. A. Callahan, Lisa Justice, *Mastering Windows Server 2003*

## ITC 307: Software Project Management

### **Module Objectives**

The module aims to provide an overview of the roles, responsibilities and management methods of the software project manager. The course intended to teach students how to develop approaches and styles o management for software projects.

### **Contents**

Introduction to software project management, Software development model and formal methods, Software size and Cost Estimation, Software Project Planning, Software Project Risk Management, Software Process Resource Management, Software Project Performance Tracking and Monitoring, Software Project Configuration Management, Project Team Management and Organization, and Software Quality.

### **Detailed Course**

- 1. Introduction to software project management** **LH 6**  
Software crisis, Software Development Phases, Characteristics of Software, What is a project? , Software products versus hardware products, Major Process in developing a software system, important factors in planning a software projects, What is software management?, Common problems with software projects, Major issues of software project management, Main problems encountered with requirements and specializations, Formal methods, Logic (Propositional calculus, First-order predicate calculus, Second-order predicate calculus), State-Based model.
  
- 2. Software development model and formal methods** **LH 5**  
Introduction (software process, Software process model, modeling), Analysis of the project (Methodologies and Technologies), Project characteristics (Control system, Information system, Imprecise requirements), Project Risks (Product uncertainty, process uncertainty, Resource uncertainty), Technical Plan (Constraints, Approach, Implementation, Implications), Software Process Model (Waterfall Model, V Model, Spiral Model, Prototyping Model, Phased Development Model, incremental development model, Iterative development model, Operational Specification Model, Transformation Model)
  
- 3. Software size and Cost Estimation** **LH 5**  
Different Level of estimation, Project Evaluation (Strategic assessment, Technical assessment, Economic Assessment), Introduction of Estimation, Estimation Approaches (Expert Judgement, Estimation by analogy, Pricing to win, Top-down, Bottom-up, Algorithmic model), Cost-benefit analysis, Cost-benefit Evaluation techniques, Problems with over-and under-estimates, Size Estimation (Models-Function point Analysis, Object Point Analysis), Cost Estimation (Model-COCOMO II)
  
- 4. Software Project Planning** **LH 5**  
Stepwise Project Planning framework, Preparation for the software project plan, Activity planning, Objectives of activity planning. Project Schedules, Projects and activities, Sequencing and scheduling activities, CPM, Various approaches towards activity plan (Activity-based approach, Product-based approach, Hybrid approach), Network Planning Model.
  
- 5. Software Project Risk Management** **LH 5**  
Project Risks, Nature of risks (Planning assumptions, Estimation errors, Eventualities), Boehm's Risk Engineering, Risk identification, Common risk factors, Boehm's Top Ten Risk Items, Risk estimation, Risk evaluation, Risk management, Risk reduction strategy.



- 6. Software Process Resource Management** **LH 4**  
The nature of resources, Identifying resource requirements, Scheduling resources, Creating critical paths, Counting the cost Being specific, Publishing the resource schedule, Cost schedules, The Scheduling sequence.
- 7. Software Project Performance Tracking and Monitoring** **LH 4**  
Importance of tracking and monitoring (planning, tracking and monitoring), Creating a management framework, Performance tracking (Setting checkpoints, collecting the data, Risk Reporting), Monitoring the progress are Resource (Time, Cost, Visualizing Technique, Earned value analysis), Prioritizing monitoring, Getting project on the right track.
- 8. Software Project Configuration Management** **LH 4**  
Software evaluation (types of changes), Configuration management, Facets of SCM, Change Control Board, Change Management, Auditing and Status Accounting.
- 9. Project Team Management and Organization** **LH 4**  
Motivation and motivational approaches, Organizational behavior, Organizational planning, Team Formation and Development , Roles in Software Development.
- 10. Software Quality** **LH 3**  
The importance of software quality, Defining software quality, Practical software quality measures, Product versus process quality management, External standards, Techniques to help enhance software quality, Basic of ISO 9000 family standards and SEI-Capability Maturity Model.

### **References**

- Highes, B. and Cotterell, M., "Software Project Management". McGraw Hill, 1999.
- Conway, K., "Software Project Management", -From Concept to Deployment", DreamTech Press, 2001
- Garmus, D. and Herron, D., "Function Point Analysis, Measurement Practices for Successful Software Projects", Addison-Wesley, 2001.

# ITC 303: Computer Based Financial Engineering

## Module Objectives

This module aims to develop students' skills in using computers, analyzing the financial operations of a business and the decision making process.

## Contents

Design and implementation of the computerized financial models. Performance evaluations of commercial financial modeling software. Designing, coding, testing, and presenting financial decision models with the help of available software tools.

On completion of this module students should be able to:

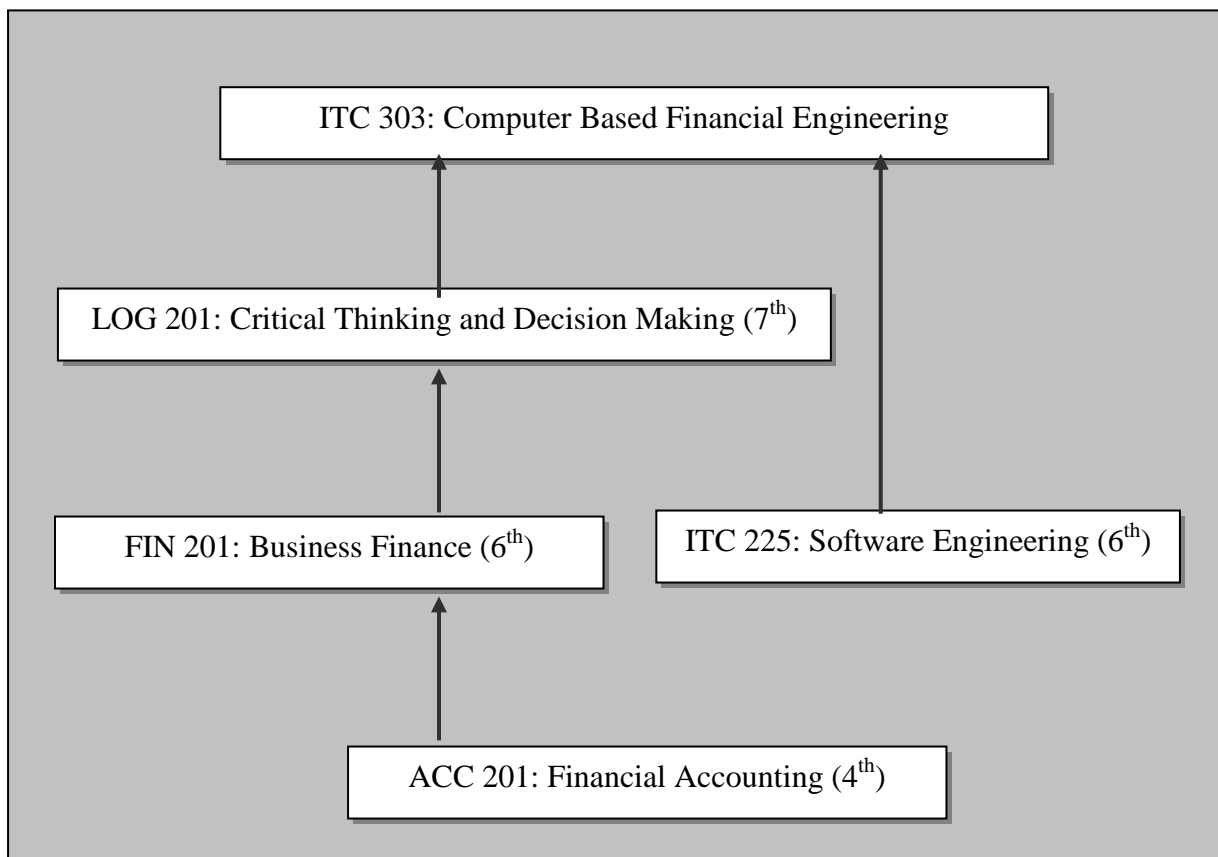
- ❖ Use computerised module or application for analysing financial operation of a business operation and decision-making process
- ❖ Design and implementation of the computerised financial models
- ❖ Performance evaluations of commercial financial modelling software
- ❖ Designing, coding, testing and presenting financial decision modules with the help of available software tools.

## POSITION OF THE MODULE IN THE OVERALL SYLLABUS

Students will require a through understanding of the following subject area:

- ❖ ACC 201: Financial Accounting (4<sup>th</sup> Semester)
- ❖ FIN 201: Business Finance (6<sup>th</sup> Semester)
- ❖ ITC 225: Software Engineering (6<sup>th</sup> Semester)
- ❖ LOG 201: Critical Thinking and Decision Making (7<sup>th</sup> Semester)

Students will also be required prior experience in computer programming (C, C++, Visual Basic, Developer 2000 etc.); database (Access, SQL Server, Oracle etc.) and spreadsheet (MS Excel).



**Detailed Course**

**SECTION I: OVERVIEW OF COMPUTER BASED FINANCIAL ENGINEERING**

**Unit 1: An Introduction to Financial Engineering**

- 1.1 Overview
- 1.2 Financial Engineering Versus Computer Based Financial Engineering
- 1.3 The Scope of Computer Based Financial Engineering
- 1.4 The Tools of Computer Based Financial Engineering
- 1.5 Where Computer Based Financial Engineering Fits In
- 1.6 Career Opportunities For Computer Based Financial Engineers

**SECTION II: FINANCIAL ANALYSIS & DECISION MAKING**

**Unit 2: Information Flow and Financial Engineering**

- 2.1 Overview
- 2.2 Financial Accounting as Sources of Financial Information
- 2.3 Recording of Financial Transactions
- 2.4 Information Processing, Classification and Analysis
- 2.5 Financial Statements
- 2.6 Users of Financial Statements
- 2.7 Use of Computerized Modules and Financial Applications

**Unit 3: Interpretation of Financial Statements**

- 3.1 The broad categories of ratio
- 3.2 Profitability and return on capital
- 3.3 Liquidity, gearing/ leverage and working capital
- 3.4 Shareholders' investment ratios
- 3.5 Presentation of a ratio analysis report

**Unit 4: Time Series Analysis**

- 4.1 The Components of Time Series
- 4.2 Finding the Trend
- 4.3 Finding the Seasonal Variations
- 4.4 Forecasting and Time Series Analysis

**Unit 5: Cost-volume-profit (CVP) Analysis**

- 5.1 CVP Analysis and Breakeven Point
- 5.2 The Profit / Volume (P/V) Ratio
- 5.3 The Margin of Safety
- 5.4 Breakeven Arithmetic and Profit Targets
- 5.5 Breakeven Charts, Contribution Charts and Profit / Volume Charts
- 5.6 Limitations of CVP Analysis

**Unit 6: Profit Planning, Decision making and Financial Engineering**

- 6.1 Short-term Business Forecasting and Financial Engineering
- 6.2 Budgeting as a tools of business forecasting
- 6.3 Performing Evaluation and Control
- 6.4 Budgeting and Profit Planning
- 6.5 Leverage

**Unit 7: Interest**

- 7.1 Simple Interest
- 7.2 Compound Interest
- 7.3 Regular Savings and Sinking Funds
- 7.4 Loans and Mortgages
- 7.5 Annual Percentage Rate (APR) of Interest

### **SECTION III: THE TOOLS OF COMPUTER BASED FINANCIAL ENGINEERS**

#### **Unit 8: Valuation Relationships and Applications**

- 8.1 Overview
- 8.2 Cash Flow
- 8.3 Time Value
- 8.4 Sensitivity Analysis of Time Value
- 8.5 The Concept of Compounding
- 8.6 The Net Present Value (NPV) Method
- 8.7 The Internal Rate of Return (IRR) Method
- 8.8 Linking Compounding and Discounting
- 8.9 Applications
- 8.10 Spreadsheet

#### **Unit 9: Financial Derivative**

- 9.1 Real Assets Vs Financial Assets
- 9.2 Meaning and Concept of Primary Securities and Derivatives Securities
- 9.3 Basic Characteristics of Financial Derivatives
- 9.4 Types of Derivatives: Forward, Futures and Options
- 9.5 Financial Derivatives and Risk Management
- 9.6 Hedging, Arbitrage and Speculation

#### **Unit 10: Futures and Forwards**

- 10.1 Overview
- 10.2 Futures
- 10.3 Forwards
- 10.4 Forward Rate Agreements (FRAs)
- 10.5 FRAs and Swaps
- 10.6 Appendix: Euro-rate Differential Futures and Forward Exchange Agreements

#### **Unit 11: The Swap Market**

- 11.1 Overview
- 11.2 History
- 11.3 A Note on Rate Conventions
- 11.4 The Structure of a Swap
- 11.5 Interest Rate Swaps
- 11.6 Currency Swaps
- 11.7 Commodity Swap
- 11.8 Variants
- 11.9 Swap Dealer's Role

#### **Unit 12: The Options Market**

- 12.1 Overview
- 12.2 Calls and Puts: The Basics
- 12.3 Payoff Profiles
- 12.4 Hedging with Options
- 12.5 Cash Settled Option

#### **Unit 13: Financial Engineering**

- 13.1 Option Combinations
- 13.2 The Swap as a Portfolio of Forwards
- 13.3 Portfolio Insurance

## SECTION IV: COMPUTER APPLICATION AND MODULE IN COMPUTER BASED FINANCIAL ENGINEERING

### Unit 14: Use of computerised modules and applications in CBF E

- 14.1 Use of Spreadsheet (MS Excel)
- 14.2 Use of available financial software package in financial analysis and decision-making.

### Unit 15: Design and implement the computerised financial modules.

- 15.1 Feasibility Studies
- 15.2 Financial Modules Development Process
- 15.3 System analysis, user requirements
- 15.4 External Design

### Unit 16: Performance Evaluation of Commercial Financial Modelling Software

- 16.1 Software sources and selection
- 16.2 Quality assurance and testing
- 16.3 Implementing systems
- 16.4 Security and legal compliance
- 16.5 Post-implementation issues

## KEY AREAS OF THE SYLLABUS

### The syllabus has following key areas:

- Use computerised module or application for analysing financial operation of a business operation and decision-making process
- Design and implementation of the computerized financial models
- Performance evaluations of commercial financial modelling software
- Designing, coding, testing and presenting financial decision modules with the help of available software tools.

## APPROACH TO EXAMINING THE SYLLABUS

	<u>Percentage of marks</u>
Internal	40%
Final	60%
- Theory	40%
- Micro Project	20%
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Total	100%
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### References:

- John F. Marshall and Vipul K. Bansal. Financial Engineering: A Complete Guide to Financial Innovation, Prentice-Hall of India Private Limited, 1999.
- Mik Wisniewski. Quantitative Methods for Decision Makers, 3<sup>rd</sup> Edition, Financial Times Prentice Hall, 2002
- I.M. Pandey. Financial Management, 6<sup>th</sup> Revised Edition, Vikash Publishing House Pvt Ltd, 1993
- BPP Publication. Financial Information for Management, 2<sup>nd</sup> Edition, Professional Business Publications, June 2002.
- BPP Publication. Information System, 3<sup>rd</sup> Edition, Professional Business Publications, June 2003.

## **ITC 305: Object Oriented Analysis and Design**

### ***Module Objectives***

This module aims to provide the knowledge of Object Technology and its approaches in solving the real life business problems.

### ***Contents***

Overview of System: System diagram; Complexity; The Object Model; Class: Nature of class, Relationship among classes and Identifying classes; Unified Modeling Language: Introduction, use case, class, object, sequence, collaboration and state chart of diagram; The process; and Introduction to CORBA.

### ***Detailed Course***

#### **Overview of system and complexity**

An Overview of Object Oriented Systems Development - Object Basics – Object Oriented Systems Development Life Cycle.

#### **Unified Modeling Language**

Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns – Frameworks – Unified Approach – Unified Modeling Language – Use case - class diagram - Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram - Activity Diagram, Identifying use cases - Object Analysis - Classification – Identifying Object relationships - Attributes and Methods.

#### **Class**

Design axioms - Designing Classes – Access Layer - Object Storage - Object Interoperability.

#### **The Object Model**

Designing Interface Objects – Software Quality Assurance – System Usability - Measuring User Satisfaction

#### **The Process**

First Principles, Macro Development Process, Micro Development Process

### ***Text Books***

- Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999 (Unit I, III, IV, V).
- Martin Fowler, "UML Distilled", Second Edition, PHI/Pearson Education, 2002. (UNIT II)

### ***References***

- Stephen R. Schach, "Introduction to Object Oriented Analysis and Design", Tata McGraw-Hill, 2003.
- James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language Reference Manual", Addison Wesley, 1999.
- Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML Toolkit", OMG Press Wiley Publishing Inc., 2004.

# ITC 306: Object Oriented Database Management System

## ***Module Objectives***

This module aims to provide the students the knowledge of Object Oriented Database Management System.

## ***Contents***

Introduction. Object Oriented Database Management System: Architectural Approach. Semantic Database Models and Systems. Object Oriented Database Systems: The object oriented database paradigm manifesto, OODBMS Architecture - An introduction, Performance Issues in OODBMS, Application Selection for OODBMS. Object / Relational Systems (ORDBMS): Open ODB / Odaptor.

## ***Detailed Course***

### **Unit 1: Introduction**

- A major Change: The relational Data Model
- Object Roles in Databases
- Sample uses of Object-oriented Databases
- Benefits of Object Orientation

### **Unit 2: Object Orientated DBMS**

- The Object-oriented Data Model
  - Object-Oriented Data Relationships
  - Object Identifiers
  - One-to-Many relationships
  - Many-to-Many relationships
  - The IS-A relationship
  - The Extends relationship
  - The Whole-Part relationship
- Relationship Integrity
- ER Diagramming Models for Object-Oriented Relationships
  - Booch Notation
  - Unified Modeling Language
- Integrating Objects into a Relational Database
- The Extended Relational Model Approach
- The Semantic Database Approach
- The Proposed Object Database Standard
  - Basic OODBMS Terminology
  - Understanding Types
  - External specifiers
  - Implementations
  - Primitive Types
  - Inheritance

- Interfaces and Inheritance
- Classes and Extensions
- Objects
- Collection Objects
- Structured Objects
- Creating and Destroying Objects
- Representing Logical Relationships

**Unit 3: Semantic Database Models & Systems**

- The Entity relationship Model
- Relational Model – Tasmania (RMT)

**Unit 4: Object Oriented Database Systems**

- Performance Issues in OODBMS
- Application Selection for OODBMS
- The Object Oriented Database Paradigm Manifesto
- The Mandatory Features
- The Optional Features

**Unit 5: OODBMS Architecture – An Introduction**

- An overview

**Unit 6: Object / Relational Systems (ORDBMS)**

- Open ODB / Oadapter
- Open ODB / Oadaptor Data Model and Language
- Open ODB Architecture
- OSQL features

**Unit 7: Objects in Oracle**

- Introducing PL/SQL
- PL/SQL language Elements
- Modular Code
- Creating objects
- Object Instance
- Storing Objects in Table
- Manipulating objects in PL/SQL and SQL
- Modifying Persistent Objects
- Inheritance

**Lecture Hours: 45**

**References:**

- Harrington J.L., (2000) “Object-Oriented Database Design, Clearly Explained”
- Morgan Kaufmann.
- Prabhu C.S.R, (2003), “Object-Oriented Database Systems”, Prentice Hall India
- Feuerstein S., Pribyl B., Oracle PL/SQL Programming, O’Reilly
- McLaughlin M., (2008), Oracle Database 11g PL/SQL Programming, Oracle Press



# ITC 308: Operating Systems

## **Module Objectives**

This module aims to provide the concepts of Operating Systems and Implementation of Systems Utilities for Inter-process communication in a multiprocessor environment.

## **Contents**

Operating Systems - Principles: Introduction and history of operating systems, Operating systems as an extended machinery and resource manager, Operating systems structures. Process Management: Introduction, Inter process communication and Process scheduling. Input / Output. Memory Management. File System.

## **Detailed Course**

### **Unit 1: Overview LH 5**

- 1.1 Introduction
- 1.2 System Structures

### **Unit 2: Process Management LH 8**

- 2.1 Process Concept
  - 2.1.1 Overview
  - 2.1.2 Process Scheduling
    - 2.1.2.1 Basic Concepts
    - 2.1.2.2 Scheduling Criteria
    - 2.1.2.3 Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue, Multilevel Feedback-Queue)
  - 2.1.3 Operations on Processes
  - 2.1.4 Interprocess Communication

### **Unit 3: Process Coordination LH 12**

- 3.1 Synchronization
  - 3.1.1 Background
  - 3.1.2 The Critical-Section Problem
  - 3.1.3 Peterson's Solution
  - 3.1.4 Synchronization Hardware
  - 3.1.5 Semaphores
  - 3.1.6 Classic Problems of Synchronization
  - 3.1.7 Monitors
- 3.2 Deadlocks
  - 3.2.1 System Model
  - 3.2.2 Deadlock Characterization
  - 3.2.3 Methods of Handling Deadlocks
  - 3.2.4 Deadlock Prevention
  - 3.2.5 Deadlock Avoidance
  - 3.2.6 Deadlock Detection
  - 3.2.7 Recovery from Deadlock

### **Unit 4: Memory Management LH 10**

- 4.1 Memory Management Strategies

- 4.1.1 Background
- 4.1.2 Swapping
- 4.1.3 Contiguous Memory Allocation
- 4.1.4 Paging
- 4.1.5 Structure of the Page Table
- 4.1.6 Segmentation
  
- 4.2 Virtual Memory Management
  - 4.2.1 Background
  - 4.2.2 Demand Paging
  - 4.2.3 Copy on Write
  - 4.2.4 Page Replacement
  - 4.2.5 Allocation of Frames
  - 4.2.6 Thrashing

**Unit 5: Storage Management**

**LH 10**

- 5.1 File System
  - 5.1.1 File Concept
  - 5.1.2 Access Methods
  - 5.1.3 Directory Structure
  - 5.1.4 File System Mounting
  - 5.1.5 File Sharing
  - 5.1.6 Protection
- 5.2 Implementing File Systems
  - 5.2.1 File System Structure
  - 5.2.2 File System Implementation
  - 5.2.3 Directory Implementation
  - 5.2.4 Allocation Methods
  - 5.2.5 Free Space Management
- 5.3 Secondary Storage Structure
  - 5.3.1 Disk Structure
  - 5.3.2 Disk Scheduling
  - 5.3.3 Disk Management
  - 5.3.4 Swap Space Management
- 5.4 I/O Systems
  - 5.4.1 I/O Hardware
  - 5.4.2 Application I/O Interface

**Laboratory:**

- Students should implement operating system functionality in their project.

**Course Book:**

- Silberschatz, A., Galvin, P. & Gagne, G., Operating System Principles, Seventh Edition, John Wiley & Sons

**References:**

- Andrew S. Tanenbaum, Modern Operating System, PHI
- Andrew S. Tanenbaum, Operating Systems Design and Implementation, Prentice Hall
- James L Peterson & Abraham Silberschatz, Operating System concepts, Addison Wesley
- Thomas W. Doeppner, Operating Systems in Depth, John Wiley & Sons

## ITC 309: Data Mining and Data Warehousing

### Module Objective

This module aims to develop the students with a basic understanding of fundamental principles and techniques of data mining and data warehousing and their use in the business organizations.

### Contents

Introduction to Data Mining. Business application of Data Mining. Multidimensional Data Model. On-Line Analytical Processing models. On- Line Analytical Processing operations. Data Warehouse. Relationships between Data Warehouse, On- Line Analytical Processing and Data Mining technology. Data Warehouse processes and system architecture. Association Analysis: Single dimensional, Multilevel and Multidimensional association rules. Algorithms for Association rules. Cluster Analysis. Major clustering methods. Classification and Prediction. Decision trees. Data Mining using Neural Net, Genetic Algorithm and Bayesian Classifier. Mining Complex types of data: Multimedia Data Mining, Web data mining, Text mining and Mining heterogeneous database.

### Detailed Course

#### UNIT – I: Introduction

- What motivated Data mining? What is Data Mining?
- On What Kind of Data?
  - ✚ Relational database
  - ✚ Data Warehouses
  - ✚ Transactional Databases
- Data Mining functionalities – What kinds of Pattern can be minde?
  - ✚ Concept/Class Description: Characterization and Discrimination
  - ✚ Association Analysis
  - ✚ Classification and Prediction
  - ✚ Cluster Analysis
  - ✚ Outlier Analysis
  - ✚ Evolution Analysis

#### Unit – II: Data Warehouse and OLAP technology for Data Mining

- What is data warehouse?
  - ✚ Differences between operational database systems and data warehouses
  - ✚ Why have a separate data warehouse?
- Multi-dimensional data model
- From Tables and SpreadSheets to Data Cubes
- Star schema, Snowflake schema and Fact constellation schema
- On-line analytical processing models and operations (drill down, drill up, slice, dice, pivot).
- Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP

#### UNIT – III Data Preprocessing

- Why Preprocess the Data?
- Data Cleaning
  - ✚ Missing values
  - ✚ Noisy Data
  - ✚ Inconsistent Data
- Data Integration and Transformation
  - ✚ Data Integration
  - ✚ Data Transformation

- Data Reduction
  - Data Cube Aggregation
  - Dimensionality Reduction
  - Data Compression
- Discretization and Concept Hierarchy Generation
  - Discretization and concept hierarchy generation for Numeric data

#### **UNIT- IV: System Process**

- Introduction
- Overview
- Typical process flow within a data warehouse
- Extract and load process
- Clean and transform data
- Backup and archive process
- Query management process

#### **UNIT – V: Process Architecture**

- Introduction
- Load manager
- Warehouse manager
- Query Manager

#### **UNIT – VI: Association analysis**

- Association Rule Mining
  - Market Basket Analysis
  - Basic concept
- Mining Single-Dimensional Boolean Association Rules from Transactional Databases
  - Apriori Algorithm
  - Generating association rules from frequent itemsets
  - Improving the Efficiency of Apriori

#### **UNIT – VII: Cluster analysis**

- What is cluster analysis?
- Types of data in cluster analysis
  - Interval scaled variables
  - Binary variables
- Partitioning methods
  - Classical Partitioning methods: k-Means and k-Medoids
  - Partitioning methods in large databases: from k-Medoids to CLARANS
- Hierarchical methods
  - Agglomerative and Divisive hierarchical clustering
  - BIRCH
- Density-based methods
  - DBSCAN
- Outlier Analysis
  - Statistical-Based Outlier Detection
  - Distance-Based outlier Detection

## **UNIT – VIII: Classification and Predication**

- What is classification? What is predication?
- Issues regarding classification and prediction
  - ✚ Preparing the data for classification and prediction
  - ✚ Comparing classification methods
- Classification by decision tree induction
  - ✚ Decision tree induction
  - ✚ Extracting classification rules from decision trees
- Bayesian Classification
  - ✚ Bayes theorem
  - ✚ Naïve Bayesian classification
- Classification by backpropagation
  - ✚ A multilayer feed-forward neural network
  - ✚ Defining a network topology
  - ✚ Backpropagation
- Other Classification methods
  - ✚ Genetic algorithm

## **UNIT – IX: Advanced concepts in data mining**

- What is multimedia mining?
- What is text mining?
- What is web mining?

## **UNIT – X: Capacity Planning**

- Introduction
- Process
- Estimating the load

### ***References:***

- Han J., Kamber M., (2001), *Data Mining Concepts & Techniques*, Elsevier.
- Anahory S., Murray D., (2001), *Data Warehousing in the real world – a practical guide for building decision support systems*, Pearson Education
- Gupta G.K., (2008), *Introduction to Data Mining with Case Studies*, Prentice-Hall of India.