

Tribhuvan University  
**Faculty of Management**  
**Office of the Dean**



*Revised*

Course detail of  
BIM (Bachelor of Information Management) 5<sup>th</sup> Semester

# ACC 202: Cost and Management Accounting

## **Module Objectives**

This module aims to provide the students with the knowledge and skills of cost and management accounting tools and techniques required for decision-making, and control.

## **Contents**

Concept of financial accounting, cost accounting, and management accounting. Cost accumulation, classifications, and segregation. Income recognition, measurement, and reporting: variable and absorption costing concept. Cost-volume-profit analysis. Budgeting and profit planning: revenue budget, purchase and production budget, direct labor and manufacturing overhead cost budget, cash collection and disbursement budget. Budgeted income statement and balance sheet. Standard cost. Flexible budgeting, Responsibility accounting. Decision regarding alternative choices: Make or Buy, Drop a Product Line, Accept and Reject a Special Offer, Replacement a Joint Product and Replacement Decisions. Ratio and Cash Flow Analysis. Investment analysis: capital budgeting concept, cash flow and profit and loss accounts, and investment analysis techniques.

## **Detailed Course**

### **Unit 1: Accounting: Cost and Management**

- Financial Accounting / Limitation of Financial Accounting
- Concept of cost accounting
- Objectives and functions of Cost Accounting
- Difference between cost and financial accounting, Limitation of cost accounting
- Management accounting
- Objectives and functions of management accounting
- Limitation of management accounting
- Difference between cost and management accounting.

### **Unit 2: Cost Concept and Cost Classification**

- Meaning of cost
- Classification of cost
- Segregation of cost into variable and fixed cost using various techniques such as account classification, scattered graph, high low point method and least square technique.

### **Unit 3: Income Recognition, Measurement and Reporting**

- Absorption costing
- Variable costing
- Advantage of absorption costing and variable costing
- Determination of net income under variable costing and absorption costing under different inventory conditions
- Reconciliation of profit between variable costing and absorption costing to report the causes of difference.

### **Unit 4: Cost, Volume, Profit Analysis**

- Relation between cost and volume-cost volume ratio
- Relation between profit and volume-profit volume (contribution margin) ratio
- Assumption of cost volume and profit analysis
- Use of cost volume analysis for
  - Break even analysis
  - Profit planning

- Methods of calculating break even sales volume
  - Variable income statement
  - Algebraic formula
  - Contribution margin approach
  - Break even chart
- Determining required sales to obtain desired profit
- Safety margin and safety margin ratio
- Sales mix for break even analysis and profit planning
  - Joint fixed cost
  - Weighted average contribution margin and contribution margin.

#### **Unit 5: Accounting for Control**

- Concept of control
- Behavioral aspects of control
- Responsibility and control

#### **Standard Costing**

- Difference between standard cost and budgeted cost
- Concepts of cost centers and development of standards
- Standard costing and variable cost
- Direct material cost
- Direct labour cost
- Variance analysis for cost control
- Direct material cost variance, yield variance, mix variance and cost variance
- Direct labour cost variance - efficiency, mix and rate variance
- Advantages and limitations of standard costing.

#### **Unit 6: Budgeting and Profit Planning**

- Concept of budget and objective of budget
- Preparation of budget for manufacturing and non-manufacturing concern
- Sales budget
- Production budget
- Purchase budget
- Direct labour and overhead budget
- Cash collection and disbursement budget
- Budgeted income statement
- Budgeted balance sheet

#### **Unit 7: Flexible Budgeting**

- Concept of flexible budgeting
- Features of flexible budgeting
- Preparation of flexible budgeting
- Flexible budget and standard costing
- Overhead variance
- Performance evaluation

#### **Unit 8: Accounting for Alternative Choices for decision making**

- Concept of decision making
- Types of decision
  - Make or buy decision
  - Drop or continue decision
  - Accept or reject o special offer
  - Equipment replacement decision

→ Decision to sell or further processing

### **Unit 9: Investment Analysis**

- Concept of capital budgeting
- Characteristics of capital expenditure
- Capital budgeting procedures
- Calculation of cash flow streams
- Types of proposals
- Technique of investment analysis.

### **Unit 10: Ratio Analysis**

- Concept of ratio analysis
- Advantage of ratio analysis
- Limitations of ratio analysis
- Types of ratios
  - Liquidity ratio
  - Leverage ratio
  - Activity ratio
  - Profitability ratio
  - Earning performance ratio
  - Productivity ratio.

### **Unit 11: Cash Flow Analysis**

- Concept of cash flow analysis
- Preparation of cash flow statement
  - Direct approach to cash flow statement
  - Indirect approach to cash flow statement

Class Lecture = 45 hrs.

Tutorials = up to 15 hrs.

Assessment = 3 hrs.

### **References:**

- Bijaya Prakash Shrestha, Yamesh Man Singh, Narendra Sharma, Khagendra Ojha, Edited by, Ramesh Pandey, *Accounting for Financial Analysis and Planning*, Buddha Academic Publishers and Distributors Pvt. Ltd.
- Colin Drury, *Management and Cost Accounting*. ELBS with Chapman and Hall
- Jerry J. Weygandt, Donald E. Kieso and Paul D. Kimmel, *Managerial Accounting, Tools for business decision making*, John Wiley and sons. Inc.
- Ratna Man Dangol, Prem Gurung, Jeetendra Dongol, *Cost and Management Accounting*, Taleju Prakashan
- Richard M Lynch, Robert W. Williamson, *Accounting for Management (Planning and Control)*, Tata McGraw Hill Publishing Company Ltd.
- Robert F. Meigh, Jan R. Williams, Susan F. Haka Mark S. Bettener - *Financial Accounting*, Irwin, McGraw Hill, International Edition.
- Robert L. Dansby, Michael D. Lawrence, *Cost Accounting*, AITBS Publishers and Distributors.
- Ronald W. Hilton, *Managerial Accounting*, Tata McGraw Hill
- Shiva Prasad Munankarmi, Bijaya Praksah Shrestha, Gautam Maharjan, *Cost and Management Accounting*, Education Publishing House.
- Yamesh man Singh, Khagendra P. Ojha, Chiranjibi Acharya, *Cost and Management Accounting*, Buddha Academic Publishers and Distributors Pvt. Ltd.

# ECO - 202: Macro Economics

## **Module Objectives**

This module aims to develop students' understanding of the macroeconomic concepts to enhance their skills in analyzing business environment for decision-making.

## **Contents**

Macroeconomics: concepts and importance. National income accounting: concepts, measurement approaches and measurement difficulties of national income. Employment theories: classical and Keynesian theories. Components of macroeconomics: consumption and saving functions, paradox of thrift, investment function, concept of multiplier and acceleration coefficient. Theory of income determination (IS-LM Model). Business cycles: phases and economic stabilization policy. Inflation: theories of inflation, computation of rate of inflation, monetary policy: objectives and instruments, demand and supply of money. Fiscal policy: objectives and instruments, Macroeconomic issues: Nepalese perspective.

## **Detailed Course**

### **Unit 1: Introduction to Macroeconomics**

**LH 2**

Meaning and scope of macroeconomics, Types of macroeconomics, Uses of macroeconomics.

### **Unit 2: National Income Accounting**

**LH 7**

Circular flow of income and expenditure (two, three and four sector economy), Meaning of national income: Various concepts of NI: GDP, NDP, GNP and NNP (in both terms – market price and factor cost), Nominal GDP, Real GDP and GDP deflator, **Potential and actual GDP**, Personal income, Disposable income and **Saving**, Per capital income. Three approaches of measurement of NI (Product, Income and Expenditure), Measurement Difficulties of NI.

#### **Numerical assignments.**

### **Unit 3: Theory of Employment**

**LH 3**

Meaning and types of unemployment, Say's law of market, Classical theory of employment, Principle of effective demand.

### **Unit 4: Components of Macroeconomics**

**LH 10**

Consumption function

- Meaning of consumption and consumption function
- Psychological law of consumption function
- Technical attributes of consumption function
- Determinants of consumption function
- Measures to raise consumption function

Saving function

- Meaning of saving and saving function
- Types of saving
- Technical attributes of saving function

- Paradox of thrift

#### Investment function

- Meaning and types of investment
- Concept of MEC, MEI and investment demand curve
- Determinants of induced investment (or MEC)
- Measures to raise induced investment
- Concept of acceleration coefficient (Tabular explanation)

#### Multiplier

- Concepts of investment multiplier
- Forward working of investment multiplier
- Leakages and importance of investment multiplier
- Concept of super multiplier

#### ***Numerical assignments (consumption, saving, investment and multiplier)***

#### **Unit 5: Hicks-Hansen Theory of Income Determination**

**LH 4**

Derivation of IS curve and product market equilibrium, Derivation of LM curve and money market equilibrium, Determination of equilibrium income.

#### ***Numerical assignments.***

#### **Unit 6: Business Cycles**

**LH 2**

Meaning and characteristics, Phases of business cycles, Economic stabilisation policy.

#### **Unit 7: Inflation**

**LH 5**

Meaning, types (on the basis of rate and control), Theories of inflation – Demand-pull, cost-push and mixed inflation, Effects (production and distribution of income and wealth), Anti-inflationary measures, Inflationary gap, Inflation and unemployment, Computation of rate of inflation (Using PPI, CPI and GDP inflator only).

#### ***Numerical assignments.***

#### **Unit 8: Monetary Policy**

**LH 3**

Concept of money supply – determinants, narrow and broad money supplies, Keynesian concept of demand for money, Monetary policy – concepts, objectives and instruments.

#### **Unit 9: Fiscal Policy**

**LH 3**

Concepts, objectives and instruments of fiscal policy, Concept of deficit financing and debt management.

#### **Unit 10: Macroeconomics Issues: Nepalese Perspective**

**LH 6**

Economic growth, development and welfare, Sources of economic growth, Privatisation, economic liberalisation and globalisation, Foreign direct investment, Foreign employment: current status and role.

## **References**

Begg, D. (2000), **Economics**, London, McGraw Hill

Bernake and Abel (2003), **Macroeconomics**, Singapore, Pearson Education

Dahal M.P. (2004), **Nepalese Economy: Towards Building a Strong Economics Nation-State**, Kirtipur, Central Department of Economics, TU / New Hira Books Enterprises.

Lipsey, R.S. and C. Harbury, (2004), **Elementary Macroeconomics**, New York, Oxford University Press

Mankiew, NG (1998), **Principles of Macroeconomics**, Orlando, The Dryden Press, Harcourt Brace College Publishers

McConnell and Bruce (2002), **Economics : Principles, Problems and Policies**, New York, McGraw Hill.

Shrestha, R.G. and Adhikari, G.M. (2008), **Macroeconomics**, Kathmandu, Asia Publications.

Todaro, M.P (2005), **Economics in the Third World**, Hyderabad, Orient Longman, Ltd.

Other suggested readings: Various Publications and Journals of Nepal Rastra Bank, Ministry of Finance, National Planning Commission, Central Bureau of Statistics, World bank, Central Department of Economics (TU) and So on.

# ITC 221: Computer Graphics

## **Objectives**

This module aims to develop students' skill in computer graphics. This module should be associated with laboratory experiments to augment the concepts taught in the class.

## **Contents**

Introduction of Computer Graphics, Hardware and Software Concept, Two Dimensional Algorithm, Three Dimensional Graph, Visible surface detection method, Illumination models and surface rendering methods, and Trends in Computer Graphics.

## **Detailed Course**

1. Introduction of Computer Graphics LH 1
  - 1.1 Early History
  - 1.2 Application of Computer Graphics
  
2. Hardware and Software Concept LH 9
  - 2.1 Input Devices  
Mouse, Touch Screen, Light Pen, Data Glove, Tablet (Digitizer), Bar Code Reader
  - 2.2 Output Devices
    - 2.2.1 Monochromatic & Color CRT
    - 2.2.2 Raster and Random Scan Display
    - 2.2.3 Flat Panel Display
      - 2.2.3.1 LED
      - 2.2.3.2 LCD
    - 2.2.4 Simple Architecture on Raster, Random Scan System
    - 2.2.5 Concept of Three Dimension viewing devices
  - 2.3 Graphics Software
    - 2.3.1 Software standards
    - 2.3.2 Need of machine independent graphics language
  - 2.4 Color Models
    - 2.4.1 RGB
    - 2.4.2 HSV
    - 2.4.3 Conversion between HSV and RGB color models
  
3. Two Dimensional Algorithm LH 15
  - 3.1 Line Drawing Algorithm
    - 3.1.1 DDA (With positive and negative slope)
    - 3.1.2 Bresenham's Line Algorithm
      - 3.1.2.1 for positive slope ( $m \leq 1$ ,  $m > 1$ )
      - 3.1.2.2 for negative slope ( $m \leq -1$ ,  $m > -1$ )
  - 3.2 Circle Algorithm
    - 3.2.1 General circle equation
    - 3.2.2 Mid-Point circle equation
  - 3.3 2D Geometric Transformation
    - 3.3.1 Basic Transformation
      - 3.3.1.1 Translation



- 3.3.1.2 Rotation
- 3.3.1.3 Scaling
- 3.3.2 Homogenous Coordinate
- 3.3.3 Composite Transformation
  - 3.3.3.1 Successive Translation
  - 3.3.3.2 Successive Rotation
  - 3.3.3.3 Successive Scaling
  - 3.3.3.4 Pivot point rotation
  - 3.3.3.5 Fixed point scaling
- 3.3.4 Other Transformation
  - 3.3.4.1 Reflection
  - 3.3.4.2 Shear
- 3.4 Two Dimensional Viewing
  - 3.4.1 Viewing pipeline
  - 3.4.2 Window to viewport coordinate transformation
  - 3.4.3 Clipping
    - 3.4.3.1 Introduction and application of clipping
    - 3.4.3.2 Line Clipping
      - 3.4.3.2.1 Cohen Sutherland line clipping
    - 3.4.3.3 Polygon clipping
      - 3.4.3.3.1 Sutherland Hodgeman polygon clipping

#### 4. Three Dimensional Graph

LH 7

- 4.1 3D object representation
  - 4.1.1 Polygon surface
  - 4.1.2 Polygon tables
  - 4.1.3 Plane equations
  - 4.1.4 Polygon meshes
- 4.2 Projections
  - 4.2.1 Parallel Projections
    - 4.2.1.1 Isometric
    - 4.2.1.2 Oblique
  - 4.2.2 Perspectives Projections
  - 4.2.3 Derivation of projections
- 4.3 3D Transformations
  - 4.3.1 Translation
  - 4.3.2 Rotation
    - 4.3.2.1 General 3D rotation
  - 4.3.3 Scaling
    - 4.3.3.1 Fixed point scaling
  - 4.3.4 Reflection
  - 4.3.5 Shear

#### 5. Visible surface detection method

LH 5

- 5.1 classification of algorithm
- 5.2 different types of algorithm
  - 5.2.1 depth buffer (z-buffer) method
  - 5.2.2 A-Buffer method

- 5.2.3 Scan line method
- 5.2.4 Depth sorting method (Painter's Algorithm)

## 6. Illumination models and surface rendering methods

LH 6

- 6.1 light source
- 6.2 basic illumination models
  - 6.2.1 Ambient light
  - 6.2.2 Diffuse reflection
  - 6.2.3 Specular reflection and Phong model
  - 6.2.4 Intensity attenuation
  - 6.2.5 Color consideration
  - 6.2.6 Transparency
  - 6.2.7 Shadows
- 6.3 Polygon rendering methods
  - 6.3.1 Constant intensity shading
  - 6.3.2 Gouraud shading
  - 6.3.3 Phong Shading

## 7. Trends in Computer Graphics

LH 2

- 7.1 Concept of Virtual reality & simulation
- 7.2 Computer animation
  - 7.2.1 Design of animation sequences
  - 7.2.2 Computer animation languages
  - 7.2.3 Morphing and simulating accelerations.

### Laboratory Work

Lab1: DDA

Lab2: Bresenham's line drawing algorithm

Lab3: Circle

Lab4: Basic transformation on 2D

- ✓ Translation
- ✓ Rotation
  - About origin
  - About pivot point
- ✓ Scaling
  - About origin
  - About fixed point

Lab5: Simple 3D Object

Lab6: Basic Transformation on 3D object

- ✓ Translation
- ✓ Rotation
- ✓ Scaling

Laboratory work will be carried out using visual or non visual high level languages.

### References

- *Computer Graphics, C Versions (Practise Hall)* : Hearne and Baker
- *Computer Graphics – Principles and Practises*: J.D. Foley, S.K. Feiner and J.F. Hughes

# ITC 222: JAVA Programming

## **Module Objectives**

This module aims to develop students' skill in JAVA programming. Students are expected to have the basic knowledge of programming with 'C' language. This module should be associated with laboratory experiments to augment the concepts taught in the class.

## **Contents**

Java Language fundamentals, Class and Objects, Inheritance, Package and Interfaces, Exception Handling, Multithreading, GUI Design , Java I/O, Java Networking Programming, Java Database Programming, Java Sevlets, Remote Method Invocation, and Java Beans.

## **Detailed Course**

### **Unit 1: Java Language Fundamentals**

**LH 18**

#### **1.1 Java Development Environment**

- 1.1.1 History
- 1.1.2 Java features (buzzwords)
- 1.1.3 Java Platform
- 1.1.4 Java Virtual Machine (JVM) and Bytecode
- 1.1.5 Process of Building and Running a Java application programs
- 1.1.6 Java Development Kit(JDK) and Some Common APIs
  - 1.1.6.1 Java Tools: javac, java, javap, appletviewer, javadoc etc..
  - 1.1.6.2 APIs: Language support package, Utilities package, Networking package, Input/Output package, AWT package and Applet Package. Deployment Technologies, User Interface Toolkits, Integration Libraries
- 1.1.7 Types of Java applications (Stand alone applications, Web Applets, Distributed applications)

#### **1.2 Basic Java language**

- 1.2.1 Java Character Sets
- 1.2.2 Java keywords
- 1.2.3 Java program structure
- 1.2.4 Java tokens
- 1.2.5 Identifiers, Literals, Operators, Separators
- 1.2.6 Constants, Variables and Data Types
- 1.2.7 Implementing a Java Program (Creating, Compiling and Running)
- 1.2.8 Java Statements (Expression, Synchronization, Guarding, Control Iteration and Jumping Statements)
- 1.2.9 Command Line arguments
- 1.2.10 Scope of a Variables ( Instance, Class, Local and Parameter)
- 1.2.11 Type Casting

1.2.12 Arrays

### **1.3 Java Classes and Objects**

1.3.1 Introduction to OOP

1.3.2 Objects

1.3.3 Defining a class

1.3.4 Constructors

1.3.5 Methods

1.3.6 Accessing class member

1.3.7 Garbage Collection

1.3.8 The finalize() Methods

1.3.9 Overloading Method

1.3.10 Overloading Constructors

1.3.11 Passing Object as a Parameters

1.3.12 Returning Objects

1.3.13 Static Members (Static methods and Block)

1.3.14 Using the final keyword

1.3.15 Introduction to Nested and Inner Classes

1.3.16 Introduction to String Class and String Manipulation

1.3.17 Java Objects Hierarch

### **1.4 Inheritance**

1.4.1 Inheritance Basic and Reusability

1.4.2 Inheritance Types and Multi Level inheritance

1.4.3 Use of super

1.4.4 Overriding methods

1.4.5 Dynamic Method Dispatch

1.4.6 Abstract Class and Methods

1.4.7 Visibility Control (Rules of thumb)

1.4.8 Using final keyword with inheritance: Final classes and Variables

### **1.5 Packages and Interfaces**

1.5.1 Using the System packages (importing packages)

1.5.2 Defining a Package (Creating your own packages)

1.5.3 Accessing a package

1.5.4 Access Protection

1.5.5 Defining Interface

1.5.6 Implementing Interface

1.5.7 Variables in Interface

1.5.8 Interface Extension

### **1.6 Exception Handling in Java**

- 1.6.1 Errors Types
- 1.6.2 Exception
- 1.6.3 Exception Handling Fundamental (try catch finally block)
- 1.6.4 Exception Types
- 1.6.5 Using try and catch
- 1.6.6 Nested try statements
- 1.6.7 Use of throw, throws and finally
- 1.6.8 Java's built-in exceptions
- 1.6.9 Creating your own Exception subclasses
- 1.6.10 Chained Exceptions

## **1.7 Multithreading**

- 1.7.1 Introduction to multithreading
- 1.7.2 Threads and Processes definitions
- 1.7.3 Life Cycle of a Thread
- 1.7.4 Thread States
- 1.7.5 Creating a threads in Java
- 1.7.6 Main Thread
- 1.7.7 Creating Multiple Threads
- 1.7.8 Using isAlive() and join() methods
- 1.7.9 Thread Priorities
- 1.7.10 Synchronization
  - 1.8.10.1 Synchronized Methods and Statements
  - 1.8.10.2 Dead lock
- 1.7.11 Interthread Communication
  - 1.8.11.1 The use of wait(), notify(), notifyAll() Methods
  - 1.8.11.2 Suspending, Resuming and Stopping Threads

## **Unit 2: Java GUI Applications and Applets Programming**

**LH 8**

- 2.1 Introduction to Abstract Window Toolkit(AWT) and AWT Components
- 2.2 Graphical User Interface Design using Java Swing
  - 2.2.1 Swing Component Hierarchy
  - 2.2.2 Container Classes
  - 2.2.3 Layout Managers
  - 2.2.4 Swing Components
- 2.3 Event handling Mechanisms
  - 2.3.1 Event Classes and Listener Interface
  - 2.3.2 Event Delegation Model
- 2.4 Introduction to Applet programming and Applet Class
  - 2.4.1 Local and Remote applet

- 2.4.2 Applet Life Cycle Methods
- 2.4.3 Use of APPLET Tag
- 2.4.4 Creating and Running an Applet program
- 2.4.5 Passing Parameters to applets
- 2.4.6 Taking Input from the Users through Applet
- 2.4.7 Basic Graphics Drawing (Line, Rectangles, Circle, etc )

**Unit 3: Java Input / Output System**

**LH 3**

- 3.1 File
- 3.2 Directories
- 3.3 I/O Stream Classes
- 3.4 Byte Streams and Character Streams
- 3.5 Reading and writing to a file
- 3.6 Random Access File
- 3.7 Introduction to Java NIO

**Unit 4: Java Network Programming**

**LH 4**

- 4.1 Introduction to Network Programming
- 4.2 TCP and UDP
- 4.3 IP Address, Port Number and Socket
- 4.4 URL and URLConnection
- 4.5 Creating a client/server application using TCP Sockets
- 4.6 Creating a client/server application using UDP Datagram

**Unit 5: Java Database Programming**

**LH 4**

- 5.1 Relational database overview
- 5.2 JDBC API
- 5.3 Driver Manager and JDBC Drivers
- 5.4 JDBC Driver Types
- 5.5 Introduction to ODBC
- 5.6 Connecting Database using JDBC ODBC Driver
- 5.7 Use of Insert, Delete, Update, Select Operations

**Unit 6: Web Programming Using Java Servlet APIs**

**LH 4**

- 6.1 Introduction to CGI and Web Server
- 6.2 Servlet Definition
- 6.3 HTTP request-response model of Servlet
- 6.4 Advantages of Servlet over CGI
- 6.5 Servlet Life-cycle methods
- 6.6 Servlet API
- 6.7 Creating Java Servlet
  - 6.7.1 Using Application Server ( E.g. Tomcat )

6.8 Session and Cookies in Servlets

**Unit 7: Distributed Application using RMI**

**LH 4**

- 7.1 Distributed applications
- 7.2 Distributed Computing Technologies
- 7.3 Principle behind distributed applications
- 7.4 Remote Method Invocation ( RMI)
  - 7.4.1 RMI Layers
  - 7.4.2 RMI Mechanism
  - 7.4.3 RMI Registry
  - 7.4.4 Creating RMI Applications

**Unit 8: Introductory concept of Java Beans**

**LH 3**

- 8.1 Java Beans
- 8.2 Bean Development Kit (BDK)and Bean Builder
- 8.3 Software Components, Introspection and Discovery, Interface methods and Properties, Persistence, Events
- 8.4 Creating a New Bean

**Project Work:** Instructor should assign project work to each group of student.

**References:**

- *The Complete Reference Java2* , Fifth Edition, Herbert Schildt, Tata McGraw-Hill New Delhi India
- *Programming with Java – A Primer*, Second Edition, E. Balagurusamy , Tata McGraw-Hill New Delhi India
- *Java How to Program*, Sixth Edition, A.M Deitel and P.J. Deitel , Pearson –Prience Hall India

# ITC 223: ARTIFICIAL INTELLIGENCE

## **Module Objectives**

This module aims to provide the students with the basic foundation on concepts of searching and knowledge representation in AI systems. The key objective is to make students more pragmatic in knowledge of AI by giving its applications like designing and training Artificial Neural Networks along with additional laboratory works.

## **Contents**

Turing test, agents & environments, blind search, heuristic search, game playing (planning), min-max & min-max with alpha-beta, general problem solving, cryptoarithmatic, propositional logic, predicates, first-order logic, clausal normal form, resolution, semantic nets, supervised & unsupervised learning, genetic algorithm, artificial neural network, natural language processing, machine translation, expert systems, machine vision, business application of AI, and ProLog/LISP.

## **Detailed Course**

Chapter 1: Introduction LH 4

- 1.1 What is AI?
  - 1.1.1 Turing test approach: Chinese room argument
  - 1.1.2 Cognitive approach
  - 1.1.3 Laws of thought approach
  - 1.1.4 Rational agent approach
- 1.2 Difference between AI and Omniscience

Chapter 2: Agents and Environments

LH 6

- 2.1 Agent, Rational agent, and Intelligent Agent
- 2.2 Relationship between agents and environments
- 2.3 Environments and its properties
- 2.4 Agent structures
  - 2.4.1 Simple reflex agents
  - 2.4.2 Model-based reflex agents
  - 2.4.3 Goal-based agents
  - 2.4.4 Utility-based agents
  - 2.4.5 Learning agents
- 2.5 Performance evaluation of agents: PEAS description

Chapter 3: Search

LH 10

- 3.1 Why search in AI?
- 3.2 Blind search (Un-informed search)
  - 3.2.1 Breadth first search (BFS)
    - Variations:** Uniform cost search
  - 3.2.2 Depth first search (DFS)
    - Variations:** Depth limited search, Iterative deepening DFS
- 3.3 Heuristic search (Informed search)
  - 3.3.1 Hill climbing
  - 3.3.2 Greedy (Best-first) search
  - 3.3.3 A\* algorithm (search)
  - 3.3.4 Means-Ends Analysis: Household ROBOT, Monkey Banana Problem



- 3.4 General Problem Solving (GPS): Problem solving agents
  - 3.4.1 Constraint satisfaction problem
  - 3.4.2 Cryptarithmic
- 3.5 Game playing and AI
  - 3.5.1 Min-max algorithm (search)
  - 3.5.2 Min-max with alpha-beta

## Chapter 4: Knowledge Representation

LH 10

- 4.1 Logic
  - 4.1.1 Propositional Logic
    - 4.1.1.1. Syntax, semantics, and properties
    - 4.1.1.2. Conjunctive Normal Form (CNF)
    - 4.1.1.3. Disjunctive Normal Form (DNF)
    - 4.1.1.4. Inference Rules
    - 4.1.1.5. Resolution
  - 4.1.2 Prehdicate Logic
    - 4.1.1.1. First-Order Predicate Logic (FOPL)
    - 4.1.1.2. Syntax and semantics in FOPL
    - 4.1.1.3. Quantifiers
    - 4.1.1.4. Clausal Normal Form
    - 4.1.1.5. Resolution
- 4.2 Semantic networks (nets): Introduction, and examples

## Chapter 5: Learning

LH 5

- 5.1 Why learning?
- 5.2 Supervised (Error based) learning
  - 5.2.1 Gradient descent learning: Least Mean Square, Back Propagation algorithm
  - 5.2.2 Stochastic learning
- 5.3 Unsupervised learning
  - 5.3.1 Hebbian learning algorithm
  - 5.3.2 Competitive learning
- 5.4 Reinforced learning (output based)
- 5.5 Genetic algorithms: operators

## Chapter 6: Applications of AI

LH 10

- 6.1 Artificial Neural Networks (ANN)
  - 6.1.1 Neural Networks (NN) and ANN
  - 6.1.2 Mathematical model of a neuron
  - 6.1.3 Activation functions: unit (unary and binary), ramp, piecewise linear, & sigmoid
  - 6.1.4 Training and testing: Basic concept
  - 6.1.5 Mc-Colloch-Pits neuron model
    - 6.1.5.1. Realization of AND, OR, NOT, and XOR gates
  - 6.1.6 Neural network architectures
    - 6.1.6.1. Single layer feed-forward architecture: ADALINE, Perceptron NN

- 6.1.6.2. Multilayer feed-forward architecture: Multilayer Perceptron (MLP), Multilayer feed-forward (MLFF) NN, Back propagation algorithm
- 6.1.6.3. Recurrent architecture: Hopfield NN
- 6.1.7 Applications of ANN
- 6.2 Natural Language Processing (NLP)
  - 6.2.1 Fundamentals of language processing
  - 6.2.2 NLP and Machine Translation (MT)
  - 6.2.3 Levels of analysis: Phonetic, Syntactic, Semantic, and Pragmatic
- 6.3 Expert systems
  - 6.3.1 Components of experts systems
  - 6.3.2 Expert systems and Intelligent systems
- 6.4 Machine vision: Introduction, and simple block diagram
- 6.5 Business applications of AI: for decision support, weather forecasting, business intelligence

**Lab Task:**

Students are required to carry out at least 6 lab tasks on predicate calculus, searching and neural networks using **ProLog** and C/C++/Java. Some of the lab tasks may be on:

- 1 Relationship programs (e.g. mother, father, brother etc)
- 2 Recursive programs: Factorial, Fibonacci series etc
- 3 Ancestor programs
- 4 Tower of Hanoi (TOH) program
- 5 Monkey banana problem
- 6 Realization of logic gates (using C/C++/Java)

**References:**

- Russel S. and Norvig P., *Artificial Intelligence: A modern Approach*, Prentice hall
- Ritch and Knight, *Artificial Intelligence*, Prentice hall
- Dan W. Patterson, *Artificial Intelligence*