# R-22 Open Electives

**CHEMICAL:**
22CH11P1  Industrial Safety Engineering
22CH11P2  Technologies for conversion of waste to energy
22CH11P3  Design and Analysis of Experiments
22CH11P4  Supervised Machine Learning

**CIVIL:**
22CE11P1  Building Planning and Services
22CE11P2  Integrated Waste Mangement for a Smart City
22CE11P3  Disaster Management
22CE11P4  Intelligent Transportation Systems
22CE11P5  Water Supply Systems
22CE11P6  Sustainable Built Environment

**EEE:**
22EE11P1  Optimization Engineering
22EE11P2  Electrical Safety Management
22EE11P3  Energy Audit
22EE11P4  Solar PV Systems

**IT:**
22IT11P1  Human Computer Interaction
22IT11P2  Introduction to Object Oriented Analysis and Design
22IT11P3  E-Commerce
22IT11P4  Fundamentals of Artificial Intelligence
22IT11P5  Introduction to Cloud Computing
22IT11P6  Fundamentals of JAVA Programming
22IT11P7  Data Structures
22IT11P8  Introduction to C++

**MANAGEMENT STUDIES:**
22HM11P1  Start-Up Ecosystem
22HM11P2  Legal Environment for Business
22HM11P3  Logistics and Supply Chain Management
22HM11P4  Fundamentals of Cost and Management Accounting
22HM11P5  Information Systems for Managing Business
22HM11P6  Introduction to Indian Taxation System
22HM11P7  Organisational Behaviour and Human Resource Management
22HM11P8  Product Management
22HM11P9  Business Communication

**ECE:**
22EC11M1  EMI /EMC and Signal Integrity: Principles, Techniques and Applications
         (SWAYAM ONLINE - 12W)- IIT Kharagpur
22EC11M2  Sensors and Actuators(SWAYAM ONLINE - 12W)-IISC Bangalore
22EC11P1  Fundamentals of Biomedical Engineering (for non ECE)
22EC11P2  Communication Systems and Applications (for non ECE)

22EC11P3   Electronic Design Automation Tools


**CSE:**
22CS11P1   Principles of Software Project Management
22CS11P2   Web Graphics (Non CSE/IT)
22CS11P3   Agile Methodologies
22CS11P4   Cyber laws
22CS11P5   Management Information Systems
22CS11P6   Computer Forensics
22CT1110   Operating Systems(Non CSE/IT)
22CT1112   Computer Networks(Non CSE/IT)
22CS11M1 Getting Started with Competitive Programming
22CS11M2  Introduction to Internet of Things  (SWAYAM ONLINE - 12W)- IIT Kharagpur


**MECHANICAL:**
22ME11P1  Digital Manufacturing
22ME11P2  Renewable Sources of Energy

**PHYSICS:**

22BP11P1: Fundamentals of Nanoscience and Nanotechnology

## List of Open Electives offered by Chemical Engineering

| | |
|---|---|
| 22CH11P1 | Industrial Safety Engineering |
| 22CH11P2 | Technologies for conversion of waste to energy |
| 22CH11P3 | Design and Analysis of Experiments |
| 22CH11P4 | Supervised Machine Learning |

# INDUSTRIAL SAFETY ENGINEERING
## (OPEN ELECTIVE)

**Course Code:22CH11P1**

L  T  P  C
3  0  0  3

**Course Outcomes:** At the end of the Course, the Student will be able to

CO1: Understand the role of Management in Safety in Prevention of Accidents
CO2: Explain the various safety measures with respect to tools and general facilities
CO3: Identify the Hazards and Preventive measures
CO4: Explain the importance of Industrial hygiene in work place
CO5: Discuss safety implementation in specific industries

## UNIT-I:                                                         10 Lectures

*Safety Management:* Definitions, Nature & Importance of Management, Elements of Management functions, Management Principles, Safety Management and its Responsibilities, Safety Department, Safety programme, Safety Education and Training, Employee Participation in Safety.

*Accident Causation and Prevention:* Causation or Occurrence? The Accident Problem, Need for Safety, Reasons for Accident Prevention, Factors Impeding Safety, Basic Terms in Accident Prevention, Theories of Accident Causation, Principles of Accident Prevention

**Learning Outcomes:** After the completion of the Unit I, the student will be able to
1. Discuss the role of management in safety. (L2)
2. Explain the need for Safety training and Employee Participation. (L3)
3. Explain the Theories of Accident Causation and prevention. (L2)

## UNIT-II:                                                        10 Lectures

Safety in Machine Guarding, Safety in Material Handling, Working at Different Levels.
Good Housekeeping, Lighting and Color, Ventilation and Heat Control, Electrical Safety, Noise and Vibration, Fire and Explosion.

**Learning Outcomes:** After the completion of the Unit II, the student will be able to
1. Give the different Machine Guards and their safety measures.(L2)
2. Distinguish between manual handling and mechanical handling. (L3)
3. Explain the safety aspects in general facilities. (L2)
4. Discuss on causes and control of fire. (L3)

## UNIT-III:                                                       10 Lectures
**Hazards and Risks Identification, Assessment and Control Techniques:**
Safety Appraisal, Analysis and Control, Plant Safety Inspection.
Hazard and Risk Assessment Techniques: Hazards, Risks & Detection Techniques, HAZOP, FTA, ETA.
On-site and Off-site Emergency Plans: Need and Types of Emergency Plans, On-site Emergency Plan, Off-site Emergency Plan

**Learning Outcomes:** After the completion of the Unit III, the student will be able to
1. Explain the steps involved in Plant Safety Inspection. (L1)
2. Explain different hazard identification methods. (L2)
3. Prepare checklist for HAZOP (Hazard and Operability) analysis. (L3)
4. Construct FTA, ETA for hazard analysis. (L4)
5. Prepare On-site and Off-site emergency plans. (L3)

## UNIT-IV:                                                                    10 Lectures

Industrial Hygiene and Health: Industrial Hygiene, Physiology of Work, Ergonomics, Occupational Health, Personal Protective Equipment.

**Learning Outcomes:** After the completion of the Unit IV, the student will be able to
1. Illustrate the role of government in formulating/implementing regulations. (L3)
2. Identify the workplace hazards. (L1)
3. Evaluate the degree of exposure of workers to hazards. (L5)
4. Explain the control strategies to control the exposure. (L2)

## UNIT-V:                                                                     10 Lectures

Safety in Engineering Industry, Safety in Construction Industry, Safety in IT industry, Safety in Docks, Safety in Chemical Industry

**Learning Outcomes:** After the completion of the Unit V, the student will be able to
1. Discuss the safety in general industries. (L2)
2. Discuss the safety in specific chemical industries. (L2)
3. Explain various factors contributing to accidents. (L2)

**Text Books:**
1.   K.U. Mistry, Fundamentals of Industrial Safety and Health, Siddarth Prakashan, 108, Western Plaza, Near Bhulka Bhavan School, Adajan Road, Surat – 395 009. (Gujarat).
2.   Crowl, D.A. and Louvar, J.F. "Chemical Process Safety (Fundamentals with applications)", 2nd Edition, Prentice Hall, 1990.
**References:**
1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA.
2. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann
3. John Ridley and John Channing, Safety at Work, 7th Edition, Butterworth-Heinemann is an imprint of Elsevier, USA, 2008.
4. Industrial Accident Prevention by H.W. Heinrich, 2nd Edition, McGraw Hill Book Co., 1941

# TECHNOLOGIES FOR CONVERSION OF WASTE TO ENERGY
## (OPEN ELECTIVE)

**Course Code: 22CH11P2**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Course Outcomes:

At the end of the course, the student will be able to

CO1: Differentiate and characterize different waste

CO2: Recognize the various waste to energy conversion processes

CO3: Explain the various thermo chemical conversion processes.

CO4: Explain the various biochemical conversion processes.

CO5: Discuss the various biomass process to energy conversion.

## UNIT I                                                           10 Lectures

Introduction

The Principles of Waste Management and Waste Utilization, Waste as a Resource and Alternate Energy source.

Waste sources and Characterization: Agro based, forest residues, industrial waste, domestic waste, Municipal solid waste.

Learning Outcomes:

1.  Characterization of waste as fuel (L2)
2.  Classify waste from different sources (L4)
3.  Describe the characteristics of industrial waste (L2)

## UNIT II                                                           8 Lectures

Waste to energy Technologies: Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation.

Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery.

Learning Outcomes:

1.  Describe the process of converting waste to energy using combustion(L2)
2.  Illustrate pyrolysis (L3)
3.  Explain Gasification. (L2)
4.  Explain anaerobic digestion and fermentation (L2)

## UNIT III                                                           12 Lectures

Energy production from waste-thermo chemical conversion: Sources of energy generation/ production from incineration, pyrolysis, gasification of waste using gasifiers, environmental and health impacts of incineration; strategies for reducing environmental impacts. A few Case studies of existing plants.

Learning Outcomes:

1.  Describe different thermo-chemical conversion of waste to energy (L2)

2. Summarize the environmental and health impacts of incineration (L2)

3. Outline the strategies for reducing environmental impacts thermos-chemical conversion (L3)

## UNIT IV                                                    10 Lectures

Energy Production from waste- Bio-Chemical Conversion: Energy production from organic wastes through anaerobic digestion and fermentation, biogas production, landfill gas generation and utilization. A few Case studies of existing plants.

Learning Outcomes:

1. Describe the process of converting waste to energy using Anaerobic digestion and fermentation (L2)

2. Explain the process of bio-gas production from waste. (L2)

3. Describe landfill gas generation and utilization. (L2)

## UNIT V                                                    10 Lectures

Biomass energy technologies: Biomass characterization (proximate and ultimate analysis); Biomass pyrolysis and gasification; Biofuels – biodiesel, bioethanol, Biobutanol; Algae and biofuels; Hydrolysis & hydrogenation; Solvent extraction of hydrocarbons; Pellets and bricks of biomass; Biomass based thermal power plants; Biomass as boiler fuel.

Learning Outcomes:

1. Describe different biomass technologies(L2).

2. Explain Biomass characterization(L2)

3. Describe the working of Biomass based thermal power plants (L2)

**Text Books:**

1. Waste-to-Energy Technologies and Global Applications, Efstratios N. Kalogirou, CRC Press, Taylor & Francis Group, 2018

2. Desai Ashok V., Non-Conventional Energy, Wiley Eastern Ltd., 1980.

3. Pichtel John, Waste Management Practices Municipal, Hazardous and Industrial, Taylor & Francis, 2005.

4. Bioenergy Research: Biomass Waste to Energy, Manish Srivastava, Neha Srivastava Rajeev Singh, Springer Publisher, 2023

# SUPERVISED MACHINE LEARNING
## (OPEN ELECTIVE)

**Course Code:22CH11P3**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of the course, the student will be able to:

**CO1:** Explain the factors and the tools for developing the supervised machine learning models.

**CO2:** Outline the feature selection for various machine learning algorithms.

**CO3:** Describe the various supervised learning models.

**CO4:** Describe the importance of Ensemble methods in machine learning.

**CO5:** Outline the various metrics used for supervised machine learning algorithms.

**UNIT-I** (5 Lectures)

What is machine learning and the role it plays in the present day.

Various applications of machine learning.

Introduction to different machine learning algorithms.

Regression and Classification problems in machine learning.

Features and target definitions.

Numerical features, nominal categorical features and ordinal categorical features.

Dealing with categorical features in machine learning.

One hot encoding and ordinal encoding techniques.

Dealing with missing data. Imputing numerical and categorical data.

The importance of transforming data. Various data transforming techniques like MinMax scaling, Standard scaling and Robust scaling.

The role and importance of Exploratory Data Analysis. Understanding and interpreting barcharts, histograms, scatterplots, normal charts, boxplots, checking for outliers in the data, Pearsons correlation and its importance and pairplots to look for feature correlation. Measures for dispersion like range, variance and standard deviation.

Introduction to bias and variance and the case of overfitting and underfitting. Problems and consequences with overfitting and underfitting.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. explain the concepts of machine learning. (L2)

2. list various applications of machine learning. (L1)

3. understand the importance of data preprocessing. (L2)

**UNIT-II** (10 Lectures)

Feature extraction and selection techniques:

Feature extraction and selection and their importance in machine learning.

Feature extraction techniques:

Linear Discriminant analysis (LDA) method, Principle component analysis (PCA) and Singular value decomposition (SVD) techniques.

Feature selection techniques:

Variance threshold method, ANOVA and F value method, Shannons Information gain index, Recursive feature elimination (RFE) method.

The problems associated with multi collinearity and how to handle them using the Pearsons correlation and the Variance Inflation Index.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. understand the importance of feature selection in reducing dimensions. (L2)

2. list the various feature selection techniques in machine learning. (L2)

3. choose the relevant feature selection method to reduce the dimensionality. (L3)

## UNIT-III                                                                    15 Lectures)

The importance of training and testing in classification and regression problems.

k fold cross validation technique to assess the performance of a classifier and regressor. The importance of stratification of data in machine learning algorithms. The role of various hyper parameters in classification algorithms.

Linear Regression method for continuous target prediction.

Regression method to handle polynomials to induce curvature in the predictive model. Loss function in linear regression, the mean square error.

Reducing overfitting in linear regression by regularization. Regularization by Lasso, Ridge and Elastic Net regression.

How the weights are updated by the gradient descent and the stochastic gradient descent algorithms.

k Nearest neighbors method for classification and regression.

Distance metrics used in the kNN algorithm : Euclidean, Manhattan and Minkowski distance measures.

Other neighborhood classifiers like the radius neighborhood and the nearest centroid classifier.

Logistic Regression for classification.

Sigmoid function and its role in Logistic regression. Loss function for Logistic regression. The importance of decision threshold in the sigmoid function in classification.

How the weights are updated by the gradient descent and the stochastic gradient descent algorithms.

Support Vector Machines (SVM) for classification.

Linearly separable classification problems. Soft and hard margin classification. Kernel based methods for non-linearly separable classification problems.  Hinge loss function as a performance measurement for SVM.

Naïve Bayes classification method.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. analyse different classification and regression models. (L4)

2. choose the appropriate classification algorithm.(L3)

3. identify the role of probability in classification. (L3)

## UNIT-IV                                                                    (10 Lectures)

Decision Trees for classification.

The Gini impurity and entropy as splitting criteria. Pruning methods to reduce overfitting.

Ensemble methods for improving the predictive performance.

RandomForest, AdaBoost and XGBoost methods.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. analyse different ensemble classification models. (L4)

2. analyse the importance of decision trees in classification. (L3)

3. compare the bagging and boosting methods. (L3)

**UNIT-V**                                                    **(10 Lectures)**

Evaluation Metrics for classification problems:

Definition of accuracy, precision, recall and f1 scores. The confusion matrix and its importance. Generating the Precision-Recall and the ROC curve. The threshold for classification as a tool for controlling the errors made during classification. The AUC as a metric for classifiers.

Multiclass classification as a One versus the Rest binary classification.

Handling Imbalanced data:

The problems associated with imbalanced data. Undersampling, oversampling and SMOTE method for handling imbalanced data for classification.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. identify the various metrics used for classification. (L4)

2. analyse the importance of ROC curve in classification algorithms. (L3)

3. identify the imbalanced data and be able to handle them. (L3)


**TEXT BOOKS:**

1) Gopal M, Applied   Machine Learning, McGraw Hill Education (India) Private Limited, 2018.

2) Simon Rogers and Mark Girolami, A First Course in Machine Learning, CRC Press 2 Edition, 2017.


**REFERENCE:**

1) Mark E. Fenner, Machine Learning with Python for Everyone. 1 Ed, Addison-Wesley, 2020.

2) Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, OReilly, 2019.

3) Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. 1 Edition, OReilly 2016.

# DESIGN AND ANALYSIS OF EXPERIMENTS
## (OPEN ELECTIVE)

**Course Code: 20CH11P4**

L T P   C
3 0 0   3

**Course Outcomes:** At the end of the course the student will be able to

CO1: Explain the importance of Design of Experiments

CO2: Determine the most important factor effecting the experiment

CO3: Construct the factorial design of experiments

CO4: Design a linear regression model for an experimental data

CO5: Asses the importance of curvature in regression and surface response model

## UNIT-I                  10 Lectures

Strategy of Experimentation, Some Typical Applications of Experimental Design, Basic Principles, Guidelines for Designing Experiments, A Brief History of Statistical Design Summary: Using Statistical Techniques in Experimentation, Sampling and Sampling Distributions, Inferences about the Differences in Means-Randomized Designs, Inferences about the Differences in Means- Paired Comparison Designs, Inferences about the Variances of Normal Distributions

**Learning Outcomes:** After the completion of the Unit I, the student will be able to
1) Explain the basic principles of experimentation(L2)
2) Compare the mean of sample with that of another sample and population(L5)
3) Compare the variance of sample with that of another sample and population (L5)

## UNIT-II                 10 Lectures

The Analysis of Variance, Analysis of the Fixed Effects Model, Statistical Analysis of the RCBD

**Learning Outcomes:** After the completion of the Unit II, the student will be able to
1. Analyze the analysis of variance (L4)
2. Conclude the results of analysis of fixed effects model(L5)
3. Use the RCBD (L3)

## UNIT-III                 10Lectures

Introduction to Factorial Designs, Basic Definitions and Principles, The Advantage of Factorials, The Two-Factor Factorial Design, The General Factorial Design, The $2^k$ Factorial Design, Introduction, The $2^2$ Design, The $2^3$ Design, The General $2^k$ Design, A single replicate of the $2^k$ design, Theaddition of center points to the $2^k$ design.

**Learning Outcomes:** After the completion of the Unit III, the student will be able to
1. Discuss the advantage of factorials(L2)

2. Apply the factorial design of experimentation (L3)
3. Evaluate the results of single replicate of22 and 23 factorials(L4)


## UNIT-IV                                                    10Lectures

Fitting Regression Models, Introduction, Linear Regression Models, Estimation of the Parameters in Linear Regression Models, Hypothesis testing in multiple regression, Confidence intervals in multiple regression

**Learning Outcomes:** After the completion of the Unit IV, the student will be able to
1. Explain the linear regression model (L2)
2. Estimate the parameters in linear regression model (L3)
3. Find the confidence intervals of the parameters(L3)


## UNIT-V                                                    10 Lectures

Introduction to Response Surface Methodology, the Method of Steepest Ascent, Experimental Designs for Fitting Response Surfaces- Designs for Fitting the First-Order Model, Designs for Fitting the Second-Order Model, Evolutionary Operation.


**Learning Outcomes:** After the completion of  the Unit V, the student will be able to
2. Discuss the response surface methodology(L2)
3. Find the step increments to achieve the target in the method of steepest ascent(L3)
4. Describe various designs to fit first and second order models(L3)


**Text Book:**

Montgomery, D.C., "Design and Analysis of Experiments", 5th edition, John Wiley and Sons Inc., New York, 2006.


**Reference:**

George.E.P.Box,J.StuartHunter,WilliamG.Hunter,"StatisticsforExperimenters:Design,Innovation,and Discovery", 2ndedition, Wiley, 2005.

# List of OPEN Electives offered by Civil Engineering

| | |
|---|---|
| 22CE11P1 | Building Planning and Services |
| 22CE11P2 | Integrated Waste Management for a Smart City |
| 22CE11P3 | Disaster Management |
| 22CE11P4 | Intelligent Transportation Systems |
| 22CE11P5 | Water Supply Systems |
| 22CE11P6 | Sustainable Built Environment |

# BUILDING PLANNING AND SERVICES
## (Open Elective)

**Course Code:** 22CE11P1          **L   T   P   C**

                                                    **3   0   0   3**

**Pre-requisites:** Engineering Drawing, Building Materials and Concrete Technology

**Course Outcome:**

At the end of the course the student will be able to:

**CO1:** Distinguish the different income groups in India and concept of climatology for housing requirements (L2)

**CO2:** Apply the concept of Building byelaws in planning of the House (L3)

**CO3:** Classify various types of plumbing and power supply systems (L2)

**CO4:** Discuss the maintenance of building and its various repairing techniques (L2)

**CO5:** Discuss fire safety requirement of a building (L2)

## UNIT-I                                            (10 Lectures)

### BUILDING CLASSIFICATION:

Classification of buildings – row houses (chawls) –Brief information about Duplex houses, Apartments, housing colonies for HIG, MIG, LIG and EWS in India – Sizes of plots

### CLIMATOLOGY:

Elements of climate, climate zones in India, climate and comfort, building orientation, factors affecting orientation, Sun, wind, optimum orientation of a building, principles of anthropometry.

**Learning outcomes:**

At the end of the unit, the student will be able to

1. classify different types of Houses (L2)
2. explain various climatic zones (L2)
3. identify the factors affecting the orientation of the building (L2)

## UNIT-II                                           (10 Lectures)

### BUILDING BYE LAWS & REGULATIONS:

Building bye laws, objectives of byelaws, minimum plot sizes, open spaces, minimum standard dimensions, built-up area, super built up area, plinth area, carpet area, floor area and FAR, FSI, lighting & ventilation, rules governing parking, fire, water supply -provisions of NBC, HVAC.

### BUILDING PLANS:

Line plans for a residential building of a minimum of three rooms including W/C, bath, and staircase as per principles of planning - Line plans for public building - school building, primary health centre, post office, function hall, and library.

**Learning outcomes:**

At the end of the unit, the student will be able to
1. explain minimum plot sizes and standard dimensions of the rooms (L2)
2. explain about lighting & ventilation (L2)
3. draw line plans for any public buildings (L2)

## UNIT-III                                                                (10 Lectures)

### PLUMBING SYSTEMS:

Drainage, gas pipelines, drinking water pipelines, Plumbing accessories installation, Plumbing fixtures, sanitary fixtures, RO and water features and services, Groundwater recharge pit.

### ELECTRICAL MAINTENANCE:

Basics of electricity – Single / Three phase supply– Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations – Solar power system.

**Learning outcomes:**

At the end of the unit, the student will be able to
1. identify the basic electric components used in the buildings (L2)
2. explain the various plumbing accessories installation (L2)
3. discuss the various techniques used in plumbing fixtures (L2)

## UNIT-IV

### MAINTENANCE AND SPECIAL REPAIRS:                           (10 Lectures)

### BUILDING MAINTENANCE:

Repairs to damaged part of the flooring, Removal of stains from concrete and terrazzo floor, Anti-termite treatment (in building, foundations, floors and woodwork) Repair of water storage sumps and tanks, Repair of any joints i.e. wall-beam joint leak, beam-column and slab-beam, joints, waterproofing and grouting.

### SPECIAL REPAIRS:

Strengthening of foundation and foundation soils, rectification of leaking roof and concrete cover, spalling of concrete, repairs to cracks in masonry wall, repairs to leakage at window sill, repairs to expansion and contraction joints, Repair materials, Criteria for selection of repair materials, Classification of repair materials.

**Learning outcomes:**

At the end of the unit, the student will be able to

1. identify various repair methods for flooring, Storage tanks (L2)
2. identify how to do strengthen the foundations, various repair materials used (L2)

3. explain the classification of repair materials (L2)

## UNIT-V

**FIRE SAFETY INSTALLATION:** **(10 Lectures)**

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials in construction of staircases and lift lobbies. Special features required for physically handicapped and elderly in buildings – Heat and smoke detectors – Fire alarm system, Snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers.

**Learning outcomes:**
At the end of the unit, the student will be able to
1. discuss basic principles of fire safety and its codal provisions in buildings (L2)
2. demonstrate the various firefighting equipment and their installation (L2)
3. explain the prevention of fires, breathing apparatus, first aid & electricity (L2)

**Text Books:**
1. N.Kumara Swamy and  A.Kameswara Rao,"Building Planning and Drawing", 8th Edition,Charotar Publications, 2010.
2. H.W. Harrison and P.M. Trotman, "BRE Building elements, Building service", BRE Press Publishers, 2000.
3. B.S. Gahlot and Sanjay Sharma, "Building repair and maintenance and management", CBS Publishers, 1st Edition, 2006.

**References:**
1. Gurucharan Singh, "Building Planning, Scheduling and Design", 2nd Edition, Khanna Publishers, 2010.
2. V.N. Vazirani and S.P. Chandola, "Building Construction", Khanna Publishers, 3rd Edition, 2003.
3. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York,1968.
4. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
5. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
6. R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
7.National Building Code 2016.

# INTEGRATED WASTE MANAGEMENT FOR A SMART CITY

## (Open Elective)

**Course Code:** 22CE11P2

**L T P C**
**3 0 0 3**

**Pre-requisites:** Environmental Science

**Course Outcomes:** At the end of the course, the student will be able to:

**CO1:** Describe current issues in solid waste and status in first 20 cities
**CO2:** Apply fundamentals of municipal solid waste management
**CO3:** Apply various disposal methods of solid waste
**CO4:** Explain management of construction and demolition waste
**CO5:** Explain management of electronic waste

### UNIT-I                                                                                     (10 Lectures)

**INTRODUCTION TO SOLID WASTE MANAGEMENT:**

Municipal Solid Waste Sources; composition; generation rates Swachh Bharat Mission and Smart Cities Program, Current Issues in Solid Waste Management and Review of MSW Management Status in First List of 20 Smart Cities in the Country.

*Learning outcomes:*

1. Explain sources, composition and generation rate of solid waste (L2)
2. Discuss Swachh Bharat Mission (L2)
3. Describe the status of solid waste in the first 20 smart cities (L2)

### UNIT-II                                                                                     (10 Lectures)

**MUNICIPAL SOLID WASTE MANAGEMENT – FUNDAMENTALS:**

Municipal Solid Waste, Characteristics and Quantities, Collection, Transportation, Segregation and Processing.

*Learning outcomes:*

1. Outline the characteristics of solid waste. (L2)
2. Explain the quantities of solid waste (L2)
3. Describe fundamentals of solid waste (L2)

### UNIT-III                                                                                     (10 Lectures)

**DISPOSAL OF MUNICIPAL SOLID WASTE:**

Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016.

*Learning outcomes:*

1. Outline the disposal methods of solid waste (L2)
2. Explain the energy recovery from MSW (L2)
3. Explain MSW Rules 2016 (L2)

## UNIT-IV                                                         (10 Lectures)

**CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT:**

Overview of C&D Waste – Sources, Effects, and Regulations, Beneficial Reuse of C&D Waste Materials.

*Learning outcomes:*
1. Discuss about sources and effects of construction waste (L2)
2. Explain regulations of construction waste (L2)
3. Describe the beneficial reuse of C&D waste materials (L2)

## UNIT-V                                                          (10 Lectures)

**ELECTRONIC WASTE (E-WASTE) MANAGEMENT:**

Sources, Effects, Issues and Status in India and globally, controlling measures, E-Waste Management Rules 2016 and Management Challenges.

*Learning outcomes:*
1. Explain sources and effects of E-Waste (L2)
2. Describe the issues and status in India and globally (L2)
3. Discuss about the E-Waste management rules 2016 and management challenges (L2)

### TEXT BOOKS
1. William A Worrell and P. AarneVeslind, "Solid Waste Engineering", 2nd Edition Cengage Learning, 2012 (ISBN-13: 978-1-4390-6217-3)
2. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, "Integrated Solid Waste Management", Tata McGraw Hill, 1993.
3. The Central Public Health and Environmental Engineering Organization (CPHEEO), "Manual on Solid Waste Management", India, 2016.

### REFERENCES

1. "Municipal Solid Waste Management Rules 2016", Central Pollution Control Board, Govt. of India, 2016.

2. "Electronic Waste Management Rules 2016", Central Pollution Control Board, Govt. of India, 2016.

3. "Construction and Demolition Waste Management Rules 2016", Ministry of Environment and Forest and Climate Change, Govt. of India, 2016.

# DISASTER MANAGEMENT
## (Open Elective)

**Course Code:** 22CE11P3

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:**

At the end of the course, the student shall be able to:

**CO1:** Explain about concepts of disaster management and types of disasters
**CO2:** Explain the Vulnerability profile of India & legal framework in India
**CO3:** Discuss about early warning systems for disaster risk reductions
**CO4:** Describe the policy and programmers for disaster risk reductions in India
**CO5:** Demonstrate rescue and relief operation in India during disaster

## UNIT–I                                                              (10 Lectures)

### INTRODUCTION TO DISASTER MANAGEMENT:

Definitions and concepts of Hazard, Vulnerability, Risk, Resilience, Concept of Disaster Management Cycle – Response, Recovery, Mitigation and Preparedness, Introduction to Various Hazards both Natural and Man-Made Hazards – Earthquakes, Cyclones, Droughts, Floods, Volcanoes, Coastal Hazards, Landslides, Forest Fires, Industrial Accidents, Biological Disasters, etc.., Climate Change, Global Warming.

*Learning outcomes:*

1. Summarize the vocabulary of disasters(L2)

2. Explain about natural and manmade disasters and their related damages to the society and infrastructure(L2)

3. Discuss about disaster phenomenon, it's different contextual aspects, impacts and public health consequences (L2)

## UNIT–II                                                             (10 Lectures)

### DISASTER MANAGEMENT IN INDIA:

Hazard and vulnerability profile of India, Disaster Management Act 2005, National Disaster Mitigation and Management Guideline on -National Policy on Disaster Management 2009, NDMA guidelines on Cyclones specifically, besides earthquakes, floods, urban floods, information systems, communication systems etc., Introduction to State Disaster Management Authorities.

**Disaster Management in the World Scenario**: Role of UNDRR, Role of UNISDR

*Learning outcomes:*

1. Summarizing the vulnerability profile of India, concept of disaster management cycle(L2)
2. Explain about the Disaster Management Act and policies in India related to financial aspects and legal proceedings(L2)

3. Describe administrative authority for organizing the disaster management situation in India and overall in the world (L2)

## UNIT–III                                        (10 Lectures)

**HAZARD ANALYSIS:**

Estimation of potential causes, characteristics and impact of Hazards. Geological Processes leading to natural hazards, Multi- Hazard Assessment, Short term and Long Term Prediction, Early warning system for different hazards, Risk Analysis for Individuals, communities etc.Role of Remote Sensing & GIS in Disaster Management and its applications, Case Studies.

*Learning outcomes:*
1. Discuss monitoring and evaluation plan for disaster response(L2)
2. Describe setting up of early warning systems for risk reductions(L2)
3. Compute risk analysis for individuals and communities(L3)

## UNIT–IV                                        (10 Lectures)

**DISASTER RISK REDUCTION (DRR):**

Assessing Vulnerabilities, Risk Assessment, Preparation of Exposure and Risk Database, Prevention and mitigation strategies for DRR, Framework of Disaster Risk Reduction. Capacity Building Measures, Community Participation, Contemporary studies and work towards disaster risk reduction, Disaster Risk Reduction Plan.

*Learning outcome:*
1. Describe the international strategy for disaster reduction(L2)
2. Explain the abilities for implementing the disaster risk reduction strategy(L2)
3. Discuss the framework of disaster risk reduction(L2)

## UNIT-V                                        (10 Lectures)

**RESPONSE AND RECOVERY OPERATIONS:**

Role of NDRF, Training of personnel, equipment necessary, public awareness creation, Mass Casualty Management, agencies involved in mass casualty management, Qualification and Duties of professionals, Response policy, Case Studies.

*Learning outcomes:*
1. Explain the importance of rescue and relief operation(L2)
2. Discuss public awareness in communities(L2)
3. Illustrate mitigation and risk reduction strategies(L3)

**TEXT BOOKS:**

1. H.K.Guptha, "Disaster management", 2ⁿᵈEdition, University Press, 2001.
2. R. B. Singh (Ed),"Disaster Management", Rawat Publication, New Delhi, 2000.

**REFERENCES:**

1. S.Seetharaman, "Construction Engineering and Management", 4th Edition, Umesh publications, New Delhi, 1999
2. Gupta, M.C., "Manuals on Natural Disaster management in India",National Centre for Disaster Management, IIPA, New Delhi, 2002.
3. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

# INTELLIGENT TRANSPORTATION SYSTEMS

## (Open Elective)

**Course Code:** 22CE11P4                                   **L    T    P    C**

                                                            **3    0    0    3**

**Course Outcomes:**

At the end of the course, student will be able to:

**CO1:** Explain sensor technologies and data collection of ITS

**CO2:** Explain about ATIS, ATMS and congestion pricing.

**CO3:** Explain about APTS, CVO, new technology and ETC

**CO4:** Discuss about regional architecture, integration of infrastructure and operational planning

**CO5:** Summarise  about ITS applications, various factors and emerging issues

**UNIT-I:**                                                 **(10 Lectures)**

**FUNDAMENTALS OF ITS:**

Definition & Historical background of ITS, Classification of ITS, ITS user services, ITS Data collection techniques – Detectors - Automatic Vehicle Location (AVL) - GIS, Sensor technologies.

*Learning outcomes:*
1.  Explain Intelligent Transportation Systems. (L2)
2.  Explain the components of ITS. (L2)
3.  Describe the Detectors used for data collection. (L2)

**UNIT-II**                                                 **(10 Lectures)**

**ATIS & ATMS:**

Advanced Traveller Information Systems (ATIS) - business models, Advanced Traffic Management Systems (ATMS), congestion pricing, HOT lanes - example deployments.

*Learning outcomes:*
1.  Explain the requirements of ATMS (L2)
2.  Describe about congestion pricing (L2)
3.  Discuss about the advantages of HOT lanes (L2)

**UNIT-III**                                                **(10 Lectures)**

**APTS & ETC:**

Fleet-oriented ITS services, Advanced Public Transportation Systems (APTS), BRTS, Commercial Vehicle Operations (CVO) and Intermodal Freight, electronic toll collection (ETC), Advanced Vehicle Control Systems (AVCS), Advanced Rural Transportation Systems (ARTS), dedicated short range communication and standards.

*Learning outcomes:*
1. Explain about the APTS (L2)
2. Describe about commercial vehicle operations (L2)
3. Explain about Electronic Toll Collection (L2)

## UNIT-IV                  (10 Lectures)

### ITS PLANNING & ARCHITECTURE:

ITS Planning, Regional architecture, Physical architecture, ITS Standards and Evaluation Methods, ITS and security, ITS and safety, Institutional Issues of ITS.

*Learning outcomes:*
1. Explain the regional architecture of ITS. (L2)
2. Differentiate ITS standards. (L2)
3. Explain various institutional issues of ITS. (L2)

## UNIT-V                  (10 Lectures)

### ITS APPLICATIONS:

Automated Highway Systems (AHS), ITS Programs in the World, Case Studies: applications in bus transport, metro and highways, Overview of ITS implementation in developed and developing countries, Advanced ITS.

*Learning outcomes:*
1. Explain the goals of Automated Highway Systems. (L2)
2. Explain the future of ITS. (L2)
3. Describe international ITS Programs. (L2)

### TEXT BOOKS:

1. Ghosh, S., Lee, T.S.,"Intelligent Transportation Systems: New Principles and Architectures", CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, "Fundamentals of Intelligent Transportation Systems Planning", Artech House, Inc., 2003.

### REFERENCES:

1. Sussman, J.M.,"Perspectives on Intelligent Transportation Systems", Springer, Berlin, 2010.
2. R.P Roess, E.S. Prassas, W.R. McShane.,"Traffic Engineering", Pearson Educational International, 3rdEdition, 2004.

# WATER SUPPLY SYSTEMS
## (Open Elective)

**Course Code:** 22CE11P5

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisites:** Environmental Science

**Course Outcomes:**
At the end of the course, students will be able to:
**CO1:** Outline of the various facets of water usage in daily life
**CO2:** Explain the origin of Natural waters and also to synthesize it for regular use
**CO3:** Discuss the utilization of non-potable water
**CO4:** Describe water supply system from a reservoir
**CO5:** Explain the characteristics of wastewater

## UNIT-I                                                                      (10 Lectures)

### WATER AND LIFE:

Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

*Learning outcomes:*
1. Explain about the necessity of water(L2)
2. Describe various types of demand(L2)
3. Discuss about water demand for fire protection(L2)

## UNIT-II                                                                    (10 Lectures)

### SOURCES OF WATER:

Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

*Learning outcomes:*
1. Discuss various types of water sources(L2)
2. Explain methods of effective use of water(L2)
3. Describe the process of recharging of aquifers(L2)

## UNIT-III                                                                   (10 Lectures)

### DUAL SUPPLY OF WATER:

Potable and non-potable water – Protected water – Grey water – Black water – Water borne diseases – water related diseases – Sewage Irrigation.

*Learning outcomes:*
1. Discuss the types of water based on quality(L2)
2. Explain various types of water diseases(L2)

3. Describe the water quality and treatment requirement for irrigation(L2)

## UNIT-IV                                                        (10 Lectures)

## DISTRIBUTION OF WATER:

Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution – Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

### *Learning outcomes:*
1. Explain the various methods of water supply(L2)
2. Discuss the various types of networks of distribution(L2)
3. Summarize the various appurtenances in distribution system(L2)

## UNIT-V                                                         (10 Lectures)

## INDUSTRIAL WATER:

Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

### *Learning outcomes:*
1. Explain the location of industry(L2)
2. Describe the quality and characteristics of industrial wastewater(L2)
3. Discuss the standards for letting industrial effluents(L2)

## TEXT BOOKS:

1. K.N. Duggal, "Elements of Environmental Engineering", 7thEdition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1stEdition Mc Graw –Hill Publications, Civil Engineering Series, 1985.


## REFERENCES:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rdEdition, Wiley, 2010.

3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

# SUSTAINABLE BUILT ENVIRONMENT
## (Open Elective)

**Course Code:** 22CE11P6

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Unit -1: Sustainable Architecture & Sites**                     (10 Lectures)

Integrated approach for green building design: factors for site selection, understanding site ecology & site analysis. Soil erosion & pollution control measures: types of soil erosion, strategies to mitigate land degradation, design techniques & challenges. Microclimate: factors affecting microclimate & heat islands, strategies to address heat island effect in built environment. Designing green spaces and enhancing biodiversity in built environment.

**Unit-2: Water Management**                     (10 Lectures)

Water balance and approach for water efficiency: 3R approach for water efficiency –Reduce, Reuse/ Recycle and Recharge. Water-efficient plumbing fixtures, standards & codes. Efficient irrigation practices – hydrozoning, control devices for water supply, irrigation systems – drip & sprinklers. Wastewater treatment & reuse, wastewater treatment technologies: physical, biological and natural. Rainwater harvesting and utilisation, groundwater recharge techniques: design considerations.

**Unit-3: Energy Management**                     (10 Lectures)

Introduction, performance evaluation and approach for energy efficiency in buildings. Energy efficiency standards & codes: BEE ECBC 2017 & Energy Performance Index (EPI), ASHRAE 90.1, star labelling for appliances. Efficient building envelope: heating loads in buildings, building orientation and form, envelope heat transfer & material specifications – wall, roof & fenestration. Air conditioning: types of air conditioning systems, design considerations and control systems. Lighting in building: daylighting & artificial lighting, methods to determine ECBC compliance for interior lighting and lighting controls. Renewable energy systems and technologies. Introduction to Net Zero Energy buildings.

**Unit-4: Sustainable Building Materials** (10 Lectures)

Attributes of Sustainable Building Materials: Recycled content, Regional material, Renewable material, Embodied energy, Embodied carbon, Material performance, Recyclability, Elimination of hazardous materials. Ecolabeling of Products: Types of Ecolabels – Type I, II & III. Sustainable Materials for Green Buildings: Ready mix concrete, Construction Blocks, Glass, Steel TMT Bars, Construction Chemicals, Insulation Materials, Cement, Paints. Waste management during construction & post-occupancy: Segregation strategies, Types of waste management – organic, inorganic, e-waste, hazardous waste

**Unit-5: Indoor Environmental Quality and Rating systems** (10 Lectures)

Indoor air quality: codes and standards, fresh air requirements, design considerations. Approach for improving indoor air quality: measures to reduce sick building syndrome, demand control ventilation, $CO_2$ monitoring in buildings, air quality monitoring. Enhancing occupants' comfort, health and wellbeing: thermal comfort, visual comfort, acoustics, ergonomics, olfactory comfort. Important provisions of ASHRAE 62.1, ASHRAE 62.2, ASHRAE 55, ASHRAE 170, ISHRAE 1001 regarding IEQ.
Introduction to IGBC rating system, Green Rating for Integrated Habitat Assessment (GRIHA) rating system, Leadership in Energy and Environmental Design (LEED) rating system, Green & Ecofriendly Movement (GEM) Green Building Certification.

**TEXT BOOKS:**

1. Kubba, S., LEED Practices, Certification, and Accreditation Handbook, 1st Edition, Elsevier, 2010
2. Indian Buildings Congress, Practical Handbook on Energy Conservation in Buildings, 1st Edition, Nabhi Publications, 2008.
3. Ministry of Power, Energy Conservation Building Code 2017, Revised Version, Bureau of Energy Efficiency, 2017.
4. Guide on Green Built Environment, IGBC, 2021
5. IGBC Green New Buildings rating system, IGBC, 2016
6. IGBC Green Homes rating system, IGBC, 2019

**REFERENCES:**

1. National Building Code, Bureau of Indian Standards, 2016
2. ANSI/ASHRAE/ASHE Standard 170-2017, Ventilation of Health Care Facilities
3. Indoor Environmental Quality Standard ISHRAE Standard- 10001 : 2019
4. IGBC Net Zero Energy Buildings Rating System, 2018

5. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards
    1. Standard 90.1-2022—Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
    2. Standard 62.1-2022 : Ventilation and Acceptable Indoor Air Quality in Residential Buildings
    3. Standard 62.2 (2007) : Ventilation and Acceptable Indoor Air Quality in Low Rise Residential Buildings

Standard 55 (2017) : Thermal Environmental Conditions for Human Occupancy

# List of Open Electives offered by Electrical and Electronics Engineering

| | |
|---|---|
| 22EE11P1 | Optimization Engineering |
| 22EE11P2 | Electrical Safety Management |
| 22EE11P3 | Energy Audit |
| 22EE11P4 | Solar PV Systems |

# Optimization Engineering
## (Open Elective-I)

**Course Outcomes:** At the end of the course, the student will be able to

**CO1** Determine and solve the mathematical model of a non-linear system using classical methods (L3)
**CO2** Apply the concepts of linear programming, transportation problem and integer programming economically and efficiently (L3)
**CO3** Formulate linear problems without constraints by using one dimensional minimization methods and univariate methods (L5)
**CO4** Analyze nonlinear problems with constraints by using penalty function method (L4)
**CO5** Analyze the dynamic programming multistage decision processes (L4)

## UNIT-I: INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES
**10 Lectures**

Statement of an Optimization problem- design vector- design constraints- constraint surface- objective function- objective function surfaces – classification of Optimization problems- Single variable Optimization- multi variable Optimization without constraints- necessary and sufficient conditions for minimum/ maximum- multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers- multivariable Optimization with inequality constraints: Kuhn- Tucker condition.

**Learning Outcome:**
1. understand the classical optimization techniques (L2)
2. solve Single variable Optimization with and without constraints problems (L3)
3. solve Multivariable Optimization with and without constraints problems (L3)

## UNIT-II:                       10 Lectures

**LINEAR PROGRAMMING:** Standard form of linear programming problem- geometry of linear programming problems- motivation to the simplex method- simplex algorithm, Two Phases of the Simplex Method, Duality in Linear Programming: Symmetric Primal–Dual Relations, General Primal –Dual Relations, Primal –Dual Relations When the Primal Is in Standard Form, Duality Theorems, Dual Simplex Method.

**Learning Outcome:**
1. understand linear programming methods(L2)
2. solve simplex algorithm and dual LP (L3)
3. analyze Duality in Linear Programming(L4)

## UNIT-III: UNCONSTRAINED NONLINEAR PROGRAMMING     10 Lectures

One- dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method, Steepest descent method, Davidon-Fletcher-Powell method

**Learning Outcome:**
1. understand non-linear programming methods (L2)
2. solve steepest descent method (L3)
3. solve Davidon- Fletcher-Powell method (L3)

## UNIT-IV: CONSTRAINED NON LINEAR PROGRAMMING                    10 Lectures

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to Convex Programming problem.

**Learning Outcome:**
1. understand characteristics of a constrained problem (L2)
2. analyze Basic approach of Penalty Function method (L4)
3. understand basic approaches of Interior and Exterior penalty function methods (L2)

## UNIT-V: DYNAMIC PROGRAMMING                                    10 Lectures
Dynamic programming multistage decision processes- types- concept of sub optimization and the principle of optimality- computational procedure in dynamic programming- examples illustrating the calculus method of solution- examples illustrating the tabular method of solution.

**Learning Outcome:**
1. understand the types of dynamic programming multistage decision processes (L2)
2. understand the computational procedure in dynamic programming(L2)
3. solvethe calculus method and tabular method of solutions (L3)

**TEXT BOOKS:**
1. S. S. Rao, "Engineering optimization: Theory and practice", 4th Edition, New Age International
   (P) Limited, 2009. (Unit – 1,2,3,4,5)
2. Kalyanmoy Deb, "Optimization for engineering Design", 11thEdition, PHI Learning (P) Limited, 2010. (Unit –1, 3,4)

**REFERENCES:**
1. K.V. Mital and C. Mohan"Optimization Methods in Operations Research and systems Analysis", 3rd Edition, New Age International (P) Limited Publishers, 1996.
2. KanthiSwarup, P.K.Gupta and Man Mohan "Operations Research", 15th Edition, SultanChand& Sons New Delhi, 2010.
3. G. Hadley, "Linear Programming", 1st Edition Narosa publishing house 1997.

**WEB LINKS:**

1. https://nptel.ac.in/courses/111105039/

# ELECTRICAL SAFETY MANAGEMENT
## (Open Elective-I)

**Course Code: 22EE11P2**

**Prerequisites:** Basic Electrical &  Electronics Engineering

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Explain the objectives and precautions of Electrical safety, effects of shocks and their prevention(L2).

**CO2:** Summarize the safety aspects during installation of plant and equipment(L3).

**CO3:** Describe the electrical safety in residential, commercial and agricultural installations(L2).

**CO4:** Describe the various Electrical safety in hazardous areas, Equipment earthing and system neutral earthing(L2).

**CO5:** State the electrical systems safety management and IE rules(L2).

**UNIT-I**                                                                                              **10 Lectures**

**INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION**
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety.
Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

**Learning Outcome:**
1.  Understand electrical safety measures (L2)
2.  Understand the hazards associated with electric current, and voltage (L2)
3.  Identify different types of electrical shocks (L2)

**UNIT-II**                                                                                            **10 Lectures**

**SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT**
Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety duringinstallation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

**Learning Outcome:**
1.  Understand installation work of electrical plant and equipment.(L2)
2.  Understand safety during installation of outdoor switchyard equipment (L2)
3.  Understand safety during installation of electrical rotating machines.(L2)

## UNIT-III

<div align="right">**10 Lectures**</div>

### ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

**Learning Outcome:**
1. Understand procedure of domestic wirings (L2)
2. Understand how to handle different domestic electrical appliances (L2)
3. Understand procedure of Agricultural pump installation (L2)

## UNIT-IV

<div align="right">**10 Lectures**</div>

### ELECTRICAL SAFETY IN HAZARDOUS AREAS

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations –Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

### EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING

Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding( System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

**Learning Outcome:**
1. Identifies different hazardous zones (L2)
2. Identify classification of equipment enclosure for various hazardous gases.(L2)
3. Understand importance of earthing system. (L2)

## UNIT-V

<div align="right">**10 Lectures**</div>

### SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

### REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE

Objective and scope – ground clearances and section clearances – Classification of electrical installations –Rules regarding first aid and fire fighting facility.

The Electricity Act, 2003.**Learning Outcome:**
1. Understand Management Safety Policy (L2)
2. Understand standards on electrical safety.(L2)
3. Understand different IE Rules and Acts. (L2)

### TEXT BOOK:
1. S.Rao, Prof. H.L.Saluja, "*Electrical safety, fire safety Engineering and safety management*", 1st edition Khanna Publishers. New Delhi, 2016 Reprint.

### REFERENCE:
1. Pradeep Chaturvedi, "*Energy management policy, planning and utilization*", Concept Publishing company, New Delhi, 1997.

## WEB REFERENCE

1. www.apeasternpower.com/downloads/elecact2003.pdf

# ENERGY AUDIT
## (Open Elective-I)

**Course Code: 22EE11P3**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of the Course the student shall be able to

**CO1** Understand the classification of Energy and importance of Energy Conservation. (L3)
**CO2** Illustrate energy auditing methodologies. (L3)
**CO3** Understand Material and Energy balance and carry out Material and energy balance.(L4)
**CO4** Determine Energy Performance assessment of equipment.(L3)
**CO5** Perform financial analysis for determining simple payback period. (L3)

## UNIT-I                                                                     10 Lectures

**INTRODUCTION:** Classification of Energy – Primary and Secondary Energy, Commercial Energy and Non-commercial Energy and Renewable & Non-renewable energy; Various forms of Energy – potential (stored energy) and kinetic(working) energy; Basics of Electrical energy and thermal energy; Energy and Environment; Energy Conservation and its importance.

**Learning outcomes**: Student should be able to
1. List out the various forms of energy sources. (L2)
2. Understand the energy fuel reserves and production. (L2)
3. Calculate per unit energy consumption. (L3)

## UNIT-II                                                                     10 Lectures

**ENERGY MANAGEMENT:** Definition and objectives of Energy Management, Energy Audit – types and methodology; need for energy audit; energy auditing methodology; Benchmarking energy performance; Maximizing system efficiency; Energy Audit Instruments.

**Learning outcomes**: Student should be able to
1. Understand the need of energy audit. (L2).
2. Discuss Energy audit instruments, Procedures and Techniques. (L3)
3. Analyze methods of field plotting (L4)

## UNIT-III                                                                     10 Lectures

**MATERIAL AND ENERGY BALANCE:** Basic principles of material and energy balance; Sankey diagram and its use; Material balances; Energy balances; Carrying out material and energy balance.

**Learning outcomes:** Student should be able to
1. Understand Material and Energy balance.(L2)
2. Discuss sankey diagrams. (L3)
3. Analyze energy balance. (L2)

## UNIT-IV                                                                    10 Lectures

**ENERGY PERFORMANCE ASSESSMENT:** Purpose and parameters of performance of (a) boilers, (b) furnaces, (c) turbines, (d) fans and blowers, (e) pumps, (f) compressors and (g) lighting. Detailed performance analysis of boilers and pumps.

**Learning outcomes:** Student should be able to
1. Explain Energy Performance assessment. (L2)
2. Determine Energy Performance assessment of boilers (L2).
3. Analyze detailed Performance of pumps. (L3).

## UNIT-V                                                                     10 Lectures

**PERFORMING FINANCIAL ANALYSIS:** Introduction, fixed and variable costs, Interest charges, simple pay-back period, discounted cash flow methods- Net Present Value method and Internal rate of return method; Factors affecting analysis

**Learning outcomes:** Student should be able to
1. Discuss fixed and variable costs. (L2)
2. Assess simple pay-back period. (L3)
3. Understand discounted cash flow methods. (L3)

## TEXT BOOKS:
1. General Aspects of Energy Management & Energy Audit,
   http://www.em-ea.org/gbook11.asp, National Certificate Examination for Energy Managers and Energy Auditors, National Productivity Council of India
2. Energy Performance Assessment for Equipment and Utility systems,
   http://www.em-ea.org/ gbook14.asp, National Certificate Examination for Energy Managers and Energy Auditors, National Productivity Council of India

## REFERENCES:
1. Murphy, W.R. , Mckay, G. (1982) 'Energy Management ', London: Butterworth-Heinemann
2. K. Smith, C.B. (Ed. 4) (1981). 'Energy Management Principles : applications, benefits, savings', Amsterdam : Pergamon Press
3. Witte, L. C. (1988), ' Industrial energy management and utilization ', Washington: Hemisphere Pub. Corp

# SOLAR PV SYSTEMS
## (Open Elective - I)

**Course Code: 22EE11P4**

**L T P C**

**3 0 0 3**

**Course Outcomes:** At the end of the course, the student will be able to
**CO1:** Describe the basics of Power and Energy calculations in relation to SPV Systems. (L2)
**CO2:** Interpret the parameters of PV Modules and their connections to form Arrays (L2)
**CO3:** Demonstrate the design, integration and economics of PV Systems (L2)
**CO4:** Understand the Importance of balance of System and MPPT (L2)
**CO5**: Explain types of batteries and their necessity for remote applications of Solar PV Systems (L2)

## UNIT-I: SOLAR PHOTOVOLTAIC ENERGY                    10 Lectures

Basics of Electricity – DC and AC Power – Measurement of Electrical Quantities- Basic Concepts about Energy and Its Use - Estimating Energy Requirement - Energy from Solar Photovoltaic (PV) Conversion Other Renewable Energy Technologies

**Learning Outcomes:**

1. Understand the basic Electrical Quantities and identify instruments used to measure them (L2)
2. Understand Energy calculations and estimation of Energy Requirement (L2)
3. Compare Solar PV Technology with other Renewable Energy Technologies (L2)

## UNIT - II        SOLAR CELLS , PV MODULES AND ARRAYS        10 Lectures

Parameters of Solar Cells , Factors affecting Electricity generated from a Solar Cell , Solar PV Modules – Ratings , Module Parameters Factors Affecting Electricity Generated by a Solar PV Module, Measuring Module Parameters, Solar PV Module Arrays - Connection of Modules in Series, in Parallel and in Series and Parallel ((Mixed Combination)

**Learning Outcomes:**

1. Describe the various parameters of PV modules and how to measure them(L2)
2. Understand the factors affecting PV output. (L2)
3. Explain the methods of combination of Modules to form Arrays (L2)

## UNIT - III    SOLAR PV SYSTEM DESIGN                    10 Lectures

Types of Solar PV Systems – Standalone, Grid-connected and Hybrid, Design Methodology for SPV System, Grid-connected Solar PV Power Systems – Introduction, Components and Configurations, Grid- connected PV System Design for Small Power Applications and for Power Plants. Economics of PV Systems-sample payback period, lifecycle costing, Introduction to Solar Advisory Model (SAM) Software.

**Learning Outcome:**

1. Understand Types of PV Systems. (L1)
2. Explain the configurations and components of Solar PV Systems. (L2)
3. Understand Economics of PV Systems and usage of SAM software (L1)

## UNIT – IV    CHARGE CONTROLLER, MPPT AND INVERTERS    10 Lectures

Need For Balance of System (BoS) , Power Converters and their efficiency , DC to AC Converters ( Inverters) , DC to DC Converters , Charge Controllers, Maximum Power Point Tracking (MPPT), Types of Wires and Wire Sizing, Junction Box.

### Learning Outcomes:

1. Define Balance of System (BoS)
2. Outline the role of various Power Converters and Charge Controllers in PV Systems (L2)
3. Explain Maximum Power Point Tracking. (L2)

## UNIT-VBATTERIES AND THEIR APPLICATIONS TO SOLAR PV SYSTEMS
## 10 Lectures

Types of batteries , Parameters of Batteries, How to select a battery, Connecting Batteries together – Series , Parallel and mixed combination, Estimating Number of Batteries to be Connected in a battery Bank, Testing and Maintenance of Batteries , Fault Detection, Instruments used for Maintenance.

Sample Case Study of a Solar PV System, Environmental Considerations of PV Systems.

### Learning Outcomes:

1. Identify important parameters of batteries and their role in selection of batteries (L3)
2. Understand how to estimate number of batteries and connection types in battery banks (L2)
3. Understand Battery maintenance procedures and fault detection methods (L2)
4. Discuss the impact of PV Systems on ecology and environment (L3)

### TEXT BOOKS:
1. Chetan Singh Solanki ,*Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers,* PHI Learning Publications, 3rd Edition, 2015
2. SAM Ver. 2.0 User guide - https://www.nrel.gov/docs/fy08osti/43704.pdf

### REFERENCES:
1. Chetan Singh Solanki,*Solar Photovoltaics: Fundamentals, Technologies and Applications,* PHI Learning Publications, 3rd Edition, 2015
2. Roger A. Messenger and Jerry Ventre, '*Photovoltaic Systems Engineering'*, Taylor and Francis Group Publications, 3rd Edition, 2010(CRC Press Reprint – 2018)
3. Soteris A. Kalogirou, *Solar Energy Engineering: Processes and Systems*, Academic Press, (Elsevier)2nd edition ,2014.

### WEB REFERENCES:
1. https://onlinecourses.nptel.ac.in/noc22_ee71/preview

## List of Open Electives offered by Information Technology

| Course code | Subject Name |
|---|---|
| 22IT11P1 | Human Computer Interaction |
| 22IT11P2 | Introduction to Object Oriented Analysis and Design |
| 22IT11P3 | E-Commerce |
| 22IT11P4 | Fundamentals of Artificial Intelligence |
| 22IT11P5 | Introduction to Cloud Computing |
| 22IT11P6 | Fundamentals of JAVA Programming |
| 22IT11P7 | Data Structures |
| 22IT11P8 | Introduction to C++ |

# HUMAN COMPUTER INTERACTION

## *(Open Elective)*

**Course Code:  22IT11P1**                                              **L  T  P  C**

                                                                        **3  0  0  3**

**Course Outcomes:** At the end of the Course, the Student will be able to:
**CO 1:** Discuss the importance of user interface (L2)
**CO 2:** Summarize the characteristics of GUI and Web User Interface and the importance of humans in the design process (L2)
**CO 3:** Illustrate screen designing goals and technological consideration in interface design (L4)
**CO 4:** Demonstrate components and software tool specification methods (L3)
**CO 5:** Illustrate different interaction devices (L4)


**UNIT-I**                                                              **(8 Lectures)**
**INTRODUCTION:** Importance of User Interface – Definition, Importance of Good Design. Benefits of Good Design, A brief history of Screen Design

**Learning Outcomes**: At the end of the module, the student will be able to
1. Understand the importance of user interface (L2)
2. Understand the importance of good design (L2)
3. Understand the advancements in the screen design (L2)

**UNIT-II**                                                             **(12 Lectures)**
**THE GRAPHICAL USER INTERFACE:** Popularity of Graphics, The Concept of Direct Manipulation, Graphical Systems: Advantages and Disadvantages, Characteristics of the Graphical User Interface,
**THE WEB USER INTERFACE:** The Popularity of the web, Characteristics of a web interface, Principles of User Interface Design
**HUMAN CONSIDERATIONS IN DESIGN**– Human Interaction with computers, Important Human Characteristics in Design, Human Considerations in Design, Human Interaction Speeds, Understand the Business Function

**Learning Outcomes**: At the end of the module, the student will be able to
1. Understand the characteristics of Graphical User Interface(L4)
2. Understand the importance of Web User Interface (L2)
3. Understand the importance of humans in design process(L2)

**UNIT-III**                                                            **(12 Lectures)**
**SCREEN DESIGNING:** Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presenting information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

**Learning Outcomes**: At the end of the module, the student will be able to
1. Understand the human considerations in screen design (L2)
2. Understand the importance of technological considerations in interface design (L2)

**UNIT-IV**                                                                        **(10 Lectures)**
**COMPONENTS** – Text and messages, Icons and Images – Multimedia, colours, uses, problems, choosing colours
**SOFTWARE TOOLS** – Specification methods, Interface – Building Tools

**Learning Outcomes**: At the end of the module, the student will be able to
1. Describe the components for text and messages (L2)
2. Describe the components for multimedia (L2)
3. Understand the importance of colours in the design process (L2)

**UNIT-V**                                                                          **(8 Lectures)**
**INTERACTION DEVICES** – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.
**Learning Outcomes**: At the end of the module, the student will be able to
1. Categorize different pointing devices (L4)
2. Categorize  different speech recognition devices (L4)
3. Illustrate different image and video display drivers (L3)


**TEXT BOOKS**:

1. Wilbert O Galitz ,*The essential guide to user interface design*, Wiley DreamTech, 3rd Edition, 2007. (For Units- I, II, III & IV (COMPONENTS))
2. Ben Shneiderman, Catherine Plaisant,  *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 5th Edition, Pearson Education Asia, 2009
   (For Units- IV (Software Tools) & V)

**REFERENCES:**

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale "*Human Computer Interaction*", 3rd Edition, Pearson, 2004.
2. Rogers, Sharps, *Interaction Design*, PRECE, 1st Edition, Wiley Dreamtech, 2002
3. Soren Lauesen, "*User Interface Design*", 1st Edition, Pearson Education, 2005

# INTRODUCTION TO OBJECT ORIENTED ANALYSIS AND DESIGN
## (Open Elective)

**Course Code: 22IT11P2**                                             **L T P C**
                                                                      **3 0 0 3**

**Course Outcomes:** At the end of the Course, the Student will be able to:
**CO1:** Describe basic Building Blocks in UML.                     (L2)
**CO2:** Demonstrate class and object diagrams in UML.      (L3)
**CO3:** Examine the behavioral modeling of the application.  (L3)
**CO4:** Model the overall framework of the system.           (L3)
**CO5:** Categorize design patterns to solve problems.         (L4)

**UNIT-I**                                                      **(10 LECTURES)**
**BASIC THINGS IN MODELING:**
The Importance of Modeling, Principles of Modeling, Object Oriented Modeling.
**INTRODUCING THE UML:**
An overview of the UML,  A Conceptual Model of the UML, Architecture, Software Development Life Cycle. (Text Book: 1)

**Learning Outcomes:** At the end of the module the student will be able to
1. Describe different building blocks. (L2)
2. Explain The Importance of Modeling. (L2)
3. Summarize the Conceptual Model of the UML. (L2)
4. Describe Software Development Life Cycle. (L2)

**UNIT-II**                                                     **(10 LECTURES)**
**STRUCTURAL MODELING:**
Classes, Relationships, Common Mechanisms and diagrams, Class diagrams, Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Object Diagrams. (Text Book: 1)

**Learning Outcomes:** At the end of the module the student will be able to
1. Demonstrate Common Mechanisms and diagrams. (L3)
2. Discuss Packages. (L2)
3. Model Object Diagrams. (L3)
4. Illustrate Types and Roles of Structural Modeling. (L3)

**UNIT-III**                                                    **(10 LECTURES)**
**BEHAVIORAL MODELING:** Interactions, Interaction diagrams, Use cases, Use case diagrams, Activity Diagrams, Events and Signals, State machines, Processes and Threads, Time and Space, State chart diagrams. (Text Book: 1)

**Learning Outcomes:** At the end of the module the student will be able to
1. Discuss Events and signals. (L2)
2. Explain processes and Threads. (L2)
3. Model Use case diagrams and Activity Diagrams. (L3)

**UNIT-IV**                                                                                              **(10 LECTURES)**
**ARCHITECTURAL MODELING:**
Component, Deployment, Component diagrams and Deployment diagrams,Patterns and Frameworks, Collaborations, Systems and Models. (Text Book: 1)

**Learning Outcomes:** At the end of the module the student will be able to
1. Identify Component diagrams and Deployment diagrams. (L1)
2. Discuss Patterns and Frameworks. (L2)
3. Illustrate Systems and Models. (L3)

**UNIT-V**                                                                                                **(10 LECTURES)**
**INTRODUCTION:** Define Design, Design Patterns using MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog. (Text Book: 2)
**Case Studies**: Bank ATM Application, Railway Reservation System.

**Learning Outcomes:** At the end of the module the student will be able to
1. Define a Design Pattern. (L1)
2. Classify different Design Patterns. (L4)
3. Analyze different Design Patterns to Solve Design Problems. (L4)
4. Model the basic UML diagrams. (L3)

**TEXT BOOKS:**

1. Grady Booch, James Rumbaugh, IvarJacobson ,"*The Unified Modeling Language User Guide*", 2nd Edition, Pearson Education, 2017.
2. Erich Gamma, "*Design Patterns By Elements of Reusable Object-Oriented Software*", 1st Edition, Pearson Education, 2015.

**REFERENCES:**

1. Meilir Page-Jones, "*Fundamentals of Object Oriented Design in UML*", 1st Edition, Pearson Education, 2006.
2. Pascal Roques, "*Modeling Software Systems Using UML2*", 1stEdition, WILEY Dreamtech, 2007.
3. AtulKahate, "*Object Oriented Analysis & Design*", 1stEdition, TMH, 2007.
4. Mark Priestley, "*Practical Object-Oriented Design with UML*", 2nd Edition, TMH, 2005.
5. Craig Larman , "*Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process*", 3rd Edition, Pearson Education, 2007.

**WEB REFERENCES:**
1. https://nptel.ac.in/courses/106/105/106105153/
2. https://www.coursera.org/learn/object-oriented-design
3. https://www.coursera.org/learn/design-patterns

# E- COMMERCE
## (Open Elective)

**Course Outcomes**:
At the end of the Course the student shall be able to

> **CO1:** Summarize the basic concepts of E-Commerce applications (L2)
> **CO2:** Examine factors considered to design electronic payment systems (L3)
> **CO3:** Demonstrate the Customization in work flow for an Intra-organizational Commerce (L3)
> **CO4:** Analyze the radical changes in advertising and marketing strategies (L4)
> **CO5:** Use multimedia concepts (L3)

## UNIT I                                                      (10 LECTURES)
**ELECTRONIC COMMERCE** - Framework, Anatomy of E-Commerce applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer-Oriented Electronic Commerce – Applications, Mercantile Process Models-from Consumer's and Merchant's Perspective.

**Learning Outcomes:**
At the end of the module, the student shall be able to:
> 1. Discuss basic components of E-Commerce Applications. (L2)
> 2. Identify various E-Commerce Applications. (L2)
> 3. Distinguish Mercantile Process Models. (L2)

## UNIT II                                                     (10 LECTURES)
**ELECTRONIC PAYMENT SYSTEMS (EPS)**- Digital Token-Based and Credit Card-Based EPS, Smart Cards, Risks in Electronic Payment systems, Designing EPS. Inter-organizational Commerce & Electronic Data Interchange (EDI), EDI Implementation, Value added networks.

**Learning Outcomes:**
At the end of the module, the student shall be able to:
> 1. Illustrate various types of Electronic Payment systems. (L3)
> 2. Identify the risks in Electronic Payment systems. (L2)
> 3. Review the EDI applications in business. (L2)

## UNIT III                                                    (10 LECTURES)
**INTRA-ORGANIZATIONAL COMMERCE** – Work-Flow Automation and Coordination, Customization and Internal Commerce, Supply Chain Management (SCM), The Corporate Digital Library – Making a Business Case for a Document Library, Types of Digital Documents, Corporate Data Warehouses**,** Introduction to BlockChain technology.

**Learning Outcomes:**
At the end of the module, the student shall be able to:
> 1. Discover Work-Flow Automation for a business process. (L3)
> 2. Identify the role of Supply Chain Management. (L2)
> 3. Prepare a business case for a document library. (L3)

## UNIT IV                                                     (10 LECTURES)
**ADVERTISING AND MARKETING ON THE INTERNET** – Information based marketing, Advertising on the Internet, On-Line Marketing Process, Market Research. Consumer Search and

Resource Discovery - Information Search and Retrieval, E-Commerce Catalogs or Directories, Information Filtering.

**Learning Outcomes:**

At the end of the module, the student shall be able to:
1. Compare the nature of marketing in E-Commerce environments. (L4)
2. Analyze the impact of advertising on the internet. (L4)
3. Select an appropriate search and indexing technique to find the target information on an E-Commerce website. (L4)

**UNIT V**                                                         **(10 LECTURES)**

**MULTIMEDIA -** Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

**Learning Outcomes:**

At the end of the module, the student shall be able to:
1. Summarize the impact of Digital Video in Electronic Commerce. (L2)
2. Discover various components needed for Desktop Video Processing. (L3)
3. Write various types of Desktop Video Conferencing. (L3)

**TEXTBOOK :**

1. Ravi KalaKota and Andrew B.Whinston, *"Frontiers of Electronic Commerce",*11<sup>th</sup> Edition, Pearson Education, 2011.

**REFERENCES :**

1.     Hendry Chan, Raymond Lee, Tharam Dillon and Ellizabeth Chang, *"E- Commerce Fundamentals and Applications"*, 1st Edition, John Wiley, 2008.

2. Jaiswal S, *"E-Commerce",* 1st Edition, Galgotia Publishers, 2008.

3. Efraim Turban, David King, Jae Kyu Lee, Ting-Peng Liang and Deborrah C. Turban, *"Electronic Commerce- A Managerial and Social Networks Perspective",* 8th Edition, Springer, 2015.

4. Kenneth C.Taudon and Carol GuercioTraver*, "E- Commerce Business, Technology, Society",* 3rd Edition, Pearson Education, 2008.

**WEB REFERENCES:**

1. https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf
2. https://swayam.gov.in/nd1_noc19_mg54/preview

# FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE
## *(Open Elective)*

**Course Code: 22IT11P4**

**L T P C**
**3 0 0 3**

**Course Outcomes:** At the end of the course, the student will be able to
**CO 1:** Summarize various AI applications, languages and Intelligent Agents (L2)
**CO 2:** Solve problems using search strategies and understand the basic process of Machine Learning. (L3)
**CO 3:** Solve problems using uninformed and informed search strategies (L3)
**CO 4:** Classify the real world problems using Artificial Neural Networks (L4)
**CO 5:** Summarize the structure and identify the building blocks of a Convolution Neural Network (L2)

## UNIT I                                                                                                  (10 Lectures)
**ARTIFICIAL INTELLIGENCE**: Introduction, Definition of AI, Goals of AI, Turing Test, Applications of AI, AI Programming Languages; Introduction, Intelligent Systems, the Concept of rationality, types of Agents, Environments and its properties, PEAS.

**Learning Outcomes:** At the end of this unit, the student will be able to
1. classify various AI Applications. (L2)
2. list the AI Languages. (L1)
3. explain various types of Agents. (L2)

## UNIT II                                                                                                 (10 Lectures)
**PROBLEM SOLVING AND SEARCHING**: Introduction to Problem Solving, Problem Formulation, State Space Representation, Problem Formulation of real world problems, Production System, Problem Characteristics, Solving problems by searching.

**Learning Outcomes**: At the end of the unit, student will be able to
1. demonstrate the state space search and control strategies techniques (L2)
2. describe Characteristics of a Problem. (L2)
3. apply various problem solving techniques for solving real world problems (L3)

## UNIT III                                                                                               (10 Lectures)
**UNINFORMED SEARCH STRATEGIES:**    Introduction, Brute Force or Blind Search, Breadth-First Search, Depth- First Search
**INFORMED SEARCH STRATEGIES:** Introduction, Hill Climbing, Best- First Search (Greedy Search), A* Search, AO* Search

**Learning Outcomes**: At the end of this unit, the student will be able to
1. differentiate between uninformed and informed search strategies (L2)
2. apply uninformed search techniques to problems. (L3)
3. apply informed search techniques to problems. (L3)

## UNIT IV                                                                                                (10 Lectures)
**ARTIFICIAL NEURAL NETWORKS (ANNs):** Introduction to Artificial Neural Networks, Basic Models of ANN's, First Artificial Neurons: McCulloh- Pitts Model, Neural Network Architecture, Single Layer Feedforward ANN, Multilayer ANN, Activation Functions, Supervised Learning, Delta Learning Rule, Backpropagation Algorithm, Unsupervised Learning Algorithm
**Learning Outcomes**: At the end of the unit, student will be able to
1. understand the architecture of an artificial neuron. (L2)
2. explain various Activation Functions.(L2)
3. illustrate different artificial neural network architecture.(L2)

4. simplify real world problems using Back propagation algorithm.(L4)

**UNIT- V**                                                                     **(10 Lectures)**

**CONVOLUTION NEURAL NETWORKS(CNNs):** Introduction, Components of CNN Architecture-Convolution Layer(with example), Pooling/Down sampling Layer, Flattening Layer, Fully Connected Layer; Rectified Linear Unit Layer, Unique Properties of CNN, Applications of CNN. (Textbook - 2-Chapter-2)

**Learning Outcomes**: At the end of the unit, student will be able to
1. understand the architecture of CNN (L2)
2. understand properties of CNN (L2)
3. understand the applications of  CNN  (L2)

**Text Books:**
1. Dr.Nilakshi Jain, *Artificial Intelligence*: *Making a System Intelligent,* Wiley Publications, 1st Edition, 2019. (For Units- I, II, III & IV)
2. Dr.S.Lovelyn Rose, Dr. L.Ashok Kumar, Dr.D.Karthika Renuka, *Deep Learning using Python*, Wiley India Pvt. Ltd., 2020.(For Unit V)

**References:**
1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson Publications, 4th  Edition, 2022.
2. Elaine Rich, Kevin Knight, Shivashankar B Nair, *Artificial Intelligence*,McGraw Hill Education,3rd Edition,  2017.

# INTRODUCTION TO CLOUD COMPUTING
## *(OPEN ELECTIVE)*

**Course Code: 22IT11P5**                                    **L T P C**
                                                              **3 0 0 3**

**Prerequisites: NIL**
**COURSE OUTCOMES:**
At the end of the Course, the Student will be able to:
**CO 1:** Summarize the importance of cloud computing in the real world.(L2)
**CO 2:** Identify applications that can be integrated using cloud services. (L1)
 **CO 3:** Evaluate cloud based applications. (L5)
**CO 4:** Analyze the security issues in cloud services. (L4)
**CO 5:** Classify the Cloud Services and Cloud related technologies. (L4)


**UNIT-I**                                                   **(10 LECTURES)**
**INTRODUCTION:**
Introduction, Cloud Computing, Cloud Deployment Models, Business Drivers for Cloud Computing, Introduction to Cloud Technologies**.**
**INFRASTRUCTURE AS A SERVICE:**
Storage as a Service: Amazon storage services, Amazon Simple Storage Services (S3), Amazon Simple DB, Amazon Relational Database Service, Compute as a Service: amazon Elastic Compute Cloud (EC2), overview of Amazon EC2, Simple EC2 Example, using EC2 for Pustak Portal.
**Learning Outcomes:** At the end of the module the student will be able to
1.   classify the cloud deployment models. (L4)
2.   compare Private vs. Public Clouds (L5)
3.   illustrate the Business Drivers for Cloud Computing (L4)
4.   summarize infrastructure as a service(L2)


**UNIT-II**                                                  **(10 LECTURES)**
**PLATFORM AS A SERVICE:**
Windows Azure: Azure Test and Deployment, Technical Details of the Azure Platform, Azure Programming Model, Using Azure Cloud Storage Services, Handling the Cloud Challenges, Designing Pustak Portal in Azure, Google App Engine, Platform as a Service: Storage Aspects, Apache Hadoop, Mashups.
**SOFTWARE AS A SERVICE:**
CRM as a Service, Social Computing Services, Document Services.

**Learning Outcomes:** At the end of the module the student will be able to
1.   summarize Windows Azure (L2)
2.   demonstrate the Azure Programming Model.(L3)
3.   explain CRM as a Service(L2)


**UNIT-III**                                                 **(10 LECTURES)**
**PARADIGMS FOR DEVELOPING CLOUD APPLICATIONS:**

Scalable Data Storage Techniques, Map Reduce Revisited, Rich Internet Applications**.**

## ADDRESSING THE CLOUD CHALLENGES:

Scaling Computation: Scale Out versus Scale Up, Amdahl's Law, Scaling Cloud Applications with a Reverse Proxy, Hybrid Cloud and Cloud Bursting: Open Nebula, Scaling Storage: CAP Theorem, Implementing Weak Consistency, Consistency in NoSQL Systems, Multi-Tenancy: Multi-Tenancy Levels, Tenants and Users, Authentication, Implementing Multi-Tenancy: Resource Sharing, Case Study: Multi-Tenancy and Security in Cloud.

**Learning Outcomes:** At the end of the module the student will be able to

1. illustrate Scalable Data Storage Techniques.(L4)
2. illustrate Hybrid Cloud and Cloud Bursting(L4)
3. apply Multi-Tenancy and Security in Cloud.(L3)

## UNIT-IV                                                              (10 LECTURES)
## DESIGNING CLOUD SECURITY:

Cloud Security Requirements and Best Practices, Risk Management, Security Design Patterns, Security Architecture Standards, Legal & Regulatory Issues, Selecting a Cloud Service Provider, Cloud Security Evaluation Frameworks.

**Learning Outcomes:** At the end of the module the student will be able to
1. summarize Cloud Security concepts.(L2)
2. classify Security Architecture Standards(L4)
3. summarize Cloud Security Evaluation Frameworks (L2)

## UNIT-V                                                               (10 LECTURES)
## MANAGING THE CLOUD:

Managing IaaS, Managing PaaS, Managing SaaS, Other Cloud-Scale Management Systems.

## RELATED TECHNOLOGIES:

Server Virtualization, Two Popular Hypervisors, Storage Virtualization, Grid Computing, Other Cloud-Related Technologies.

**Learning Outcomes:** At the end of the module the student will be able to
1. identify Cloud services & Cloud-Scale Management Systems.(L1)
2. compare Two Popular Hypervisors (L5)
3. compare Cloud-Related Technologies (L5)

## TEXT BOOKS:

1. Dinkar Sitaram, Geetha Manjunath, "Moving to the Cloud: Developing Apps in the New World of Cloud Computing", 1st Edition, Elsevier, 2017.

REFERENCES:
1. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing – A Hands-on Approach", 1st Edition, Universities press pvt Ltd, 2016.
2. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley India Pvt Ltd, 2011.
3. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, TataMcGrawHill Education, 2011.

## WEB REFERENCES:
1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.coursera.org/specializations/cloud-computing
3. https://www.coursera.org/learn/introduction-to-cloud

# Fundamentals of Java Programming
## *(Open Elective)*

**Course Code: 22IT11P6**　　　　　　　　　　　　　　　　　　　　**L  T  P  C**

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**3  0  0  3**

Pre-Requisites: Programming for Problem Solving Using C

**Course Outcomes:**

At the end of the Course the student shall be able to

**CO1:** Interpret object orientation and programming strategies (L2)

**CO2:** Demonstrate classes, objects and method overloading. (L3)

**CO3:** Describe Inheritance and illustrate Dynamic Method Dispatch.(L2)

**CO4:** Use of Packages and Interfaces.(L3)

**CO5:** Illustrate about exceptions and Threads.(L3)


**UNIT-I**　　　　　　　　　　　　　　　　　　　　　　　　　　**12 Lectures**

**Introduction to Object Oriented Programming:** What is Object Oriented Programming? Object Orientation as a New Paradigm: The Big Picture , An Overview of Java: Process Oriented Vs Object Oriented Programming, OOP Principles, Java Buzz Words, The Byte Code, A First Simple Program

Data Types and Variables, Operators and Expressions, Control Statements, Type Conversion and casting, Arrays.


**Learning Outcomes:**

At the end of the module, students will be able to:

1. Summarize object-oriented programming features and Java features. (L2)
2. Discuss  various data types and control statements in Java. (L2)
3. Explain how to create various types of arrays (L2)


**UNIT-II**　　　　　　　　　　　　　　　　　　　　　　　　　**10 Lectures**

**Introduction to Objects & Classes:** Class Fundamentals with Variables and Methods, Declaring objects for accessing variables and  methods.

**Constructors:** Default and Parameterized, this keyword and Garbage Collection, Final and Static Keywords, Overloading Methods, Overloading Constructors, Using objects as Parameters, Returning objects, String and String Buffer.


**Learning Outcomes:**

At the end of the module, students will be able to:

1. Explain classes and objects. (L2)
2. Illustrate about constructors and methods and Method Overloading. (L3)
3. Demonstrate Java programs for manipulating Strings. (L3)


**UNIT-III**　　　　　　　　　　　　　　　　　　　　　　　　　**08 Lectures**

**Inheritance:**

Inheritance Basics, Types of Inheritance, Using Super keyword for constructors, Super to call variables and methods, Method Overriding, Dynamic Method Dispatch

**Learning Outcomes:**
At the end of the module, students will be able to:
1. Describe different kinds of inheritance. (L2)
2. Interpret the usage of super keyword in inheritance. (L2)
3. Explain Method overriding and dynamic method dispatch (L2)

**UNIT-IV**                                                                10 Lectures
**Packages and Interfaces: Defining** a Package, importing a package, Package Example, Access
Protection, An Access Example, Abstract classes,

**Interfaces:** Defining and Implementing Interfaces
Exploring java.lang: Wrapper classes, Object, Math, Runtime
Exploring java.util: The collection framework: Array List, Hash Set and Hash Map, String Tokenizer,
Calendar, Scanner

**Learning Outcomes:**
At the end of the module, students will be able to:
1. Demonstrate the use of packages in Java. (L2)
2. Explain various built-in Java classes. (L2)
3. Use various methods of Java built-in classes. (L3)

**UNIT-V:**                                                                10 Lectures
**Exception Handling**: Exception Handling Fundamentals, Exception Types, throw, throws and finally,
Creating your own exceptions, Chained Exceptions.
**Multithreaded Programming:** Java Thread Model, The Main thread, Two ways of Creating a
Thread, Creating Multiple Threads, isAlive(),join(), Synchronization

**Learning Outcomes:**
At the end of the module, students will be able to:
1. Discuss about exceptions. (L2)
2. Illustrate exception handling in Java. (L3)
3. Demonstrate multi-threaded programs. (L3)

**TEXT BOOKS:**
1. Herbert Schildt, *Java The complete reference*, 11th Edition, McGraw Hill, 2019
2. Timothy budd, *An introduction to object-oriented programming*, 3rd Edition,
   Pearson Education, 2009.

**REFERENCE BOOKS:**
1. Y. Daniel Liang *Introduction to Java Programming Comprehensive Version*, 10th Edition,
   Pearson, 2015.
2. Cay S. Horstmann, *Core Java Volume I–Fundamentals*, 11 th Edition, Pearson 2019

**WEB REFERENCES:**
1. *https://onlinecourses.nptel.ac.in/noc19_cs84/preview*

# DATA STRUCTURES
## *(OPEN ELECTIVE )*

**L T P C**
**3 0 0 3**

**Course Code: 22IT11P7**

**Prerequisite:** Programming for Problem Solving Lab using C

**Course Outcomes:** At the end of the course, a student will be able to
**CO1:** Classify different Searching and Sorting Algorithms.(L2)
**CO2:** Apply  the concepts of using stacks and queues for various applications.(L3)
**CO3:** Apply the concepts of linked lists.(L3)
**CO4:** Interpret the concepts of Trees.(L2)
**CO5:** Explain the concepts of  Graphs.(L2)

**UNIT-I**                                                                    **(10 Lectures)**
**SEARCHING TECHNIQUES:**
Linear Search, Transpose Sequential Search, Binary Search, Interpolation Search.
**SORTING TECHNIQUES:**
Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.
**Learning Outcomes:** At the end of the module, student will be able to
1.   illustrate how different searchings  would work with examples. (L2)
2.   describe insertion, selection, and bubble sort. (L2)
3.   explain Merge Sort, Quick sort with example. (L2)

**UNIT-II**                                                                   **(10 Lectures)**
**LINEAR DATA STRUCTURES AND APPLICATIONS:**
**ABSTRACT DATA TYPES**: Introduction, List ADT, Stack ADT, Queue ADT.
**STACK-**    Definition, Basic Stack Operations, Implementation using Arrays, Applications-
Recursion.
**QUEUE-** Definition, Basic Queue Operations, Implementation using Arrays, Applications,
Circular Queues and Priority Queue.
**Learning Outcomes:** At the end of the module, student will be able to
1.   explain the need of Linear Data Structures and their Applications. (L2)
2.   implementation of  stack and Queue data structure. (L3)
3.   describe the advantages of circular, priority queue. (L2)

**UNIT-III**                                                                 **(10 Lectures)**
**LINKED LISTS:**
Dynamic Memory Allocation, Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists .
**Learning Outcomes:** At the end of the module, student will be able to
1.   Illustrate various functions to allocate memory dynamically. (L2)
2.   demonstrate how to declare structures to be used in simple linked lists, doubly linked lists and
circular linked lists. (L3)
3.   write algorithms for inserting, deleting, and searching in a simple linked list. (L3)

**UNIT-IV**                                                                  **(10 Lectures)**
**NON-LINEAR DATA STRUCTURES – TREES:**
Trees, Tree Terminology, Binary Trees, Binary Tree Travels, operations on Binary trees, Binary
Search Trees and its operations , Creation of binary tree from in-order and pre(post)order traversals,

applications of binary trees.

**Learning Outcomes:** At the end of the module, student will be able to
1. explain the need of Non-Linear Data Structures and their Applications. (L2)
2. describe various terminologies related to trees. (L2)
3. compare different types of trees and their applications. (L2)

**UNIT-V**                                                **(10 Lectures)**
**NON-LINEAR DATA STRUCTURES – GRAPHS**
Graph, Graph Terminology, Graph Traversals- Breadth First Traversals, Depth First traversals, Minimal Spanning Trees.

**Learning Outcomes:** At the end of the module, student will be able to
1. describe various terminologies related to Graphs. (L2)
2. explain Graph Traversals techniques (L2)
3. discuss Prim's algorithm for finding the minimal spanning tree of a graph. (L2)

**Text Books:**
1. Reema Thareja, "*Data Structures Using C*", 2nd edition, Oxford Publication, 2014
2. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "*Fundamentals of Data structures in C++*", 2nd Edition, University Press (India) Pvt.Ltd.,2008.

**References:**
1. Richard G. Gilberg & Behrouz A. Forouzan, "*Data Structures*", 2nd Edition, Thomson, 2007.
2. Seymour Lipschutz, "*Data Structures with C*", 1st Edition, PHI, 2009.
3. Debasis Samanta, "*Classic Data Structures*", 2nd Edition, PHI, 2009 .
4. G.A.V.PAI, "*Data Structures and Algorithms*", 1st Edition, TataMcGraw Hill, 2010.

**Web References:**
1. https://nptel.ac.in/courses/106102064/
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

# Introduction to C++
## *(OPEN ELECTIVE ))*

**Course Code: 22IT11P8**

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| 3 | 0 | 0 | 3 |

**Prerequisites:** Problem Solving using C.

## COURSE OUTCOMES:
At the end of the Course the student shall be able to

**CO 1:** Apply the concepts of operators, Inline functions and function overloading to solve problems. (L3)

**CO 2:** Analyze software problems in terms of objects and classes. (L4)

**CO 3:** Classify inheritance types and illustrate code reusability in solving problems. (L4)

**CO 4:** Develop programs to solve real time problems using virtual functions and generic templates. (L6)

**CO 5:** Develop programs which illustrate the use of files. (L6)

**UNIT-I** (12 Lectures)

**Introduction to C++:**

Structure of C++ program, tokens, keywords, identifiers, basic data types, derived data types, constants, dynamic initialization, reference variables, scope resolution operator, type modifiers, type casting, operators and control statements, input and output statements in C++, Function prototyping and components, Passing parameters: Call by reference, Return by reference, Inline function, Default arguments, Overloaded function.

**Learning Outcomes:** At the end of the module, students will be able to:

1. describe the basic data types, operators and control statements (L2)
2. describe the syntax and semantics of the C++ programming language. (L2)
3. solve problems by writing programs using inline functions for efficiency and performance. (L3)

**UNIT-II** (10 Lectures)

**Principles of OOP:**

Object Oriented Technology- Basic concepts and benefits of OOP.

**Classes and Objects:**

Class specification, Member functions, access qualifiers, static data members and member functions. Instance creation - Array of objects - Dynamic objects - Static Objects – Objects as arguments -Returning objects

**Constructors and Destructors:**

Constructors- Parameterized constructors, Overloaded Constructors, Constructors with default arguments, copy constructors, Destructors.

**Learning Outcomes:** At the end of the module, students will be able to:

1. describe object oriented programming concepts. (L2)
2. demonstrate the usage of copy constructors and class member functions.(L3)
3. illustrate Overloading of constructors in C++. (L4)

**UNIT-III** (10 Lectures)

**Operator Overloading:**

Operator function-overloading unary and binary operators, overloading the operator using Friend function, Data conversion.

**Inheritance:**

Defining derived classes. Single Inheritance - Protected data with private inheritance, Types of Inheritance-Multiple Inheritance, Multilevel Inheritance, Hierarchical Inheritance, and Hybrid Inheritance. Constructors in derived and base Class,

**Learning Outcomes:** At the end of the module, students will be able to:
1. explain how the operators can be overloaded. (L2)
2. describe how inheritance promotes code reuse in C++ with example programs. (L2)
3. classify types of inheritances and select suitable type in solving problems.(L4)

**UNIT-IV** (10 Lectures)
**Virtual functions and polymorphism**:
Virtual Functions, Dynamic polymorphism, Virtual constructors and destructors, Abstract classes.
**Templates in C++:**
Generic Programming with Templates-Introduction, function templates, overloaded function templates,
function templates with user defined types, class templates, class templates and Inheritance.

**Learning Outcomes:** At the end of the module, students will be able to:
1. illustrate the use of function templates.(L4)
2. demonstrate the use of class templates.(L2)
3. develop programs which illustrate how virtual functions can be used for implementation of dynamic binding.(L6)

**UNIT-V** (8 Lectures)
**I/O Streams**: file stream classes, file open and close sequential input and output functions, file pointer and manipulators-file pointer handling functions.

**Learning Outcomes:** At the end of the module, students will be able to:
1. describe the storage of the data through files. (L2)
2. develop programs which illustrate the use of predefined file I/O functions to perform operations on files. (L2)
3. develop programs which illustrate the use of file pointer handling functions. (L6)

**Text Book:**
1. E. Balagurusamy, *"Object Oriented Programming with C++"*, Seventh edition, McGraw Hill Education, 2017.
2. John R Hubbard, *"Programming with C++"*, Third edition, McGraw Hill Education, 2017

**References:**
1. Herbert Schildt, *"C++: The Complete Reference"*, 4th Edition, McGraw Hill Education, 2017.
2. Ashok N Kamthane, *"Programming in C++"*, 2nd Edition, Pearson Education India, 2013.
3. Bjarne Stroustrup, "*The C++ Programming Language"*, 1e: Third edition, Pearson Education India, 2002.
4. Reema Thareja, *"Object Oriented Programming with C++"*, Revised First Edition , Oxford Higher Education, 2018.

**Web References** :
1. https://nptel.ac.in/courses/106/105/106105151/
2. https://nptel.ac.in/courses/106/101/106101208/

## List of Open Electives offered by Management Studies

| | |
|---|---|
| 22HM11P1 | Start-Up Ecosystem |
| 22HM11P2 | Legal Environment for Business |
| 22HM11P3 | Logistics and Supply Chain Management |
| 22HM11P4 | Fundamentals of Cost and Management Accounting |
| 22HM11P5 | Information Systems for Managing Business |
| 22HM11P6 | Introduction to Indian Taxation System |
| 22HM11P7 | Organisational Behaviour and Human Resource Management |
| 22HM11P8 | Product Management |
| 22HM11P9 | Business Communication |

# START-UP ECOSYSTEM

**Course Code: 22HM11P1**

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**Course Objectives**

The objective of the course is to understand the concept of a start-up, identify the required strategic resources and entrepreneurial strategies in developing entrepreneurship competencies.

**Course Outcomes**

CO 1: To understand the concept of entrepreneurship and identify the dimensions and resources required to establish a start-up. (L2)

CO 2: To identify the entrepreneurial strategies and various business models, and develop the entrepreneurial competencies. (L2)

CO 3: To analyse the schematic of the new venture's environment and understand the elements of the business plan. (L4)

CO 4: To identify the various sources of finance for a new venture and role of central and state government in promoting entrepreneurship. (L2)

CO 5: To know the institutions supporting the business enterprises at central level institutions, state level institutions, and other agencies. (L2)

**UNIT - I: Foundations of Start-up**                        **(10 Lectures)**

Concept of Entrepreneur - Features - Types - Functions - Entrepreneurship - Characteristics - Evolution - Entrepreneurial process - Dimensions and Paradoxes - Attributes of Strategic Resources - Approaches - Social Entrepreneur - Women Entrepreneur - Role of entrepreneurship in economic development - Constraints for the growth of entrepreneurial culture - Start-up success stories.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the concept of entrepreneur and entrepreneurship. (L2)
2. Describe the evolution and process of entrepreneurship. (L1)
3. Outline the dimensions and paradoxes of entrepreneurship. (L3)
4. Identify the attributes of strategic resources and different approaches. (L1)
5. Analyse the role of social and women entrepreneurs in economic development. (L4)

**UNIT – II: Entrepreneurial Strategies and Competencies**          **(10 Lectures)**

Business Models and Strategy - Entry Wedges - Resource-Based Strategies - Information Rules Strategies - Strategy and Industry Environments - Crafting and Evaluating Strategy - Entrepreneurship competencies - qualities of a successful entrepreneur - Entrepreneurial traits - Developing competencies - Tools of assessment - Institutional Framework - Role of SSI Sector in the Economy - Failure, Causes and Preventive Measures - Turnaround Strategies.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the different business models and strategies. (L2)
2. Examine the entry wedges and resource-based strategies. (L3)
3. Analyse the entrepreneurial competencies and traits. (L4)
4. Develop the assessment tools and institutional framework. (L3)
5. Examine the failure, causes, preventive measures and strategies. (L3)

**UNIT – III: Start-up Environment and Business Plan**        **(10 Lectures)**
Schematic of the New Venture's Environment - Processes of Business Environment Analysis - Political, Governmental, Stakeholder, Technological, Macroeconomic, Socio-demographic, Competitive and Competitor Analysis - Elements of Business plan - Feasibility study - Critiquing the plan - Formalities and procedures in registration of a business - Regulatory norms and legal aspects - Format and presentation of report – Marketing strategies.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the schematic of the new venture's environment. (L2)
2. Analyse the business environment of a start-up. (L4)
3. Develop a start-up business plan and examine the elements. (L3)
4. Examine the regulatory norms and legal aspects. (L3)
5. Prepare the report format and presentation. (L3)

**UNIT – IV: Managing New Venture and Financing**        **(8 Lectures)**
Preparing for the new venture launch - New venture expansion strategies - Venture Capital and Angel Investment - Importance and Benefits - Sources of Investment - Role of Central Government and State Government in promoting Entrepreneurship - Introduction to various incentives, subsidies and grants - Export Oriented Units - Fiscal and Tax concessions.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the process of new venture launch or expansion. (L2)
2. Know the importance of venture capital and angel investment. (L2)
3. Examine the role of the central and state government in promoting entrepreneurship. (L3)
4. Identify the various incentives, subsidies and grants. (L1)

**UNIT - V: Institutional Financial Support**        **(10 Lectures)**
Institutions supporting the small business enterprises: Central level institutions, state level institutions, other agencies. District Industries Centres (DICs) - Industrial Development Corporation (IDC) - State Financial Corporation (SFCs) - Small Scale Industries Development Corporations (SSIDCs) - Khadi and Village Industries Commission (KVIC) - Technical Consultancy Organisation (TCO) - Small Industries Service Institute (SISI) - National Small Industries Corporation (NSIC) - Small Industries Development Bank of India (SIDBI) - NBFC's in India

**Learning Outcomes:** At the end of this unit students will be able to:
1. Identify the institutions supporting business enterprises. (L1)
2. Explore the support of central level institutions. (L3)
3. Analyse the state level institutions' support for entrepreneurship. (L4)
4. Identify the other agencies supporting small business enterprises. (L1)

**Text Books**
1.       Vasant Desai, *Small-Scale Enterprises and Entrepreneurship Ecosystem*, 6th Edition, Himalaya Publishing House, 2016.
2.     Robert Hisrich, Michael Peters, and Dean Shepherd, *Entrepreneurship*, 11th Edition, McGraw Hill Education, 2019.
3.       Poornima M. Charantimath, *Entrepreneurship Development and Small Business Enterprises*, 3rd Edition, Pearson Education, 2018.
5.    Andrew Zacharakis, William Bygrave, and Andrew Corbett, *Entrepreneurship*, 4th Edition, Wiley, 2016.
6.    Marc J. Dollinger, *Entrepreneurship: Strategies and Resources*, 4th Edition, Marsh Publications, USA, 2008.

7. Rajeev Roy, *Entrepreneurship*, 2nd Edition, Oxford University Press, 2011.
8. C.V. Bakshi, *Entrepreneurship Development*, 2nd Edition, Excel Publications, 2010.

**References**
1.   Norman M. Scarborough & Jeffery R. Cornwall, Essentials of Entrepreneurship and Small Business Management, 9th Edition, Prentice Hall, 2018.
2.   Howard Frederick, Allan O'Connor, & Donald F. Kuratko, Entrepreneurship: Theory, Process and Practice, 4th Edition, Cengage Leaming, 2016.
3.  Vasant Desai, Entrepreneurship Management, 1st Edition, Himalaya Publishing House, 2013.
9.  MadhurimaLall, Entrepreneurship, 1st Edition, Excel Publications, 2012.
10.  Eric Ries, The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Publishing, 2011.
11.  MadhukarShukla, Social Entrepreneurship in India, 1st Edition, SAGE Publications India Pvt Ltd., 2020.
12.  Peter Thiel & Blake Masters, Zero to One: Notes on Start Ups, or How to Build the Future, Random House, 2014.

# LEGAL ENVIRONMENT FOR BUSINESS

**Course Code: 22HM11P2**

| L | T | P | C |
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## Course Objectives

The primary objective of this course is to provide the student adequate information and knowledge about the legal environment i.e. essential for establishing and executing business operations. This would enable the student to understand various aspects of Indian business laws and legal compliances which helps them in smooth conduct of business operations.

## Course Outcomes

CO 1: Understand the essential aspects of Indian Contracts Act 1872.(L2)

CO 2: Describe various legal compliances of Negotiable Instruments Act 1881 and The Consumer Protection Act, 1986.(L2)

CO 3: Understand the features and various guidelines of the Sale of Goods Act 1930.(L2)

CO 4: Comprehend the use of Right To Information Act 2005 and understand the cyber laws in India.(L2)

CO 5: Describe the guidelines of Indian Companies (Amendment) Act-2013.(L2)

## UNIT - I: Indian Contracts Act-1872                    (10 Lectures)

Introduction, Objectives, Definition of a Valid Contract, Offer and Acceptance, Capacity to Contract, Consent, Consideration, Performance of Contracts, Discharge of Contracts, Breach of Contract and Void Agreements, Quasi Contracts, Freedom to Contract.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand various aspects of a valid contract (L2)
2. Differentiate between agreement and contract. (L2)
3. Describe the performance and discharge of contracts. (L2)
4. Explain special cases of contracts (L3)

## UNIT - II: Negotiable Instruments Act-1881 & the Consumer Protection Act, 1986
### (10 Lectures)

**Negotiable Instruments Act-1881:** Negotiable Instruments: Promissory Note, Bills of Exchange & Cheques and their definitions and characteristics, Types of endorsements, Holder- Holder in due course, Discharge of Parties.

**The Consumer Protection Act, 1986:** Aims and Objects of the Act, Redressal Machinery under the Act, and Procedure for complaints under the Act, Remedies, Appeal, and Enforcement of orders and Penalties.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Outline various negotiable instruments and types of endorsements (L2)
2. Explain holder and holder in due course. (L3)
3. Explain aims and objectives of the consumer protection act 1986. (L3)
4. Describe the procedure for complaining and grievance redressal mechanism. (L2)

## UNIT - III: Sales of Goods Act-1930                    (8 Lectures)

Contract of sale, Goods and their classification, meaning of price, Conditions and Warranties, passing of property in goods, Transfer of title by non-owners, Performance of a contract of sale, Unpaid seller and his rights, Remedies for breach of contract

**Learning Outcomes:** At the end of this unit students will be able to:
1. Outline the aspects of the contract of sale. (L2)
2. Understand various legal aspects relating to transfer of property and title. (L3)
3. Explain legal aspects relating to performance of contract of sale. (L3)
4. Describe the rights of unpaid sellers and remedies for breaching sale contracts. (L2)


**UNIT - IV: RTI Act 2005 & Cyber Laws**                    **(10 Lectures)**
Right to Information Act-2005: Meaning, Features of the act, Procedure of Request for information.
Cyber Laws: Cyber space, Cyber-Crime- Types, Emergence and salient features of I.T. Act-2000, Legal recognition of Electronic Records, Electronic signatures, Digital Signatures and Digital Certificates, Role of Cyber Regulations Appellate Tribunal.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand various aspects of RTI ACT 2005. (L2)
2. Understand the essence and features of Cyber Laws in India. (L2)
3. Describe various features of electronic records. (L1)
4. Understand the role of Cyber Regulations Appellate Tribunal. (L2)


**UNIT - V: Indian Companies (Amendment) Act-2013**            **(10 Lectures)**
Introduction, Company – Definition, Meaning, Features and Types, One Person Company, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Know the concept of Company. (L2)
2. Outline types of companies. (L3)
3. Understand the procedure for formation of a company. (L2)
4. Explain the procedure for conduct of Annual General Body Meetings (L3)
5. Describe the process of winding up of a company. (2)


**Text Books**
1. N.D.Kapoor, Elements of Mercantile Law, 34th edition, Sultan Chand & Sons,  2017
2. M C Kuchhal&VivekKuchhal, Business Law, 5 th Edition, Vikas Publication, 2018
3. Pillai R.S.N., V.Bagavathi, Business Law, First edition reprint, Sultan Chand, 2006
4. Tulisian P.C, Business Law, Third edition, TMH, 2018
6. Sujit Kumar Das &Pankaj Kumar Roy, Business Law, First edition, Oxford university press, 2017
7. V.K Jain & CA ShashankS.Sharma, Business Laws, Second edition, Taxmann, 2020
8.    S.N.Maheshwari, S.K.Maheshwari: A Manual of Business Laws, Himalaya Publishing House, Mumbai, 2009


   **Reference Books**
1. Chandra Bose: Business Law, PHI Learning, New Delhi, 2010.
2. S.SGulshan: Business Law, Excel Books, New Delhi, 2010
3. Ministry of Companies Affairs (MCA), Companies act 2013, Ministry of Companies Affairs (MCA), Real time updated E-Book
4. AkhileshwarPathak, Legal Aspects of Business, 7th edition, McGraw hill, 2018
5. Durga Das Basu, Introduction to the Constitution of India, 23rd edition, LexisNexis, 2015

# LOGISTICS AND SUPPLY CHAIN MANAGEMENT

**Course Code: 22HM11P3**

| | L | T | P | C |
|---|---|---|---|---|
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**Course Objective**
To introduce the basic concepts of logistics and supply chain and process with a focused approach towards manufacturing and retail sector.

**Course Outcomes**
CO1: To introduce the basic concepts and process of supply chain management with a focussed approach towards manufacturing and retailing.(L3)
CO2: To understand the demand requirement and forecasting and also to integrate technology through customer service in SCM.(L2)
CO3: To plan and organize and manage inventory in material management department.(L3)
CO4: To understand different purchasing and sourcing decisions in SCM.(L2)
CO5: To organize supply chain networks and have a basic insight into various contemporary practices.(L3)

**UNIT - I: Introduction to Supply Chain Management**            **(8 Lectures)**
Supply Chain-Concept- Need and Evolution: Approaches, Phases and processes of supply chain drivers and obstacles. Supply Chain strategies- Strategic fit and scope.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the need and evolution for supply chain (L2)
2. Explain different phases of supply chain (L2)
3. Summarize the process of supply chain drivers (L2)
4. Explain the scope of supply chain management (L2)

**UNIT - II: Demand and Supply in Supply Chain Management**       **(10 Lectures)**
Planning Demand and Supply in SCM – Demand forecasting, aggregate planning, managing predictable variability. Customer service and Integration of technology in SCM (IT & E-business) - New product development process managing in supply chain.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Where to Integrate technology in SCM (L1)
2. How to forecast demand (L1)
3. Understand Customer Service Management in SCM (L2)
4. Understand New Product Development process (L2)

**UNIT - III: Inventory Planning and Managing Inventory**       **(10 Lectures)**
Inventory Planning and Managing Inventory in SCM- Benefits of Inventory Planning- Factors affecting inventory approaches and Methods to manage Inventory.
Inventory Control: Inventory Audits and Cycle counts; Challenges in Inventory Management.

**Learning Outcomes:** At the end of this unit students will be able to:
1. List various factors affecting Inventory (L1)
2. How to manage Inventory (L1)
3. Understand the importance of Inventory (L2)
4. Outline different approaches to manage inventory (L2)
5. Identify the Challenges in Inventory Management (L1)

**UNIT - IV: Sourcing and Logistics Management**                    **(10 Lectures)**
Purchasing and sourcing decisions in SCM- Transportation, Logistics, Warehousing, Containerization and Packaging and Outsourcing.
Logistics Management: Types of Logistic Activities; Importance of Logistics Management, Integrated Logistics and its Support, Determinants of Designing Logistical System

**Learning Outcomes:** At the end of this unit students will be able to:
1.  Understand purchasing and sourcing decisions (L2)
2.  Explain the Transportation systems and Logistics(L2)
3.  Understand various warehousing techniques(L2)
4.  Explain different methods of Packaging (L2)
5.  Understand integrated logistics and support in SCM (L2)


**UNIT - V: Designing Supply Chain Network**                        **(10 Lectures)**
Distribution Network- Performance Management and Control; Benchmarking, Gap Analysis; Balance Score card for SCM
Recent trends; Improvement in supply chain visibility, Risk factors and costs- Resilience for global value chain under threat- Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management.

**Learning Outcomes:** At the end of this unit students will be able to:
1.  List out different contemporary management practices (L1)
2.  Understand supply chain distribution network (L2)
3.  Explain performance management (L2)
4.  Outline recent trends in SCM (L2)


**Text Books:**
1.   Sunil Chopra and Peter Meindi, *SCM-Strategy, Planning & Operation*, 6th Edition, Pearson Publishers, Reprint 2019
2.  Rahul V Attekar, *SCM-Concepts & Cases*, 2ndEditon, PHI, 2017
3.  Mohanty RP, &Deshmukh SG, *Essentials of SCM*, 1st Edition, Jaico Publishers, Reprint 2018

**References:**
1.  Agarwal DK, *Logistics & Supply Chain Management*, 1st Edition, MacMillan India, Reprint 2018
2.   Mentzer, John T., *Fundamentals of SCM-Twelve Drivers of Competitive Advantage*, 3rdEdition, Sage Publications, 2018
4.  *Logistics and Supply Chain Management*, 5th Edition; FT Publishers International; Reprint 2019
5.   Michael H Hugos: Essentials of Supply Chain Management, 4th Edition, Wiley Publishers, Reprint 2018.

# FUNDAMENTALS OF COST AND MANAGEMENT ACCOUNTING

| Course Code: 22HM11P4 | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives**
To provide an in-depth study of the cost accounting principles and techniques for identification, analysis and classification of cost components to facilitate managerial decision making.

**Course Outcomes**
CO 1: Understand and explain the conceptual framework of cost accounting (L2)
CO 2: Know the elements of cost and compute material and labour costs (L3)
CO 3: Understand and compute the overhead costs, and analyse the methods of costs (L3)
CO 4: Apply different costing techniques in decision making (L4)
CO 5: Apply the concept of standard costing, variance analysis and budgetary control (L4)

**Unit-I: Introduction to Cost Accounting:** (10 Lectures)
Introduction, nature, importance and scope of cost Accounting, Cost Accounting vs. Management Accounting vs. Financial Accounting, Advantages and limitations of cost accounting, types of costs.

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Under the objectives and significance of cost accounting (L2)
2. Analyse the relationship with financial and management accounting (L3)
3. Know the various cost objects and cost units (L3)
4. Identify the various elements of cost and its classification (L1)

**Unit-II: Elements of Cost: Material and Labour Costs** (10 Lectures)
Material cost: Direct and indirect material cost, issue of materials (LIFO & FIFO), levels of materials, EOQ, ABC Analysis, Bin card
Labour cost: Direct and indirect labour cost, methods of wage payment and the Incentive schemes- Halsey, Rowan, and Taylor's Differential piece wage.

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Identify the inventory control techniques (L1)
2. Analyse the issue and levels of materials (L3)
3. Computation of EOQ and ABC Analysis (L3)
4. Understand the accounting and control of labour cost (L3)
5. Know the methods of wage payment and incentive schemes (L3)

**Unit-III: Overheads and Methods of Costs** (10 Lectures)
Classification, allocation, apportionment and absorption of overheads, under and over absorption, capacity levels and costs, activity-based cost allocation (simple problems).
Single or output costing, Job costing, Contract costing, Process costing (simple problems)

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the allocation, apportionment and absorption of overheads (L2)
2. Analyse the Capacity Levels and Costs (L3)
3. Know the accounting treatment for certain items (L3)

**Unit-IV: Decision Making:**                                                         **(8 Lectures)**
Make or Buy decisions, Product mix, Sales mix, Add or drop and shutdown of the firm.

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Analyse the various methods of costing (L3)
2. Prepare the cost sheets for job and batch costing (L4)
3. Prepare the cost sheets for contract costing and process costing (L34
4. Analyse the process preparing the service costing (L4)

**Unit-V: Cost Accounting Techniques**                                              **(10 Lectures)**
Standard Costing & Variance Analysis: Advantages and limitations, computation of variances relating to material and labour costs only (simple problems)
Budget and Budgetary Control: Concepts, Types of Budgets, Advantages and limitations, Preparation of Budgets (simple problems)

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Know the different cost accounting techniques (L3)
2. Apply marginal costing for decision making (L4)
3. Compute variances related to material and labour costs (L4)
4. Prepare various budget estimations (L4)
5. Maintain the cost accounting records and integral systems (L3)

**Text Books**
1. M.N. Arora, *Cost and Management Accounting*, 3rd Edition, Himalaya Publishing House, 2016.
2. Jain, S.P. and K.L. Narang, *Cost Accounting: Principles and Practice*. Kalyani Publishers, 2014.
3. Maheshwari, S.N. and Mittal, S.N., *Cost Accounting: Theory and Problems (27th Edition)*. Shree mahavir book depot (publishers), 2020.
4. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan, *Cost Accounting: A Managerial Emphasis*, Pearson Education.
6. Nigam, B.M. Lall and I.C. Jain. *Cost Accounting: Principles and Practice.* PHI Learning

**Reference Books**
1. Singh, Surender. Cost Accounting, Scholar Tech Press, New Delhi.
2. Iyengar, S.P. Cost Accounting. Sultan Chand & Sons
3. H.V. Jhamb, Fundamentals of Cost Accounting, Ane Books Pvt. Ltd.
4. Rajiv Goel, Cost Accounting. International Book House

# INFORMATION SYSTEMS FOR MANAGING BUSINESS

**Course Code: 22HM11P5**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objectives**

The objective of the course is to provide a basic idea of the importance of information systems in managing the business and decision-making process.

**Course Outcomes**

CO 1: To understand the importance of information systems in managing business.(L2)
CO 2: To know the various information management and decision-making systems.(L2)
CO 3: To know the e-business strategies and application of information systems in different sectors..(L2)
CO4: To examine the online security systems and legal issues of e-business.(L3)
CO5: To analyse the use of information systems in business industries and know the consumer protection privacy and rights.(L4)

**UNIT-I: Introduction to Information systems                    (10 Lectures)**

Introduction – definition, Role and objectives of IS in Business - Evolution of Business Information System - IS Infrastructure and Organization – Global Information System – drivers, challenges and opportunities - strategic Dimensions of IS - Impact of electronic communications on traditional business

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the evolution and growth of the business information system. (L2)
2. Outline the IS infrastructure and plan for development. (L2)
3. Know the business objectives and dimensions of IS. (L2)
4. Analyse the impact of e-communication on traditional business. (L3)

**UNIT-II: Information Management and Decision Making            (10 Lectures)**

Data Source, Data storage, Data Warehousing, Data Mining, Web mining, Data analytics- Knowledge Management - Business Process Re-engineering - Artificial Intelligence - Business Decision making process - Decision Support Systems

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand various information management systems. (L2)
2. Identify the use of web mining and data analytics in business decisions. (L1)
3. Outline the concepts of knowledge management, BPR, and AI. (L2)
4. Understand the business decision making system and DS systems. (L2)

**UNIT-III: Strategy and Applications                       (10 Lectures)**

E-business strategy, analysis and objectives, supply chain management, e-procurement, e-marketing, customer relationship management - Applications of e-commerce in different sectors–Service, Industry, Domestic– Multidisciplinary Approach, e-business models, Intelligent Agents – ERP Tools and Modules – Opportunities and Challenges – Mobile Commerce

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Determine the e-business strategy analysis and objectives. (L2)
2. Understand the concepts of SCM, e-marketing and CRM. (L2)
3. Analyse the use of e-commerce in different sectors. (L3)
4. Examine the e-business models, ERP tools and modules. (L3)

5. Analyse the opportunities and challenges. (L3)


**UNIT-IV: Online Security and Legal Issues**          **(10 Lectures)**

Online Payment system – E-Security – Security Protocols – How sites are hacked – Internet Governance – Firewall

Legal Issues: Software Intellectual Property Law – Contract Law for E-Business – Cyber Law Issues and Societal impact


**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the online payment and e-security system. (L2)
2. Know how sites are hacked and firewalls. (L2)
3. Understand the Software Intellectual Property Law and contract law. (L2)
4. Analyse the cyber law issues and Societal impact. (L3)


**UNIT-V: E-Business Industries and Consumer Protection**      **(8 Lectures)**

E-Business Industries: Online Retail Sector – Online Financial Services – Online Travel Services – Online Career Services – Online Publishing – Online Entertainment

Consumer Protection: Privacy and Information Rights – Warranties and New Products.


**Learning Outcomes:** At the end of the unit the student will be able to:
1. Know about the various e-business industries. (L2)
2. Understand the consumer protection privacy and rights. (L2)
3. Analyse the warranties and new products. (L3)


**Text Books**
1. Chaffey, D., E-Business and E-Commerce Management, 3rdEdition, Pearson, 2009.
2. Joseph, P.T., E-Commerce: An Indian Perspective, 4th Edition, PHI, 2012.
4. Kalakota, R. and Whinston, A., Frontiers of Electronic Commerce, Pearson, 2011.
5. Schneider, G.P., Electronic Commerce, Cengage Learning, 10th Edition, 2012.

**Reference Books**
1. Turban, E., King, D. and Lee, J., Electronic Commerce: A Managerial and Social Networks Perspective 2012, Prentice Hall, 2011.
2. Turban, E., Lee, J., King, D.,Liang, T.P. and Turban, D., Electronic Commerce 2010, 6th Edition, Pearson, 2012.

# INTRODUCTION TO INDIAN TAXATION SYSTEM

**Course Code: 22HM11P6**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

The objective of the course is to provide an overview of income tax act, 1961 and analyse the procedure involved in computation of income from salary, deductions, exemptions and tax planning of individuals.

**Course Outcomes**

CO 1: To understand the basic concepts of income tax law, 1961, scope of total income and residential status.(L2)

CO 2: To examine the various heads of income for from salaries and income from house property.(L3)

CO 3: To analyse the computation of income under profits and gains of business or profession, capital gains and other sources.(L4)

CO 4: To know the different set off and carry forward of losses with regard to house property, profession and business.(L2)

CO 5: To understand the concept of Indirect Taxes - Goods and Services Tax Act and Rules, and overview of Customs Law(L2)

**UNIT - I: Introduction to Income Tax Law**                    (10 Lectures)

Concepts of tax - Overview of income tax act, 1961 – Capital and revenue receipts - Basic concepts and Definitions - Basis of charge and rates of tax – Scope of Total Income – Residential status and incidence of tax - Exempted Incomes – Deductions in computing total income

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the concepts of tax and income tax act. (L2)
2. Determine the capital and revenue receipts. (L2)
3. Know the basic concepts and basics of tax rates. (L2)
4. Understand the scope of total income and residential status. (L2)
5. Identify the exempted incomes deductions. (L1)

**UNIT – II: Computation of Income from Salaries and House property**            (10 Lectures)

Salary: Basic elements of salary, basis of charge, computation of salary, allowances, perquisite, valuation, standard deduction and tax on employment or professional tax (Simple problems)

House property: Chargeability, Exempted properties, Computation of Income, Taxes levied by local authority (Municipal Tax), Deductions u/s 24, Self-occupied property, unoccupied property (Simple problems)

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the basic elements of salary deductions. (L2)
2. Compute the income from salaries. (L3)
3. Know the basic concepts in computing income from house property. (L2)
4. Identify the taxes levied by local authority and deductions. (L1)
5. Outline the self-occupied property and unoccupied property. (L3)

**UNIT – III: Computation of Income under Profits and Gains of Business or Profession and Capital Gains**                              (10 Lectures)

Meaning of Business & Profession, Income chargeable under the head profits & gains of business or profession, Expenditures allowed as deduction, Specific Deductions, Assessment of firm (Simple problems)

Capital Gains – basis of charge, capital asset, computation of capital gains. Computation of income from other sources (Simple problems)

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Know the meaning of business and profession under different heads. (L2)
2. Identify the expenditures, deduction and assessment of the firm. (L1)
3. Compute the income under profits and gains of business or profession. (L3)
4. Understand the capital gains and its computation procedure. (L3)
5. Determine the computation of income from other sources. (L3)


**UNIT – IV: Set Off and Carry Forward of Losses**                  **(8 lectures)**

Introduction – Inter source and Inter head adjustment – Carry forward of losses of income from house property - Carry forward & set off of business loss other than speculation loss - Carry forward and set off of capital loss and speculation loss - Set off and Carry forward of unabsorbed depreciation

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Know the inter source and inter head adjustments. (L2)
2. Understand the carry forward of losses of income from house property. (L2)
3. Identify the carry forward and set off of business loss and speculation loss. (L1)
4. Determine the set off and carry forward of unabsorbed depreciation. (L3)


**UNIT – V: Basics of Indirect Taxes**                  **(10 Lectures)**

Concept of Indirect Taxes - Goods and Services Tax Act and Rules - Overview on CGST, SGST, IGST, UTGST Act - Goods and Services Tax Network – Levy and Collection of Tax - Concept of Time, Value and Place of Supply - Input Tax Credit and Computation of GST Liability - Procedural Compliance under GST - Overview of Customs Law

**Learning Outcomes:** At the end of the unit the student will be able to:
1. Understand the Goods and Services Tax Act and Rules. (L2)
2. Outline the GST Network and levy and collection of tax. (L2)
3. Understand the concept of time, value and place of supply. (L2)
4. Determine the Input Tax Credit and Computation of GST Liability. (L3)
5. Know the procedural compliance under GST and understand the customs law. (L2)


**Text Books:**

1. Vinod K Singhania & Kapil Singhania, *Direct Taxes Laws and Practice (2020-21)*, 63rd Edition, Taxman, New Delhi, 2020.
2. Taxmann's, *Income Tax Act - As amended by Finance Act 2020*, 65th Edition, New Delhi, 2020.
3. Girish Ahuja, & Ravi Gupta, *Systematic Approach to Indirect Taxation: Including GST and Customs*, 5thEdition, Wolters Kluwer India Private Limited, 2020.
4. Jaya Vasudevan Suseela, *Indirect Taxation: GST and other Indirect Taxes*, EBC Publications, 2019.
5. TN Mahonaran, *Student's Handbook on Taxation (Includes Income Tax and GST Law),* Snow White, 2020.
6. Taxmann's, *Students' Guide to Income Tax Including GST*, 62nd Edition 2020-21, Taxmann Publication Pvt. Ltd., 2020.
7. B.R. Sharma, *Direct Tax Planning and Management*, Random Publications, 2016.

**Reference Books:**

1. B.K. Goyal, *Taxation Laws*, Singhal Law Publications, 2018.

2.  Raj Trika, *Direct Tax Planning and Management* (1st Edition), ABD Publishers, 2009.

3. B.B. Lal& N. Vashisht, Direct Taxes: *Income Tax Wealth Tax and Tax Planning*, 30th Edition, I K International Publishing House Pvt. Ltd, New Delhi, 2012.

4. Vinod K Singhania, *Direct Tax including Tax Planning and Management (2020-21)*, 41st Edition, Taxman, New Delhi, 2020.

5. ICAI, *Indirect Taxation*, The Institute of Cost Accountants of India (ICAI), 2020.

6. ICAI, *Direct Taxation*, The Institute of Cost Accountants of India (ICAI), 2020.

# ORGANISATIONAL BEHAVIOUR AND HUMAN RESOURCE MANAGEMENT

**Course Code: 22HM11P7**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

## Course Objective

To provide an understanding of the basic principles of organizational behaviour so as to acquaint the students with managerial skills and the required inputs with reference to human resource management.

## Course Outcomes

CO 1: To define and explain the basic concepts of organizational behaviour and motivation (L2).

CO 2: To explain the essential concepts of organisational conflicts, resolution of conflicts through negotiation, change management and organisational development (L2).

CO 3: To familiarize the various aspects of HR, to deal effectively with people resourcing and talent management and HR functions in an organization (L2).

CO 4: To understand the concepts of HRD, its role and importance in the success of organization (L2).

CO 5: To develop an understanding towards compensation management and industrial relations (L3).

## UNIT-I: Introduction to Organisational Behaviour        (10 Lectures)

Meaning and scope of organizational behaviour- Challenges and Opportunities – Foundations of Individual behaviour, Motivation - Theories (Maslow, ERG, Douglas McGregor, and two-factor theory), Group dynamics, Leaderships styles

**Learning Outcomes:** At the end of this unit students will be able to:
1. Define Organizational behaviour (L1)
2. Understand and define organizational behaviour (L2)
3. Understand the factors that influence individual behaviour (L2)
4. Explain the importance and theories of Motivation (L2)

## UNIT-II: Organisational Conflict and Change        (10 Lectures)

Organizational Conflict - causes and consequences - conflict and negotiation,

Organizational change, change management process, resistance to change, flexibility and crisis management – Organisational Development – concept and significance

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand andanalyse the dynamics of organisational conflict (L2)
2. Analyse the significance and process of change management in organisations (L4)
3. Understand the significance of organisational development (L2)

## UNIT-III: Introduction to Human Resource Management        (10 Lectures)

HRM: Meaning, definition and functions. Job Analysis, Job Design, Human Resource Planning - Recruitment and Selection - Sources of Recruitment - Selection process, Placement and Induction

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand and assimilate the principles and functions of HRM (L2)
2. Understand the importance of Human Resource planning and its process (L2)
3. Explain the different sources of recruitment (L2)
4. Analyse the process of selection (L4)

**UNIT-IV: Human Resource Development**           **(8 Lectures)**

Introduction to Human Resource Development: Concepts - Training and Development - methods of training, importance of Performance Appraisal, traditional and modern methods of performance appraisal, Job Evaluation - methods of Job Evaluation, Wage and Salary Administration

**Learning Outcomes:** At the end of this unit students will be able to:
1. Outline the importance of Human Resource Development (L2)
2. Explain the various types of Training methods (L2)
3. Differentiate between traditional and modern methods of performance appraisal (L4)
4. Understand the importance of wage and salary administration (L2)

**UNIT-V: Compensation Management, Industrial Relations and Emerging HR Practices**       **(10 Lectures)**

Compensation – Concepts and Principles, Influencing Factors, Emerging Trends in Compensation – Methods of Payment – Incentives and Rewards, Managing Industrial Relations – Emerging trends and practices in human resource management

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the concept and principles of compensation management (L2)
2. Examine the emerging trends in compensation management (L2)
3. Understand the concept of industrial relations (L2)
4. Explain the Emerging trends and practices in human resource management (L2)

**Text Books**
1. K. Aswathappa, Organizational Behaviour, 12th edition, Himalaya, 2016
2. Edwin B. Flippo, Personnel Management, 6th edition, TMH, 2013
3. P. Subba Rao, Management & Organizational Behavior, 2nd edition, Himalaya, 2014
4. C.B. Mamori a& VSP Rao, Personnel Management, 20th edition, Himalaya, 2015
5. Stephen P. Robbins, Organisational Behaviour, 11th edition, PHI Learning / Pearson Education, 2008

**Reference Books**
1. Rustum S. Davar, Personnel Management & Industrial Relations, 10th edition, Vikas Publishers, 2009
2. K.Venkataratnam, Human Resource Management, 1st edition, Seven hills Book Publications, 2011
3. K. Aswathappa, Human Resource & Management, 6th edition, Tata McGraw Hill, 2010
4. Mc Shane & Von Glinov, Organisational Behaviour, 4th edition, Tata Mc Graw Hill, 2007

# PRODUCT MANAGEMENT

**Course Code: 22HM11P8**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## Course Objective

To provide an understanding of the basic concepts of product management so as to acquaint the students with product and market research and provide the required inputs with reference to product development.

## Course Outcomes

CO 1: To understand the concept of product management and identify the key principles and practices of product management. (L2)

CO 2: To identify the target market and develop a product roadmap. (L2)

CO 3: To understand market segmentation and able to identify potential risks and opportunities. (L2)

CO 4: To analyse the product development process and develop go-to-market strategies. (L4)

CO 5: To identify the opportunities for product optimization and growth. (L3)

## Unit 1: Introduction to Product Management                    (10 Lectures)

Definition and scope of product management - Historical context and evolution of product management - Key principles and practices of product management - Roles and responsibilities of product managers

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the scope of product management (L2)
2. Examine the historical context and evolution (L3)
3. Understand the key principles and practices of product management (L2)
    4. Explain the roles and responsibilities of product managers (L2)

## Unit 2: Product Strategy                                (10 Lectures)

Identifying target market and customer needs - Defining product vision, mission, and objectives - Establishing product positioning and differentiation - Defining key features and benefits - Developing a product roadmap

**Learning Outcomes:** At the end of this unit students will be able to:
1. Identify target market and customer needs (L2)
2. Define product vision, mission and objectives (L1)
3. Develop a product roadmap (L3)

## Unit 3: Market Research and Analysis                          (10 Lectures)

Conducting market research to gather customer insights - Analyzing the competitive landscape and identifying trends - Understanding market segmentation and customer personas - Identifying potential risks and opportunities

**Learning Outcomes:** At the end of this unit students will be able to:
1. Conduct market research to gather customer insights (L2)
2. Analyse the competitive landscape (L4)
3. Understand market segmentation and customer personas (L2)

**Unit 4: Product Development and Launch**          **(10 Lectures)**

Managing product development process and cross-functional teams - Prioritizing and managing product backlogs - Conducting user testing and gathering feedback - Developing go-to-market strategies and launch plans

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the managing product development process (L2)
2. Conduct user testing and gathering feedback (L3)
3. Develop go-to-market strategies and launch plans (L3)


**Unit 5: Product Lifecycle Management and Optimization**     **(8 Lectures)**

Monitoring and managing product performance metrics - Identifying opportunities for product optimization and growth - Planning for product retirement and end-of-life management - Leading continuous improvement efforts and innovation initiatives

**Learning Outcomes:** At the end of this unit students will be able to:
1. Monitor and manage product performance metrics (L3)
2. Identify opportunities for product optimization and growth (L2)
3. Plan for product retirement and end-of-life management (L3)


**Text Books**
1. Donald Lehmann and Russell Winer, 'Product Management', 4thEdition, McGraw Hill Education, 2017.
2. Kaushik Mukerjee, 'Product Management: Text and Cases', PHI Learning, 2010.
3. Gurucharan Raghunathan and Lokesh Kannaiyan, 'Product Management Simplified', Notion Press, 2021.

**Reference Books**
1. Majumdar Ramanuj, 'Product Management in India', PHI Learning, 2008.
2. Matt LeMay, 'Product Management In Practice: A Practical, Tactical Guide For Your First Day And Every Day After', 2nd Edition, Shroff/O'Reilly, 2022.

# BUSINESS COMMUNICATION

**Course Code: 22HM11P9**

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**Course Objective**

The course aims to develop written and verbal communication skills for effective business communication.

**Course Outcomes**

CO 1: To understand the process of communication and characteristics of effective organizational communication. (L2)

CO 2: To identify the communication channels and barriers to effective communication. (L2)

CO 3: To know the various forms of business communication and types of business letters. (L2)

CO 4: To analyse the importance of listening and develop listening skills. (L4)

CO 5: To identify the problems of report writing and business presentations. (L2)

**Unit-I: Introduction**

Communication-Defining communication, Process of communication, Communication Model, Objectives of communication, Principles of communication, Importance of Business communication, Characteristics of Effective Organizational Communication.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Understand the concept of communication (L2)
2. Identify the objectives and principles of communication (L2)
3. Understand the characteristics of effective communication (L2)

**Unit-II: Communication Channels**

7 C's, Channels of communication, Types of communication, Dimensions of communication, Verbal, Non-Verbal, Formal, Informal communication. Barriers to Effective Communication and ways to overcome them, Facilitators to Communication, Effective Listening, Malfunctions of communication, Business Etiquettes.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Know the dimensions and types of communication (L2)
2. Examine the barriers to effective communication (L3)
3. Identify the malfunction of communication (L2)

**Unit-III: Forms of Communication and Business letters**

Forms of Business Communication, Written Communication, Oral Communication, Non verbal Communication, Technology of Business Communication, Peculiarities of Communication in Indian Organizations. Fundamental of Business writing, Format of Business, Types of Business letter, Inquiry letter, complaint letter Persuasive letter, Proposal, Report Writing.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Know the various forms of business communication (L2)
2. Identify peculiarities of communication in Indian organizations (L2)
3. Understand the fundamentals of business writing (L2)

**Unit-IV: Messages and Listening**

Employment Messages , summarizing Conduct of Meeting‑Agenda, Notice, Notes, Minutes, Office Memorandum, Office Orders, Press Release, Business Letter Writing‑Need, functions & Kinds, Layout. Listening: Importance of Listening, Types of Listening, Barriers to Listening and overcoming them, Listening situations, Developing Listening Skills,

**Learning Outcomes:** At the end of this unit students will be able to:
1. Summarize the conduct of Meeting‑Agenda (L2)
2. Understand the importance and types of listening (L2)
3. Identify the barriers to listening and overcoming them (L2)

**UNIT-V: Report Writing and Presentation**

Report writing‑ Problems, Organization and techniques of writing. Spoken skills Conducting Presentation, Oral presentation, Debates, Speeches, Interview, Group Discussion, English Pronunciation, Building Vocabulary.

**Learning Outcomes:** At the end of this unit students will be able to:
1. Know the problems of report writing (L2)
2. Understand the techniques of writing (L2)
3. Understand the various presentations and spoken skills (L2)

**Text Books:**
1. Business Communication: Concepts, Cases and Applications by P.D. Chaturvedi and Mukesh Chaturvedi
2. Effective Business Communication by Asha Kaul
3. Business Communication: Strategies and Skills by Meenakshi Raman and Prakash Singh
4. Essentials of Business Communication by Rajendra Pal and J. S. Korlahalli

**Reference Books:**
1. "Business Communication Essentials" by Courtland L. Bovee and John V. Thill
2. "Strategic Business Communication" by Penni Cushman and Darlene Fowler

# LIST OF OPEN ELECTIVES OFFERED BY DEPT. OF ECE

| | |
|---|---|
| 22EC11M1 | EMI /EMC and Signal Integrity: Principles, Techniques and Applications (SWAYAM ONLINE - 12W)- IIT Kharagpur |
| 22EC11M2 | Sensors and Actuators(SWAYAM ONLINE - 12W)-IISC Bangalore |
| 22EC11P1 | Fundamentals of Biomedical Engineering (for non ECE) |
| 22EC11P2 | Communication Systems and Applications (for non ECE) |
| 22EC11P3 | Electronic Design Automation Tools |

# EMI /EMC AND SIGNAL INTEGRITY: PRINCIPLES, TECHNIQUES AND APPLICATIONS
# (OPEN ELECTIVE)

**Course Code:  22EC11M1**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:Electromagnetic theory**

**PROF. AMITABHA BHATTACHARYA**

**IIT Kharagpur**

## ABOUT THE INSTRUCTOR:

Prof. Amitabha Bhattacharya was born in Kolkata, West Bengal in the year 1964. He received his B.Tech, (E&ECE) Degree from IIT Kharagpur in 1986, M.E. (E&TCE) from Jadavpur University in 1994 and Ph.D. (E. & ECE) from IIT Kharagpur in 1998.

He started his professional career in 1986 by joining as Junior Research Engineer in an ISRO- sponsored research project at IIT Kharagpur and continued thereafter as a Senior Research Assistant in a DRDO sponsored Research Project till 1991. In 1997, he joined SAMEER, Mumbai and then Defence Lab, Jodhpur as a Research Scientist. From 2000 onwards he joined teaching profession, first as an Assistant Professor in the Electronics and Instrument Department of Indian School of Mines, Dhanbad and then in 2007, in the faculty of Electronics and Electrical Communication Engineering Department of IIT Kharagpur in 2007. Presently he is working as an Associate Professor in the same Department and is involved in the teaching and research activities of the RF and Microwave Group of the E&ECE Department.

Prof. Bhattacharya's research interest is in the areas of Microwave Imaging, Microwave Propagation, High Power Microwaves and Microwave Stealth Technology. He has published 97 international research publications, two technical reports for Indian Defense, written a Tata McGraw Hill published text book on "Digital Communication" and co-authored a book chapter on "Modal Analysis of Reflector backed Hybrid Printed dipole antenna". He has also developed 3 NPTEL MOOC online courses on microwave technology. He has been principal Investigator of 19 research projects and consultancies sponsored by agencies like DRDO, ISRO, Indian Army, BARC, MHRD, Wipro etc.,  has conducted 18 short term courses specially training scientists from HAL, ISRO, DRDO, Indian tri-services etc. in the areas of Electromagnetic Environments and Microwave Technologies. Dr. Bhattacharya has supervised six Ph.D. thesis and thirty five postgraduate theses. Presently he is supervising nine research students.

**ABOUT THE COURSE:**

The course "EMI /EMC and Signal Integrity: Principles, Techniques and Applications" covers a broad spectrum of the high frequency RF circuit design issues from the perspective of the electromagnetic interference mitigation. It covers the engineering modeling of source, system and sink with thorough and eloquent analysis, and finally shows applications of the technique in modern electronics industry.

It first develops a simplified model called "EMC model" to introduce the basic concepts of the EMC design. Then it introduces the common EMC units and EMC requirements for electronic systems. Then it introduces some elegant techniques to derive the signal spectra commonly encountered in industry. Keeping the same pedagogic style, it also shows the elegant techniques for introducing the basic emitters and basic lines in the same framework. With this framework it then introduces the concepts of Radiated emission and susceptibility and thereafter conducted emission and susceptibility. The concept of crosstalk, shielding and electrostatic discharges are then touched upon. Finally the electronics system design for EM compatibility is emphasized at the end of the course.

This course will not only help the undergraduate and graduate students by providing them with fundamental concepts of electromagnetic compatibility and signal integrity but also will help the design engineer to get familiar with different state of the art techniques of EMC design. In a nutshell, this course would lay the foundation for further exploring the vast area of EMC design by the course participants

**COURSE LAYOUT:**
**Week 1:** Introduction to Electromagnetic Compatibility
**Week 2:** EMC Requirements for Electronic Systems
**Week 3:** Signal spectral analysis
**Week 4:** Two and three conductor transmission lines
**Week 5:** Elemental Radiators
**Week 6:** Radiated Emission
**Week 7:** Radiated Susceptibility
**Week 8:** Conducted Emission
**Week 9:** Conducted Susceptibility
**Week 10:** Cross talk
**Week 11:** Shielding and ESD
**Week 12:** System Design for EMC

**References:**
https://onlinecourses.nptel.ac.in/noc24_ee67/preview
https://nptel.ac.in/courses/108105375

# SENSORS AND ACTUATORS
## (SWAYAM ONLINE - 12W) - IISC BENGALURU
## (OPEN ELECTIVE)

**Course Code: 22EC11M2**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:** Basic Electronics



**DR. HARDIK J PANDYA**
**Dept. of Electrical & Electronic Engineering,**
**IISc Bengaluru**

## ABOUT INSTRUCTOR :

Dr. Hardik J. Pandya is an Assistant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is heading an Advanced Microsystems and Biomedical Devices Facility for Clinical Research as well as Biomedical and Electronic Engineering Systems Laboratory which focuses on the cutting-edge research on novel devices for solving unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India.

## COURSE OUTLINE :

This course is designed with an aim of educating students in microtechnology and its use to fabricate sensors and systems. The students will have an exposure to sensors and its importance in the real world. The students will also be able to understand how to fabricate some of those sensors. They will have an exposure towards how to fabricate the sensors and its application in the real world and understand and also learn modern day microsensors and microactuators, how to simulate some of those sensors and characterise before fabricating it.

## COURSE LAYOUT :

**Week 1:** Basics of Energy Transformation: Transducers, Sensors and Actuators

**Week 2:** Understanding of thin film physics: Application in MOSFET and its variants

**Week 3:** Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)

**Week 4:** Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)

**Week 5:** Basic understanding of Photolithography for pattering layer. Detailed overview of Etching methods.

**Week 6:** Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured ba sed gas sensors

**Week 7:** Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications

**Week 8:** Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications

**Week 9:** Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques.

**Week 10:** Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics

**Week 11:** Understanding of Sensor Interfacing with Microprocessor to build electronic systems.

**Week 12:** Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems

**Weblink:**

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# FUNDAMENTALS OF BIOMEDICAL ENGINEERING
## (OPEN ELECTIVE)
## (For NON ECE Branches)

**Course Code:22EC11P1**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Prerequisites: Applied Physics / Engineering Physics
Course Outcomes: At the end of the course the student will be able to
CO1: Understand the basic medical instrumentation system and bioelectric potentials(L2)
CO2: Illustrate different types of electrodes to acquire bio-signals (L3)
CO3: Demonstrate clinical laboratory measurements and assistive devices (L3)
CO4: Discuss about the latest developments in medical imaging systems (L2)
CO5: Outline patient care and safety while using biomedical equipment (L4)

## UNIT-I                                                                                           8 Lectures
**Components of Medical Instrumentation Systems**
Basic Medical Instrumentation System, Static and dynamic characteristics of medical instruments, Bio-signals and characteristics. Problems encountered with measurements from human beings, Sources of Bioelectric Potentials,  Resting and Action Potentials.

Learning outcomes: At the end of this unit, the student will be able to
1. describe the basic instrumentation system (L2)
2. summarize various problems occurring during measurements (L2)
3. understand the sources of bioelectric potentials (L2)

## UNIT-II                                                                                         12 Lectures
**Bio-Potential Electrodes and Physiological Transducers**
Electrode potential and its  equivalent circuit, Types of Electrodes-Surface Electrodes, Needle Electrodes, Micro Electrodes, Biochemical Transducers.
**Bio-Signal Acquisition**
Electrical Conduction system of the heart, Electrocardiogram, ECG leads, Einthoven triangle, Plethysmography, EEG 10-20 lead system and EMG.

Learning outcomes: At the end of this unit, the student will be able to
1. describe different types of electrodes involved in measurements (L2)
2. illustrate the functioning of heart and measurement of ECG (L3)
3. demonstrate the importance of EEG and EMG (L3)

## UNIT-III                                                                                        12 Lectures
**Clinical laboratory Measurements**
Blood cell Counter, Blood flow meters- Electromagnetic blood flow meter, Ultrasonic Doppler blood flow meter, automated blood pressure measurements.
**Physiological Assist Devices & Therapeutic Equipment**
Pacemakers -External & internal, Defibrillators- External & internal, Hemodialysis machine.

Learning outcomes: At the end of this unit, the student will be able to
1. describe various blood element measurements (L2)
2. illustrate basic functioning of pacemakers and defibrillator (L3)
3. understand the purpose of hemodialysis machine (L2)

## UNIT-IV                                                                                         10 Lectures
**Monitory and Imaging Equipment**

Spirometry, Ventilators, Arrhythmia Monitor, Foetal Monitor and Incubator, X-ray machine, Computed Tomography (CT), Magnetic Resonance Imaging System, Ultrasound Imaging system.

Learning outcomes: At the end of this unit, the student will be able to
1. describe the functionality of monitoring equipment (L2)
2. understand concepts of X-ray imaging (L2)
3. explain different medical imaging techniques (L2)

**UNIT-V**                                                                                            **8 Lectures**
**Patient Care and Safety**
The elements of Intensive Care Monitor, Diagnosis, Calibration and reparability of Patient Monitoring equipment, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the various Intensive Care Equipment (L2)
2. illustrate different physiological effects due to electrical shock (L3)
3. analyze different methods of accident prevention (L4)

**Text Books:**
1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, *Biomedical Instrumentation and Measurements,* 2nd Edition, PHI, 2004.
2. Dr. M. Arumugam, *Biomedical Instrumentation.* 2nd Edition, Anuradha publications, 2002.

**References:**
1. R.S. Khandpur, *Hand-book of Biomedical Instrumentation,* 2nd Edition, TMH, 2003.
2. John G. Webster, *Medical Instrumentation, Application and Design,* John Wiley, 3rd Edition, 2009.
3. Onkar N. Pandey, Rakesh Kumar, *Bio-Medical Electronics and Instrumentation,* 3rd Edition, Katson Books, 2002.

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# COMMUNICATION SYSTEMS AND APPLICATIONS
## (OPEN ELECTIVE)
## (FOR NON ECE BRANCHES)

**Course Code:22EC11P2**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites: Not applicable**

Course Outcomes: At the end of the course the student will be able to

CO1: Understand the fundamental concepts of analog and digital modulation (L2)
CO2: Understand the wireless system standards and its applications (L2)
CO3: Illustrate the basic principles of cellular mobile communication systems (L3)
CO4: Understand the functionality of Satellite communication system (L2)
CO5: Illustrate the basic concepts of Optical Communication (L3)

## UNIT-I                                                    10 Lectures
**Analog & Digital Modulation**

Introduction to communication systems, Need for Modulation, Amplitude modulation, Modulation Index, Frequency-Domain representation of AM, Basic Principles of Frequency Modulation, Modulation index, FM signal bandwidth, Comparison of AM and FM.

Pulse Code Modulation block diagram description, Benefits of Digital Communication, Modulation for data communication: Frequency shift keying, Phase Shift Keying and Quadrature Amplitude Modulation.

Learning outcomes: At the end of this unit, the student will be able to
1. examine the basic principles of Analog modulation schemes (L2)
2. understand the significance of PCM in digital communication (L2)
3. examine the concepts of digital modulation schemes (L2)

## UNIT-II                                                   10 Lectures
**Wireless Technologies**

Wireless LAN, PAN and Bluetooth, ZigBee and Mesh Wireless Networks, WiMAX and wireless Metropolitan-Area Networks, Infrared Wireless, Machine-to-Machine (M2M) and Internet of Things (IoT) Applications.

Learning outcomes: At the end of this unit, the student will be able to
1. examine the available wireless networks (L2)
2. understand the wireless systems and its applications (L2)
3. discuss the applications of  IoT (L2)

## UNIT-III                                                  10 Lectures
**Mobile Communication**

Introduction to Cellular Mobile System, Generation of wireless mobile systems (1G-5G), Types of cells, Operation of cellular systems, Frequency reuse, Co-Channel Interference, Cell splitting and Cell Sectoring, Channel assignment strategies, Handoff strategies.

Learning outcomes: At the end of this unit, the student will be able to
1. list the main applications of the Internet (L2)
2. describe the Packet switching transmission system (L2)
3. explain the operation of a router (L2)

## UNIT-IV                                                   10 Lectures
**Satellite Communication**

Principles of Satellite orbits and Positioning, Satellite Communication Systems, Repeaters, Transponders, Frequency Allocations, Spectrum usage, Frequency reuse, Ground stations, Satellite Applications-

Communication Satellite, Direct Broadcast Satellite, Satellite Cell phones, Surveillance Satellite, Global Navigation Satellite Systems: GPS receivers, GPS applications.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the principles of Satellite orbits (L2)
2. understand the concept of frequency reuse in Satellite Communication Systems (L2)
3. discuss the Applications of Satellite in Communication and Surveillance (L2)

## UNIT-V                                                                      10 Lectures
**Optical Communication**
Optical Communication Systems, Fiber-Optic Cables, Basic elements of a fiber-optic communication system, Applications of Fiber optics, Principles of Fiber-Optic Cable – Critical Angle, Numerical Aperture, Fiber-Optic Cable construction, Types of Fiber-Optic Cables, Fiber-Optic Cable Specifications, Connectors and splicing, Optical Transmitters and Receivers, Wavelength-Division Multiplexing.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the basic elements of a fiber-optic communication system (L2)
2. calculate Critical Angle and Numerical Aperture of Fiber-Optic Cable (L3)
3. understand the working principle of Optical Transmitters and Receivers (L2)

**Text Books:**
1. Louis E. Frenzel Jr., *Principles of Electronic Communication Systems*, 4th Edition, McGraw-Hill Education, 2016.
2. Theodore S.Rappaport, *Wireless Communications*, 2nd Edition, Pearson education, 2002.

**Reference:**

1. Kennedy G, Davis B, Prasanna SR. *Electronic Communication Systems,* 6th Edition, Tata McGraw-Hill Publishing Co. Ltd, 2017.
2. Coolen, John, and Dennis Roddy, *Electronic Communications*, 4th Edition, Prentice Hall of India, 2014.

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# ELECTRONIC DESIGN AUTOMATION TOOLS
## (OPEN ELECTIVE)

**Course Code: 22EC11P3**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

Course Outcomes: At the end of the course students will be able to
CO1: Explain the importance of Simulation in VLSI design (L2)
CO2: Show how Synthesis help in analyzing the VLSI designs (L3)
CO3: Illustrate the implementation of SPICE for analyzing the circuits (L3)
CO4: Apply CAD tools for the implementation of mixed signal designs (L3)
CO5: Demonstrate the PCB design process using Orcad tool (L3)

## UNIT-I                                                                  10 Lectures
**Simulation Using HDLs**
Simulation-Types of Simulation, Logic Systems, Working of Logic Simulation, Cell Models, Delay Models, State Timing Analysis, Formal Verification, Switch-Level Simulation, Transistor-Level Simulation.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the importance of logic simulation (L2)
2. summarize about various delay models (L2)
3. discuss about the importance of formal verification (L2)

## UNIT-II                                                                 10 Lectures
**Synthesis Using HDLS**
Verilog and Logic Synthesis, VHDL and Logic Synthesis, Memory Synthesis, FSM Synthesis, Performance-Driven Synthesis. Advanced CAD Tools for Simulation and Synthesis.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the importance of logic synthesis (L2)
2. describe about memory and FSM synthesis (L2)
3. predict the significance of performance driven synthesis (L3)

## UNIT-III                                                                10 Lectures
**Circuit Design and Simulation Using SPICE**
Need for electronic circuit simulators, SPICE simulator directives, MOS transistor models, Design and Analysis of Analog and Digital Circuits Using SPICE tool.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the SPICE Models (L2)
2. interpret the design and analysis of analog circuits using SPICE (L2)
3. use the SPICE tool for designing the digital circuits (L3)

## UNIT-IV                                                                 10 Lectures
**An Overview of Mixed Signal VLSI Design**
Fundamentals Of Analog And Digital Simulation, Mixed Signal Simulator Configurations, Understanding Modeling, Integration To CAD Environments.
Learning outcomes: At the end of this unit, the student will be able to
1. understand the significance of analog and digital simulations (L2)
2. explain about the mixed signal simulation configuration (L2)

3. discuss how modeling features are useful in CAD environment (L2)

## UNIT-V                                                                 10 Lectures
**Tools For PCB Design and Layout**

An Overview of High Speed PCB Design, Design Entry, Simulation and Layout Tools for PCB. Introduction to Orcad PCB Design Tools.

Learning outcomes: At the end of this unit, the student will be able to
1. understand the simulation and layout tools for PCB design (L2)
2. describe the overview of High Speed PCB Design (L2)
3. apply the Orcad tool for the design of PCB (L3)

## Textbooks:
1. Bhasker, J., " *A Verilog HDL Primer",* BS Publications, 2001.
2. Bhasker, Jayaram. *Verilog HDL synthesis: a practical primer*. Star Galaxy Publishing, 1998.
3. Mohindru, Pooja, and Pankaj Mohindru. *Electronic Circuit Analysis using LTSpice XVII Simulator: A Practical Guide for Beginners*. CRC Press, 2021.

## References:
1. ORCAD: Technical Reference Manual, Orcad, USA.
2. SABER, "Technical Reference Manual", Analogy Nic, USA.
3. M.J.S.SMITH, "Application-Specific Integrated Circuits", (1997). Addison Wesley
4. Bruun, Erik. "CMOS Integrated Circuit Simulation with LTspice." 2017.

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## List of Open Electives offered by CSE

| Course Code | Title of the Course |
|---|---|
| 22CS11P1 | Principles of Software Project Management |
| 22CS11P2 | Web Graphics (Non CSE/IT) |
| 22CS11P3 | Agile Methodologies |
| 22CS11P4 | Cyber laws |
| 22CS11P5 | Management Information Systems |
| 22CS11P6 | Computer Forensics |
| 22CT1110 | Operating Systems(Non CSE/IT) |
| 22CT1112 | Computer Networks(Non CSE/IT) |
| 22CS11M1 | Getting Started with Competitive Programming (MOOCs) |
| 22CS11M2 | Introduction to internet of things (MOOCs) |

# PRINCIPLES OF SOFTWARE PROJECT MANAGEMENT

**Course Code: 22CS11P1**

**L T P C**

**3 0 0 3**

**Course Outcomes**: At the end of the Course the Student will be able to:
CO 1: Explain about the software project Management and software project estimation techniques(L2)
CO 2: Demonstrate the software  project planning and scheduling strategies. (L2)
CO 3: Identify the software  project organization structure and Risk Management.(L3)
CO4: Explain resource allocation, monitoring of a software project.(L2)
CO5:Explain software quality estimation and source code management .(L2)

## UNIT-I                                                      (12 Lectures)

**Introduction to software project management**: Introduction, What is a project?  Software projects versus other types of project, Activities covered by software project management ,Plans, methods and methodologies , Some ways of categorizing software projects.

**Software Effort Estimation :**

Introduction, estimations,  Problems with over and under estimation,  The basis for software estimating. Software effort estimation techniques, Bottom-up estimating, The top-down approach and parametric models, Expert judgement, Estimating by analogy ,Albrecht function point analysis, Function points Mark, COSMIC full function Points, COCOMO II: A Parametric productivity model.

Learning Outcomes: At the end of the unit the student will be able to
 1. Illustrate about Software Project management. (L2)
 2.  Illustrate various estimation techniques  for the given project. (L2)
 3. Explain the COCOMO and Parametric productivity model. (L2)

## UNIT-II                                                     (12 Lectures)

**Activity planning and scheduling**:

The objectives of activity planning , When to plan, Project schedules, Projects and activities Sequencing and scheduling activities, Network planning models, Formulating a network model, Adding the time dimension, The forward pass, The backward pass, Identifying the critical path Activity float, Shortening the project duration, identifying critical activities, Activity-on-arrow networks.

Learning Outcomes: At the end of the unit the student will be able to
 1. Demonstrate various planning models. (L2)
 2. Apply the time dimension of the project. (L3)
 3. Illustrate the critical path activity of a Project. (L2)

## UNIT-III                                                    (12 Lectures)

**Managing people in Software Environments**:

Understanding behaviour, Organization behaviour, Selecting the right person for the job  instruction in the best methods, The Oldham-Hackman job characteristics model, Stress, Health and safety.

**Risk management:** Categories of risk, A framework for dealing with risk ,Risk identification, Risk

assessment, Risk planning, Risk management Evaluating risks to the schedule, Applying the PERT technique, Monte Carlo simulation, Critical chain concepts.

Learning Outcomes: At the end of the unit the student will be able to
 1. Summarize the organizational behaviour of a project. (L2)
 2. Explain the stress,health and safety. (L2)
 3. Choose Appropriate risk management techniques to evaluate the project. (L3)

## UNIT-IV                                                      (12 Lectures)

Resource allocation: 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.

Monitoring and control: Creating the framework, Collecting the data, Visualizing progress, Cost monitoring, Earned value analysis, Prioritizing monitoring. Getting the project back to target

**Learning Outcomes:** At the end of the unit the student will be able to

1. Explain various Resource allocation techniques for a given project.(L2)
2. Summarize the  monitoring and controlling process for a project(L2)
3. Demonstrate the prioritization and visualizing the project.(L2)

## UNIT-V                                                      (12 Lectures)

**Software quality:**  The place of software quality in project planning, The importance of software quality, Defining software quality, Product versus process quality management. Quality management systems, Process capability models, Techniques to help enhance software quality, Testing, Quality plans.

**Source    Code    Management**:Source    code    management,Principles    of    Source    Code Management,importance,Source    Code    Management    Core    Concepts,Defect    and    Requirements Tracking.Managing the Globally Distributed Development Team,Tools Selection.

**Learning Outcomes:** At the end of the unit the student will be able to

1.Demonstrate Software Quality and Management techniques.(L2)
2. Summarize the  source code management for a project(L2)
3.Explain the tracking and selection of tools for a project.(L2)

## Text Book :

1. Software Project Management, 6th Edition, Bob Hughes, Mike Cotterel, Rajib Mall, McGraw-Hill, 2018

2.  Configuration Management Best Practices: Practical Methods that Work in the Real World,by Robert Aiello, Leslie Sachs,August 2010

## Reference Books:

1. Walker Royce, "Software Project Management – A UnifiedFramework", 1stEdition, Pearson Education, 2002.
2.  PankajJalote, "Software Project Management in Practice", 1stEdition, Pearson Education, 2002.

## Web Reference:

1.   https://onlinecourses.nptel.ac.in/noc19_cs70/preview

2.   https://www.javatpoint.com/scm-tools

# WEB GRAPHICS
## (NON CSE & IT)

**Course Code: 22CS11P2**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**COURSE OUTCOMES**: At the end of the Course the student shall be able to
**CO1:** Explain the knowledge about working principles of different Output devices (L2)
**CO2:** Use of geometric transformations on graphics objects and their application in composite form. (L3) **CO3:** Explore projections and visible surface detection techniques for display of 3D scene on 2D surface. (L3)
**CO4:** Analyze hidden surface and line removal algorithms in 3D modeling (L3)
**CO5:** Determining basic concepts of computer animation and significance of languages. (L3)

## UNIT-I
## INTRODUCTION TO COMPUTER GRAPHICS:                    10 Lectures
Introduction, Basic Concepts,Display Devices,Applications of Computer Graphics
### OpenGL Introduction:
OpenGL architecture,Primitives and Attributes, Interaction,Picking
### Scan Conversion:
Introduction , Line Drawing Algorithms: DDA, Bresenham's Line Drawing, Circle Generation algorithms:Mid Point Circle Algorithm, Ellipse Generation Method: Mid point ellipse generation method.

**Course Outcomes:** At the end of this module students will be able to
1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.(L2)
2. Illustrate core concepts of OpenGL. (L2)
3. Understand the procedures for line, circle and ellipse generation. (L2)

## UNIT-II                                                          10 Lectures
### 2-D GEOMETRICAL TRANSFORMS:
Translation, scaling, rotation, reflection and shear transformations, matrix homogeneous coordinates, composite transforms. Transformations between coordinate systems
**Viewing**: Classical and computer viewing, Viewing with a computer, Positioning of the camera, Clipping, Cohen-Sutherland Line-segment clipping, Polygon clipping, Clipping of other primitives.
**Course Outcomes:** At the end of this module students will be able to

1. Illustrate the basics of 2D-Transformations (L2)
2. Apply the transformations of 2D to obtain composite transformations (L3)
3. Explain 2D Viewing pipeline and understand basic clipping techniques. (L2)

## UNIT-III                                                         10 Lectures
### 3-D GEOMETRIC TRANSFORMATIONS:
Translation, rotation, scaling, reflection and shear transformations, composite transformations.
### 3-D VIEWING: Viewing pipeline, viewing coordinates, view volume and general projection
transforms and Projections
**Course Outcomes:** At the end of this module students will be able to

1. Illustrate the basics of 3D-Transformations (L2)
2. Apply the transformations of 3D to obtain composite transformations (L3)
3. Understand 3D projection transformations and view volume. (L2)

## UNIT-IV                                                          10 Lectures
### VISIBLE SURFACE DETECTION METHODS:
Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area subdivision and octree methods.

### COLOR MODELS: properties of light, XYZ, RGB, YIQ and CMY color models
**Course Outcomes:** At the end of this module students will be able to

1. Classify the Visible Surface Detection methods.(L2)
2. Understand various algorithms for both Image Space and Object Space algorithms (L2)
3. Illustrate different color models (L2)

## UNIT-V                                                           10 Lectures
### COMPUTER ANIMATION:
Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications,Tweening
### Scalable Vector Graphics:
**Introduction to SVG,** Creating a simple SVG image,Using SVG as a content image, Drawing with code, Directly embedding SVG in an HTML document.
**Course Outcomes:** At the end of this module students will be able to

1. Explain the Computer Animation Design Sequence through steps (L2)
2. Understand the importance of Computer Animation Languages (L2)
3. Illustrate the basic use of SVG (L2)

### Text Books:
1. Computer Graphics, Atul P. Godse, Dr. Deepali A. Godse Technical Publications, 01-Jan-2021
2. Donald Hearn and M.Pauline Baker, *"Computer Graphics"*, 2nd Edition, PHI/Pearson Education, 2018.
3. Mastering SVG: Ace web animations, visualizations, and vector graphics with HTML, CSS, and JavaScript

### Reference Books:
1. Computer Graphics with OpenGL, Heam & Baker, 3rd Edition, Pearson 2016.
2. Computer Graphics Using OpenGL, F.S. Hill, Jr, and M. Kelley, Jr., 3rd Edition, Pearson/PHI, 2016.
3. Computer Graphics through OpenGL: From Theory to Experiments, Sumantha Guha, Chapman and Hall/CRC, 2011 (For OpenGL and related examples).
4. David F Rogers, *"Procedural elements for Computer Graphics"*, 2nd Edition, Tata Mc Graw Hill, 2008

### Web References:
1. https://nptel.ac.in/courses/106/106/106106090

# AGILE METHODOLOGIES

**Course Code: 22CS11P3**

**L  T  P  C**
**3  0  0  3**

**Course Outcomes:** At the end of the course the student should be able to: CO1:
Explain fundamentals of Agile methodology.
CO2: Explain agile principles.
CO3: Apply Scrum principles.
CO4: Apply practices of XP and Incremental design.
CO5: Develop methods to eliminate waste.

## UNIT I                                                                    (8 Lectures)

**LEARNING AGILE:** Getting Agile into Your Brain, Understanding Agile Values, No Silver Bullet, Agile to the Rescue, Adding Agile Makes a Difference. A Fractured Perspective, How a Fractured Perspective Causes Project Problems. The Agile Manifesto, Purpose Behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software Over Comprehensive Documentation, Customer Collaboration Over Contract Negotiation, Responding to Change Over Following a Plan, Principles Over Practices. Understanding the Elephant, Methodologies Help You Get It All in Place at Once, Where to Start with a New Methodology.

**Learning Outcomes:** At the end of the unit, student will be able to
1. explain Agile methodology. (L2)
2. explain the purpose of each practice in Agile. (L2)
3. explain the first steps followed in the new methodology.(L2)

## UNIT II                                                                   (12 Lectures)

**THE AGILE PRINCIPLES:** The 12 Principles of Agile Software, The Customer Is Always Right...Right? , "Do As I Say, Not As I Said". Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Better Communication for the Ebook Reader Project. Project Execution—Moving the Project Along, A Better Working Environment for the Ebook Reader Project Team. Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

**Learning Outcomes:** At the end of the unit, student will be able to
1. explain Principles of Agile software. (L2)
2. explain the purpose of effective communication in Agile.(L2)
3. explain the connections among the principles of Agile .(L2)

## UNIT III                                                                  (10 Lectures)

**SCRUM AND SELF-ORGANIZING TEAMS:** The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team Owns the Project, The Scrum Master Guides the Team's Decisions, The Product Owner Helps the Team Understand the Value of the Software, Everyone Owns the Project, Scrum Has Its Own Set of Values ,Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, How to Hold an Effective Daily Scrum. Sprinting into a Wall, Sprints, Planning, and Retrospectives, Iterative or Incremental?, The Product Owner Makes or Breaks the Sprint, Visibility and Value, How to Plan and Run an Effective Scrum Sprint.

**SCRUM PLANNING AND COLLECTIVE COMMITMENT:** Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Make Your Software Useful, User Stories Help Build Features Your Users Will Use, Conditions of Satisfaction, Story Points and Velocity, Burndown Charts, Planning and Running a Sprint Using Stories, Points, Tasks, and a Task Board. Victory Lap, Scrum Values Revisited, Practices Do Work Without the Values (Just Don't Call It Scrum), Is Your Company's Culture Compatible with Scrum Values?

**Learning Outcomes:** At the end of the unit, student will be able to

1. explain Scrum and organizing Teams.(L2)
2. explain the Sprints. (L2)
3. apply the concept of User Stories.(L3)

## UNIT IV                                                        (12 Lectures)

**XP AND EMBRACING CHANGE:**Going into Overtime, The Primary Practices of XP, Programming Practices, Integration Practices, Planning Practices, Team Practices, Why Teams Resist Changes, and How the Practices Help. The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, XP Helps Developers Learn to Work with Users, Practices Only "Stick" When the Team Truly Believes in Them, An Effective Mindset Starts with the XP Values, The XP Values, Paved with Good Intentions. The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change, The Principles of XP, XP Principles Help You Understand Planning, XP Principles Help You Understand Practices—and Vice Versa, Feedback Loops.
**XP, SIMPLICITY, AND INCREMENTAL DESIGN:** Code and Design, Code Smells and Antipatterns (or, How to Tell If You're Being Too Clever), XP Teams Look for Code Smells and Fix Them, Hooks, Edge Cases, and Code That Does Too Much. Make Code and Design Decisions at the Last Responsible Moment, Fix Technical Debt by Refactoring Mercilessly, Use Continuous Integration to Find Design Problems, Avoid Monolithic Design, Incremental Design and the Holistic XP Practices. Teams Work Best When They Feel Like They Have Time to Think, Team Members Trust Each Other and Make Decisions Together. The XP Design, Planning, Team, and Holistic Practices Form an Ecosystem Incremental Design Versus Designing for Reuse, When Units Interact in a Simple Way, the System Can Grow Incrementally, Great Design Emerges from Simple Interactions, Final Score.
**Learning Outcomes:** At the end of the unit, student will be able to
1. explain the primary practices of XP.(L2)
2. identify and find Design problems. (L3)
3. apply incremental design practice. (L3)

## UNIT V                                                         (8 Lectures)

**LEAN, ELIMINATING WASTE, AND SEEING THE WHOLE:** Lean Thinking, Commitment,
Options Thinking, and Set-Based Development, Creating Heroes and Magical Thinking. Eliminate Waste, Use a Value Stream Map to Help See Waste Clearly, Gain a Deeper Understanding of the Product, See the Whole, Find the Root Cause of Problems That You Discover. Deliver As Fast As Possible, Use an Area Chart to Visualize Work in Progress, Control Bottlenecks by Limiting Work in Progress.

**KANBAN, FLOW, AND CONSTANTLY IMPROVING:** The Principles of Kanban, Find a Starting Point and Evolve Experimentally from There. Stories Go into the System; Code Comes Out, Improving Your Process with Kanban, Visualize the Workflow, Limit Work in Progress. Measure and Manage Flow, Managing Flow with WIP Limits Naturally Creates Slack. Make Process Policies Explicit So Everyone Is on the Same Page. Emergent Behavior with Kanban.
**THE AGILE COACH:** Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

**Learning Outcomes:** At the end of the unit, student will be able to
1. make use of an area chart to visualize work in progress. (L3)
2. explain the principles of Kanban. (L2)
3. explain the principles of Coaching. (L2)

## TEXT BOOKS :
1. Andrew Stellman, Jill Alison Hart, *Learning Agile,* O'Reilly, 2015.

## REFERENCE BOOKS:
1. Andrew stellman, Jennifer Green, *Head first Agile,* O'Reilly, 2017.
2. Rubin K , *Essential Scrum : A practical guide to the most popular Agile process,* Addison-Wesley, 2013.

# CYBER LAWS

**Course code: 22CS11P4**

**L  T  P  C**

**3  0  0  3**

**Course Outcomes:** At the end of the course, the student will be able to:

CO1: Understand the need and impact of the cyber laws. (L2)
CO2: Describe laws relating to electronic records. (L2)
CO3: Analyze international cyberspace laws. (L3)
CO4: Describe offenses under cyberspace law. (L2)
CO5: Describe the provisions in the IT Act. (L2)

## UNIT-I                                                    (12 Lectures)

**INTERNET, E-COMMERCE AND CYBER LAWS:** Understanding Computers, Internet and Cyber Laws , Need for Cyber Laws , Impact of the Internet and Information Technology (IT) on Business and Society, The Character and Use of Internet Technologies, Conceptual Framework of E-commerce, The Role of Electronic Signatures in E-commerce.

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the need for Cyber Laws (L2)
2. Understand various modes of E-commerce, web development and hosting agreements. (L2)
3. Understand the role of digital signatures in authentication, security threats to cyberspace and E-commerce (L2)

## UNIT-II                                                    (10 Lectures)

**LEGAL ASPECTS OF ELECTRONIC RECORDS/DIGITAL SIGNATURES:**  Recognition of Electronic Records ,The Legal Recognition of Electronic /Digital Signatures, The Rules and Regulations of Certifying Authorities in India.

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the legal recognition of electronic/digital signatures (L2)
2. Understand the retention of electronic records in India. (L2)
3. Securing and verifying electronic signatures in India. (L2)
4. Understand the role of certificate authority and duties of subscribers under the law. (L2)

## UNIT-III                                                    (10 Lectures)

**INTERNATIONAL EFFORTS RELATED TO CYBERSPACE LAWS:** International efforts related to cyber crimes and cyber laws, Council of Europe(COE) Convention on Cyber Crimes, Some Measures to be taken at the National/Domestic Level, Domestic Measures Relating to Offences of Child Pornography

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the United Nations commission on international trade law (L2)
2. Understand the internet law and policy forum. (L2)
3. Understand the measures to be taken at the national/domestic level. (L2)

**PENALTIES, COMPENSATION AND OFFENSES UNDER THE CYBERSPACE AND INTERNET IN INDIA:** Penalty and Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review, Some Important Offenses under The Cyberspace Law and the internet in India

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the compensation for failure to protect data (L2)
2. Understand about Terrorism on cyberspace/Internet. (L2)
3. Understand about violation of the right of privacy on cyberspace/Internet. (L2)

**UNIT-V:**                                                    **(8 Lectures)**

**OTHER OFFENSES UNDER THE INFORMATION TECHNOLOGY ACT IN INDIA:**
 A Brief Overview of Cyber Crimes, The Role of Electronic Evidence and Miscellaneous Provisions of the IT Act, Social Media and Social Networking Meaning, Crimes and Information Technology Laws

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the overview of cybercrimes. (L2)
2. Understand the offenses related to the protected system. (L2)
3. Understand about Indian evidence act. (L2)
4. Understand the Existing Indian laws on social media crimes (L2)

**Text Books:**

1.  Harish Chander, "Cyber Laws and IT Protection",2$^{nd}$ Edition, PHI/Pearson, 2014.

**Reference Books:**

1.  VivekSood, "Cyber Law Simplified", 1stEdition, Fourth Reprint TMH, 2008.

**Web References:**

1.  http://www.cyberlawsindia.net/2sides.html

# MANAGEMENT INFORMATION SYSTEMS

**Course code: 22CS11P5**

**L T P C**

**3 0 0 3**

**Course Outcomes:** At the end of the course, the student will be able to:
**CO1:** Describe information systems in a business environment and strategic uses of IT.( L2)
**CO2:** Understand data resource management. (L2)
**CO3:** Summarize different telecommunications and networks.(L2)
**CO4:** Model e-Commerce system. (L3)
**CO5:** Demonstrate decision support in business. (L3)

## UNIT I                                                                                      (10 Lectures)

**Information Systems in Business:** Introduction, The real world of Information Systems, The fundamental roles of IS in business, Trends in IS, Types of Information Systems, Managerial challenges of IT.
**Competing with Information Technology:** Fundamentals of Strategic Advantage- Strategic IT, Competitive strategy concepts, Strategic Uses of IT, Building a Customer-Focused Business, The value chain and strategic IS; Using Information Technology for Strategic Advantage- Strategic uses of IT, Reengineering business processes, Becoming an agile company, Creating a Virtual Company. (Chapter 1-2)

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the fundamental roles of IS in business. (L2)
2. Explain different competitive strategy concepts. (L2)
3.Summarize strategic uses of Information Technology. (L2)

## UNIT II                                                                                      (10 Lectures)

**Data Resource Management:** Fundamental Data Concepts, Database Structures, Database Development, Types of Databases, Data Warehouses and Data Mining, Traditional File Processing, The Database Management Approach.

**Learning Outcomes:** At the end of the module, students will be able to:

1. Explain fundamental data concepts. (L2)

2. Describe different types of databases. (L2)

3. Explain traditional file processing. (L2)

## UNIT III                                                                                      (10 Lectures)

**Telecommunications and Networks:** The Concept of a Network, Trends in Telecommunications, The Business Value of Telecommunications Networks, The Internet Revolution, The Role of Intranets, A Telecommunications Network Model, Types of Telecommunications Networks, Digital and Analog Signals, Telecommunications Media, Wired Technologies, Wireless Technologies.

**Learning Outcomes:** At the end of the module, students will be able to:

1. Explain different concepts of a network. (L2)
2. Understand the Internet revolution. (L2)
3.Explain different types of Telecommunications Networks. (L2)

## UNIT IV                                                                                      (10 Lectures)
**e-Commerce Systems** : e-Commerce Fundamentals- Introduction, Scope, Essential e-Commerce

Processes, Electronic Payment Processes; e-Commerce Applications and Issues- Business-to-Consumer e-Commerce, Web Store Requirements, Business-to-Business e-Commerce, e-Commerce Marketplaces. (Chapter- 9)

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the role of e-Commerce in business . (L2)
2. Illustrate the various strategies of e-Commerce. (L3)
3. Explain the electronic payment process in business. (L2)

**UNIT V**                                                                                                  **(10 Lectures)**

**Decision Support in Business:** Introduction, Decision Support Trends, Decision Support Systems, Management Information Systems, On-line analytical processing, Using DSS, Executive information systems, Enterprise portals and decision support, Knowledge management systems, Business and Artificial Intelligence (AI), An overview of AI, Expert systems.(Chapter- 10)

**Learning Outcomes:** At the end of the module, students will be able to:

1. Understand the concept of Decision support in Business. (L2)
2. Explain the role of enterprise  portals in Business. (L2)
3. Demonstrate the role of Artificial intelligence in Business (L3)

**Text Books:**

1. James A. O' Brien, George M. Marakas, *"Management Information Systems"*, Tata McGraw Hill, 10th Edition,2013.

**Reference Books:**

1. Kenneth C. Laudon, Jane P. Laudon,"*Management Information System, Managing the Digital Firm"*, Pearson Education,15th Edition,2017
2. Steven Alter,"*Information Systems -The Foundation of E-Business"*,  Pearson Education,4th Edition,2009.
3.  W.S. Jawadekar,"*Management Information Systems: Text & Cases*", 4th Edition,200

# COMPUTER FORENSICS

**CourseCode:22CS11P6**                                                  **L  T  P  C**

                                                                         **3  0  0  3**

**Course Outcomes:** At the end of the course a student will be able to:
CO1: Outline the types of forensics technologies and services (L2)
CO2: discuss about forensic evidence and preservation of digital evidence (L2)
CO3: Illustrate the concept of identifying data and reconstructing past events (L2)
CO4: Examine the surveillance tools for information warfare in future (L3)
CO5: Examine advanced computer forensics (L3)

## UNIT-I:                                                            (10 Lectures)
**Computer Forensics Fundamentals:** Use of forensics in Law enforcement, Employment proceedings, Services, Benefits of professional forensics methodology, Steps taken by computer forensics specialists.
**Types of Forensics Technology:** Types of military forensics technology, Types of law enforcement in forensics technology, Types of business forensics technology.
**Types of forensics services:** Occurrence of cyber crimes, Forensics investigative services, Forensic process improvement, Understanding terms in computer forensics.
**Learning Outcomes:** At the end of the unit, student will be able to
>    1. Discuss the benefits of forensics technology (L2)
>    2. Demonstrate different types of forensics technologies (L2)
>    3. Discuss the forensic services (L2)

## UNIT-II:                                                           (10 Lectures)
**Computer forensics evidence and capture:**
**Data Recovery:** Definition, Data backup and recovery,Role of backup in data recovery,Data recovery solution.
**Evidence Collection:**Why collect evidence? Obstacles, Types and rules of evidence,Volatile evidence, General procedure,Collection and archiving,Methods of collection, Artifacts and collection steps.
**Preservation of Digital Evidence:** Preserving digital crime scene, computer evidence processing steps.
**Learning Outcomes:** At the end of the unit, student will be able to
>    1. Explain about the data backup and recovery process (L2)
>    2. Discuss the methods of collecting evidence (L2)
>    3. Explain the process of preserving digital crime scene (L2)

## UNIT-III:                                                          (10 Lectures)
**Computer forensics Analysis:**
**Discovery of electronic evidence:** Electronic document discovery.
**Identification of  data:** Introduction, Forensics identification and analysis of technical surveillance devices,Inferences drawn from identification of data, Agenda for action in identification of data.
**Reconstructing past events:**Useable file formats, Unusable file formats, converting files.
**Learning Outcomes:** At the end of the unit, student will be able to
>    1. Discuss the analysis of surveillance devices (L2)
>    2. Explain the Usable and Unusable file formats (L2)

3. Discuss the inferences drawn from identification of data(L2)

**Information Warfare:** E-bombs, Emp effect, Snoop, sniff and snuff tools, Email wiretaps, spy dust balls and mechanical dragonflies, Nanotechnology.

**Surveillance tools for Information warfare in future:** Cyber surveillance, Cyber footprint and Criminal tracking, Implications of cookies and integrated platforms, Data mining for what? The Wireless internet.

**Learning Outcomes:** At the end of the unit, student will be able to

1. Discuss  E-bombs, Snoop, Sniff and snuff tools (L2)
2. Explain about nanotechnology  (L2)
3. Examine the surveillance tools for information warfare (L3)

**Networks:** A technical approach, Destruction of email, Damaging computer evidence, Documenting the intrusion of destruction of data, System testing.

**Advanced Computer Forensics:** Advanced Encryption, Advanced hacking, Source addresses.

**Learning Outcomes:** At the end of the unit, student will be able to

1. Examine  the documenting process of intrusion of destruction of data. (L3)
2. Determine System Testing process in networks. (L3)
3. Examine advanced encryption and advanced hacking. (L3)

**TEXT BOOKS:**
1. John R.Vacca, Computer Forensics: Computer crime scene investigation.

**REFERENCE BOOKS:**
1. Amelia Phillips,Bill Nelson, Christopher Steuart, Guide to Computer Forensics and Investigations, Fourth Edition.

**WEB REFERENCES:**
1. https://www.techtarget.com/searchsecurity/definition/computer-forensics
2. http://www.acpo.police.uk/documents/crime/2011/201110-cba-digital-evidence-v5.pdf

# OPERATING SYSTEMS

**Course Code:   22CT1110**

**L  T  P  C**
**3  0  0  3**

## COURSE OUTCOMES:

At the end of the Course the student shall be able to

**CO 1:** understand functional architecture of an operating system. (L2)

**CO 2:** distinguish CPU scheduling algorithms. (L4)

**CO 3:** analyze process coordination. (L4)

**CO 4:** classify File System and directory implementations. (L4)

**CO 5:** analyze different disk scheduling algorithms.(L4)

## UNIT-I                                                                                          (10 Lectures)

### INTRODUCTION AND SYSTEM STRUCTURE

**Introduction**: Operating system, functions of operating system, types of operating system, computer system organization, computer system architecture, operating system structure, operating system operations, computing environments, open source operating systems.

**Operating System Structures:** operating system services, system calls, types of system calls, system programs, operating system structure, operating system debugging and system boot.

**Learning Outcomes:** At the end of the module, students will be able to

1. summarize Operating system services, organization and architecture. (L2)
2. understand the concept of system calls. (L2)
3. describe various Computing systems. (L2)

## UNIT-II                                                                                       ( 10 Lectures)

### PROCESS MANAGEMENT

**Process Concept**: Process, Process Control Blocks, Operations on Processes, Inter process Communication

**Multithreaded Programming**: Multicore programming, Multithreading Models, Thread Libraries, Threading Issues

**Process Scheduling:** Scheduling Criteria, scheduling algorithms (FCFS, SJF, Round Robin, and Priority) and their evaluation, Multiprocessor scheduling. Case Study: Linux.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. explain Process concepts and identify the operations on process(L2)
2. analyze Inter Process Communication(L4)
3. understand Multithreading(L2)
4. analyze,differentiate and apply Scheduling Algorithms(L4)

## UNIT-III                                                                                     (10 Lectures)

### PROCESS COORDINATION

**Synchronization:** The Critical- section problem, Peterson's Solution, Synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples, atomic transactions. Case Study: Linux

**Deadlocks:** System model, deadlock characterization, Methods for Handling Deadlock, deadlock prevention, detection and Avoidance, recovery from deadlock.

**Learning Outcomes:** At the end of the unit, the student will be able to

1. explain the synchronization problems(L2)
2. illustrate the problems of Deadlocks(L4)
3. understand the methods of handling deadlocks(L2)

## UNIT-IV                                                                ( 12 Lectures)

**Memory management strategies:** Swapping, contiguous memory allocation, paging, structure of the page table, segmentation.

**Virtual-memory management:** Demand paging, Copy on write, page-Replacement algorithms (FIFO, LRU, LFU, Optimal Page Replacement)

**File systems and implementation:** File Concept, Access Methods, Directory Structure, File System Mounting. File system structure, File System Implementation, Directory Implementation, Allocation Methods, Free-space Management

**Learning Outcomes:** At the end of the unit, the student will be able to

1. explain the memory management strategies. (L2)
2. differentiate paging and segmentation. (L2)
3. understand the File concepts and directory structure. (L2)
4. analyze Virtual memory. (L4)

## UNIT-V                                                                  (8 Lectures)

**STORAGE MANAGEMENT**

**Secondary-storage structure:** Overview of Mass-storage structure, disk structure, disk attachment, disk scheduling, swap-space management,RAID

**Protection**

Goals and Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights

**Learning Outcomes:** At the end of the unit, the student will be able to

1. understand disk scheduling concepts(L2)
2. illustrate swap space management(L4)
3. explain goals and principles of protection  (L2)
4. analyze revocation of access rights (L4)

## TEXT BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, *Operating System Principles*, 9th Edition, John Wiley &Sons,2018.

## REFERENCES:

1. William Stallings, *Operating Systems – Internal and Design Principle*", 9[th]Edition, Pearson education/PHI,2018.
2. D.M. Dhamdhere, *Operating systems - A Concept based Approach*, 3rd Edition,  TMH,2017.
3. Charles Crowley*, Operating Systems - A Design Approach*, 1st Edition, TMH,2017.
4. Andrew S Tanenbaum, *Modern Operating Systems*, 3rd Edition, Pearson/PHI,2014.

## WEB REFERENCES:

1. https://nptel.ac.in/courses/106/105/106105214/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012/lecture-notes-

# COMPUTER NETWORKS

**Course Code: 22CT1112**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**: At the end of the Course the student will be able to: **CO1:** Outline Network models and Transmission media.

**CO2:** Compare various error control and flow control concepts.

**CO3:** Summarise various Routing algorithms and Congestion control principles.

**CO4:** Describe Transport layer protocols. **CO5:** Explain the application layer protocols.

## UNIT-I                                                     (8 Lectures)
**DATA COMMUNICATION :** Characteristics, Components, Data flow, Network criteria, Topologies,Network model, Layered tasks, ARPANET, OSI model, TCP/IP protocol suite, Addressing (Text Book-2).
**PHYSICAL LAYER:**Transmission Media: Guided and unguided, Connecting devices: Hub, switch, bridge, router, Gateway. (Text Book-2).
**Learning Outcomes:** At the end of the unit the student will be able to
1. state the characteristics of network components and data flow.(L1)
2. discuss the network models and protocol stack.(L2)
3. differentiate transmission media and addressing mechanisms.(L2)

## UNIT-II                                                     (12 Lectures)
**DATA LINK LAYER:** Design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols. (Text Book-1).
**RANDOM ACCESS:** ALOHA, CSMA/CD, CSMA/CA, Controlled access, Channelization, Wired LAN: IEEE Standards, Standard Ethernet, Wireless LAN:IEEE802.11, ATM: architecture,layers (Text Book-2).
**Learning Outcomes:**At the end of the unit the student will be able to
1. classify error detection and correction techniques. (L2)
2. explain random access and controlled access protocols. (L2)
3. contrast various ATM layers.(L2)

## UNIT-III                                                    (12 Lectures)
**NETWORK LAYER**: Design issues, Routing algorithms, Internetworking, Network layer in the Internet. (Text Book-1).
**CONGESTION CONTROL**: Approaches to Congestion Control, Traffic-Aware Routing, Traffic Throttling, Load shedding, traffic shaping. (Text Book-1).
**Learning Outcomes:**At the end of the unit the student will be able to:
1. describe the design issues and routing algorithms in the network layer. (L2)
2. explain the internet control protocols. (L2)
3. discuss the various congestion control mechanisms (L2)

## UNIT-IV                                                     (8 Lectures)
**TRANSPORT LAYER:**Transport services, Elements of transport Protocols, TCP and UDP (Text Book-1).
**DELAY-TOLERANT NETWORKING:**DTN Architecture, The Bundle Protocol (Text Book-1).
**Learning Outcomes:**At the end of the unit the student will be able to
1. summarize various transport services available in the transport layer.(L2)
2. differentiateTCP and UDP protocols.(L2)
3. discuss DTN architecture.(L2)

## UNIT-V                                                     (10 Lectures) APPLICATION
**LAYER:**Domain Name Space (DNS), SNMP, Electronic mail: MIME, SMTP, IMAP.
**CONTENT DELIVERY:** Content Delivery Networks, Peer-to-Peer Networks.

**Learning Outcomes:** At the end of the unit the student will be able to
1. describe the concepts of DNS. (L2)
2. explain about electronic mail protocols.(L2)
3. discuss the content delivery networks.(L2)

## TEXT BOOKS:
1. Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks* , 5th Edition, Pearson New International Edition, 2016.
2. Behrouz A. Forouzan, *Data Communication and Networking*, 4th Edition, McGraw- Hill, 2017.

## REFERENCES:
1. William Stallings, *Data and Computer Communication*, 8th Edition, Pearson, PHI, 2013.
2. Douglas Comer, *Internetworking with TCP/IP*, 6th Edition, PHI, 2015.

## WEB REFERENCES:
1. https://nptel.ac.in/courses/106105183/

# Getting Started with Competitive Programming

## (MOOCs)

Course Code:  22CS11M1

L T P C
3 0 0 3

Reference:  https://onlinecourses.nptel.ac.in/noc22_cs82/preview

## Instructor bio



**Prof. Neeldhara Misra**

IIT Gandhinagar

Neeldhara Misra is an Assistant Professor of Computer Science and Engineering at the Indian Institute of Technology, Gandhinagar. Her primary research interest involves the design and analysis of efficient algorithms for "hard" problems in general, and parameterized algorithms in particular. The problems considered are typically concerned with combinatorial optimization, frequently in the context of graph theory, social choice, games, geometry, and constraint satisfaction.

ABOUT THE COURSE :

This is a course on algorithm design with a focus on issues of modeling and implementation. Each lecture will be focused entirely on one or two problems that reveal the use of a specific algorithmic technique. The techniques themselves are chosen to be in line with those covered in existing NPTEL courses on data structures and algorithms, so that students who complete those courses can find in this course a natural follow up. This course is intended for anyone who wants to deepen their appreciation for algorithmic

techniques that they have learned in a foundational course and/or would like to take a first step towards preparing for coding competitions such as the ICPC.

INTENDED AUDIENCE : Undergraduate students who have already done a basic data structures/algorithms course.

PREREQUISITES : Data Structures and Algorithms, Familiarity with a programming language (ideally C++ or Python)

**Course layout**

Week 1: Sorting and Searching Algorithms

Week 2: Greedy Algorithms - I

Week 3: Greedy Algorithms - II

Week 4: Disjoint Set Union with Path Compression

Week 5: Minimum Spanning Tree

Week 6: Shortest Paths: Dijkstra and Beyond

Week 7: Network Flows - I

Week 8: Network Flows - II, Divide and Conquer

Week 9: Dynamic programming - I

Week 10: Dynamic programming - II

Week 11: Dynamic programming - III

Week 12: Dynamic programming - IV

Books and references

Algorithms by Jeff Erickson (freely available online)

 Algorithms Illuminated by Tim Roughgarden

Algorithm Design

Jon Kleinberg and Éva Tardos

Introduction to Algorithms

Cormen, Leiserson, Rivest, Stein

Competitive Programming 4: The Lower Bound of Programming Contests in the 2020s by Steven Halim and Felix Halim

Guide to Competitive Programming: Learning and Improving Algorithms Through Contests Antti Laaksonen

# Introduction to Internet of Things

# (MOOCs)

Course Code: 22CS11M2

L T P C
3 0 0 3

Reference: https://onlinecourses.nptel.ac.in/noc20_cs22/preview

## Instructor Bio



**Prof. Sudip Misra**

**IIT Kharagpur**

Dr. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles.His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of

Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award).Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier).Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

## About the Course

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

INTENDED AUDIENCE  : CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering

PREREQUISITES              : Basic programming knowledge

## Course layout

**Week 1**: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

**Week 2**: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

**Week 3**: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

**Week 4**: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

**Week 5**: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

**Week 6**: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

**Week 7**: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

**Week 8**: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

**Week 9**: Cloud Computing(contd), Sensor-Cloud

**Week 10**: Fog Computing, Smart Cities and Smart Homes

**Week 11**: Connected Vehicles, Smart Grid, Industrial IoT

**Week 12**: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring

## Books and references

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Research papers

## List of Open Electives offered by Mechanical Engineering

| course code | Name of the course |
|---|---|
| 22ME11P1 | Digital Manufacturing |
| 22ME11P2 | Renewable Sources of Energy |

## List of Open Electives offered by Mechanical Engineering

| course code | Name of the course |
|---|---|

# DIGITAL MANUFACTURING

## (OPEN ELECTIVE)

**Course Code: 22ME11P1**          L     T     P     C

                                    3      0      0      3

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Explain Architecture of Digital Manufacturing System (L2)

**CO2:** Discuss on the role of CAD and design process in digital manufacturing (L2)

**CO3:** Explain the application of reverse engineering / discuss on techniques for processing of CAD models for digital manufacturing (L2)

**CO4:** Explain the principal and process involved in development of parts by additive manufacturing (L2)

**CO5:** Discuss on the use of digital manufacturing equipment / explain the role of software in digital manufacturing (L2)

**UNIT – I**                                                                       **08 Lectures**

**Introduction to Digital Manufacturing**: Definition of digital manufacturing, Historical perspective on industrial production and outlook, Industrial Revolutions, Industry 4.0, Cyber- physical system, Factory of the future, Operation Mode and Architecture of Digital Manufacturing System.

**Learning Outcomes:** At the end of this unit, the student will be able to

1. discuss on the historical perspective on industrial production (L2)
2. explain on the concept of Industry 4.0 (L2)
3. explain the architecture of digital manufacturing system. (L2)

**UNIT – II**                                                                      **10 Lectures**

**Cad Modeling**: Design process and role of CAD, Types and applications of design models, Three dimensional modelling schemes, Wire frames and surface representation schemes, Solid modelling - Parametric modelling, Assembly modelling.

**Learning Outcomes:** At the end of this unit, the student will be able to

1. discuss on design process and role of CAD (L2)
2. explain the types and applications of design models (L2)
3. summerize on three dimensional modelling schemes (L2)

**UNIT – III**                                                                    **10 lectures**

**Reverse Engineering**: Need, Reverse engineering process, Reverse engineering hardware and software, Geometric model development.

**Computer Aided Manufacturing:** Component modelling, Machine and tool selection, Defining process and parameters, Tool path generation, Simulation, Post processing.

**Learning Outcomes**: At the end of this unit, the student will be able to

1. explain the need of reverse engineering (L2)
2. discuss on hardware and software used in reverse engineering (L2)
3. explain on tool selection and process and parameters in computer aided manufacturing (L2)

**UNIT – IV**                                                                     **10 lectures**

**Additive Manufacturing for Digital Transformation**: Introduction to additive manufacturing, Additive manufacturing process chain, Material selection, Manufacturing, Post processing, Additive manufacturing technologies and processes, Vat photo polymerization, Material extrusion, Material

jetting, Sheet lamination, Powder bed fusion, Binder jetting, Planning and slicing additive manufacturing software.

**Learning Outcomes:** At the end of this unit, the student will be able to
1. explain the additive manufacturing process chain (L2)
2. discuss on classification of additive manufacturing process based on initial state of materials (L2)
3. explain the processes used in additive manufacturing for a range of materials (L2)

**UNIT – V**                                                                 **12 lectures**

**Concept Modelers, Translators and 3D Printing Software:** Introduction, Principle, Thermo jet printer, Sander's model market, 3- D printer, Genisys Xs printer, JP system 5, object quadra System-Rapid proto typing. Standard interface to convey geometric description from CAD package to Rapid prototyping system, Stereo Lithography (STL)file, Initial Graphics Exchange Specification(IGES)file, Hewlett-Packard Graphics Language(HP/GL) file.

**Additive manufacturing software for editing features and to export files to printers**: Ansys, Autodesk Netfabb, 3dSystems, Materialise Magics, Solid Edge, Amphyon.

**Learning Outcomes:** At the end of this unit, the student will be able to
1. explain the principle and working of 3D printers (L2)
2. discuss on suitable interface to convey geometric description from CAD package to RP system (L2)
3. explain on suitable software for editing features and to export files to printers (L2)

**Text Books:**
1. Zude Zhou Shane (Shengquan) Xie Dejun Chen,"Fundamentals of DigitalManufacturing Science''Springer Series in Advanced Manufacturing,2012 (Unit-I)
2. Ibrahim Zeid and Sivasubramanian R, "CAD/CAM - Theory and Practice", Tata McGraw Hill Education, 2011. ( Unit-II)
3. Vinesh Raja and Kiran J Fernandes, "Reverse Engineering- An Industrial Perspective", Springer-Verlag, 2008 ( Unit-III)
4. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 3rd Edition, World scientific publications, 2014.(Unit-IV&V)

**Reference Books:**
1. Pham D T and Dimov S, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping", Springer-Verlag, 2001.
2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", Springer, 2005.
3. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", Springer, 2004.

# RENEWABLE SOURCES OF ENERGY

# (OPEN ELECTIVE)

**Course Code: 22ME11P2**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Discuss non-conventional sources of energy and explain the working of different solar energy applications (L2)

**CO2:** Discuss wind energy conversion systems and explain sources of geothermal energy (L2)

**CO3:** Describe different biogas plants and working of different gasifiers (L2)

**CO4:** Explain the working principle of different fuel cells and ocean thermal energy conversion Systems (L2)

**CO5:** Describe the working of magneto hydro dynamic power systems and principles of energy conservation (L2)

## UNIT- I                                                                                     10 Lectures

**Introduction to Energy Sources**: Energy sources and their availability, non-conventional sources, advantages of renewable energy sources, prospects of renewable energy sources.

**Solar Energy**: Solar energy collectors – flat plate collectors and concentrating collectors, solar energy storage systems – mechanical, electrical, chemical and electro-magnetic, solar pond, applications of solar energy – solar water heating, solar distillation, solar cooking.

**Learning Outcomes:** At the end of this unit, the student will be able to
  1. describe various sources of renewable energy (L2)
  2. explain the working of flat plate and concentrating solar collectors (L2)
  3. discuss methods of storing solar energy and applications of solar energy (L2)

## UNIT- II                                                                                     10 Lectures

**Wind Energy**: Basic principles of wind energy conversion, site selection considerations, basic components of Wind Energy Conversion System (WECS), classification of WEC systems, wind energy collectors – horizontal axis machines and vertical axis machines, generating systems, applications of wind energy.

**Geothermal Energy**: Geothermal sources, hydrothermal resources – vapor dominated and liquid dominated systems, hybrid plants – geothermal preheat and fossil superheat; applications of geothermal energy, advantages and disadvantages of geothermal energy

**Learning Outcomes:** At the end of this unit, the student will be able to

  1. discuss different wind energy conversion technologies **(L2)**
  2. explain the working of different geothermal energy resources (L2)
  3. describe the applications of geothermal energy (L2)

## UNIT- III                                                  10 Lectures

**Energy from Biomass**: Biomass conversion technologies, photosynthesis, biogas generation, factors affecting biogas generation, classification of biogas plants – floating drum plants and fixed dome plants, selection of site for biogas plant, utilization of biogas; Methods for obtaining energy from biomass, biomass gasification, classification of biomass gasifiers, fixed bed gasifiers and fluidized bed gasifiers, applications of gasifiers, advantages and limitations of gasifiers.

**Learning Outcomes:** At the end of this unit, the student will be able to
1. describe various biogas generation methods (L2)
2. discuss various factors affecting the selection of biogas plants (L2)
3. explain the working and summarize the advantages and limitations of biomass gasifiers (L2)

## UNIT- IV                                                10 Lectures

**Chemical Energy sources**: Fuel cells -principle of operation of fuel cell, types of fuel cells –hydrogen oxygen, solid-oxide, alkaline, polymer electrolyte membrane fuel cells, advantages, disadvantages and conversion efficiency of fuel cells, applications of fuel cells.

**Energy from the oceans**: Ocean thermal energy conversion-open cycle and closed cycle systems, energy from tides – basic principle of tidal power, components of tidal power plants, single basin and double basin systems, ocean waves – wave energy conversion systems.

**Learning Outcomes:** At the end of this unit, the student will able to
1. describe the working principle of different fuel cells (L2)
2. explain the working of open cycle and closed cycle OTEC systems (L2)
3. explain the working of single and double basin tidal power systems (L2)

## UNIT- V                                                 10 Lectures

**Unconventional Sources of Energy:** Principles of MHD power generation – open cycle and closed cycle – advantages and limitations. Basic principles of thermo-electric and thermo-ionic power generation – advantages and limitations.

**Energy Conservation**: Economic concept of energy, principles of energy conservation and energy audit, energy conservation technologies, co-generation, waste heat utilization, combined cycle power generation

**Learning Outcomes:** At the end of this unit, the student will able to
1. explain the working of open and closed cycle MHD power generation systems (L2)
2. describe the working of thermo-electric and thermo-ionic power generation systems (L2)
3. discuss different ways to reduce energy consumption and explain energy conservation systems (L2)

**Text Book:**

G.D. Rai, *Non-conventional sources of energy,* 6th Edition, Khanna Publishers, 2017.

**Reference Books:**

1. D.P. Kothari, R. Rakesh and K.C. Singal, Renewable Energy Resources and Emerging Technologies, 3rd Edition, Prentice India Pvt. Ltd, 2022.

**2.** G.S. Sawhney, Non-Conventional Energy Sources, 1st Edition, Prentice India Pvt. Ltd, 2012**.**

3. G.N. Tiwari and M.K. Ghosal, Renewable Energy Resources: Basic Principles and Applications, 1st Edition, Alpha Science International Ltd, 2005.

# FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY
## (OPEN ELECTIVE)

**Course Code: 22BP11P1**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:** At the end of the course, the students will be able to

CO1: understand the basic concepts and significance of nanoscience and nanotechnology (L2).

CO2: recognize the different synthesis methods of nanomaterials (L1).

CO3: analyze structural and morphological properties by using different techniques (L4).

CO4: demonstrate the vibrational and optical properties of nanomaterials by using different spectroscopic techniques (L3).

CO5: describe the applications of different nanomaterials and make use of gained knowledge in their higher study and research (L1).

## Unit I: Introduction                                                                    [10 L]

Definitions: nanomaterials, nanoscience, nanotechnology; nanoscience in nature, historical perspective, significance of nanoscience, classification of nanomaterials: zero-, one-, two- and three-dimensional nanomaterials, surface area to volume ratio, quantum confinement effect, density of states, properties of nanomaterials (optical, electrical, magnetic, mechanical, thermal).

**Learning outcomes (LOs)**

At the end of the unit, the student will be able to

1. recognize the historical development of nanoscience and its decade back instinctive use in various applications (L1).

2. describe the effect of nanoscale size of a material on its various properties (L1).

3. understand the concepts of science of nanomaterials (L2).

## Unit II: Synthesis of Nanomaterials                                                      [8L]

Top-down approaches: ball milling, sputtering, laser ablation, photolithography, exploding wire method; bottom-up approaches: chemical vapour deposition, molecular self assembly, sol-gel technique.

**Learning outcomes (LOs)**

At the end of the unit, the student will be able to

1. describe the nanomaterials preparation approaches (L1).

2. explain the preparation methods of nanomaterials (L2).

3. describe the synthetic protocols of various preparation methods (L1).

## Unit – III: Structural and morphological characterization techniques [10L]

Miller indices, interplanar spacing, Bragg's law, diffraction of X-rays by crystals: powder method: determination of lattice parameters, crystallite size, strain, scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM).

**Learning outcomes (LOs)**

At the end of the unit, the student will be able to

1. understand the basics of crystallography (L1).

2. describe the X-ray diffraction method in analyzing various crystals and crystallite parameters (L4).

3. apply the microscopic techniques to understand the surface morphology of nanomaterials (L3).

## Unit – IV: Spectroscopic characterization techniques [10L]

Basic concepts of spectroscopy, energy dispersive spectroscopy (EDS), Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, UV-Vis spectroscopy: determination of band gap, thickness and refractive index of the thin film.

**Learning outcomes (LOs)**
At the end of the unit, the student will be able to
1. understand the concept of spectral analysis of a nanomaterial (L2).
2. describe the various spectroscopic techniques in extracting compositional and vibrational information of the nanomaterials (L2).
3. determine some of the optical properties using UV-Vis absorption/transmission spectra (L3).

## Unit–V: Applications of Nano-materials [12L]

Medicine and health care: targeted drug delivery, therapy; bio sensors: plasmonic biosensor, artificial nose, lab on a chip; information and computer technology: integrated circuits, data storage (NRAM), displays; water purification and remediation, energy harvesting: photovoltaic cell, hydrogen generation and storage, batteries.

**Learning outcomes (LOs)**
At the end of the unit, the student will be able to
1. explain the applications of nanomaterials in medical science and biodetection (L2).
2. describe the use of nanomaterials in elimination of water pollutants (L1).
3. understand the use of nanomaterials in energy harvesting and data storage (L1).

**Text Book**

1. Essentials in nanoscience and nanotechnology by Narendra Kumar, Sunita Kumbhat, John Wiley Sons, Inc (2016).

**Reference Books**

1. Introduction to Nanotechnology, Charles P Poole Jr and Frank J Ownes, John Wiley Sons, Inc (2003).
2. Nanotechnology: Fundamentals and Applications, Manasi Karkare, I.K. International Publishers (2013).
3. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A.N. Banerjee, PHI Learning Private Limited (2009).
4. X-ray diffraction- a practical approach by C. Suryanarayana and M Grant Norton, Springer US (2013).