# *Department of*
# COMPUTER SCIENCE & ENGINEERING

4 Years B.Tech Degree Programme

## REGULATION & SYLLABUS 2017

**Choice Based Credit System**
**Outcome Based Assessment**

**SEMESTER- V & VI**

**AUTONOMOUS**

**Accredited by NBA**

**Accredited by NAAC with 'A' Grade (3.28 out of 4.00 CGPA)**


**GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY**

*Affiliated to UGC New Delhi & Biju Patnaik University of Technology, Odisha*

**GUNUPUR – 765022, Odisha, India**

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** To render best platform for adequate training and opportunities to work as teams on projects with effective communication skills and leadership qualities and understand professional ethics, social awareness and organizational context in which their engineering skills are utilized.

**PEO2:** To endow the students with sound knowledge in the field of mathematics, basic science and engineering fundamentals to solve and inculcate the ability to utilize their skills to prepare them for higher studies, research and analyze engineering problems.

**PEO3:** To extend an ability to analyze the need of the society by providing innovative solutions, leading to their personal cum professional growth as an entrepreneur.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO 1:** To provide students an understanding of the expectations of industry and practical competence with a broad range of programming language and open source platforms through value added courses.

**PSO 2:** The ability to analyze and develop computer programs in the areas related to artificial intelligence, big data analytics and cyber security for efficient design of computer-based systems of varying complexity.

## PROGRAMME OUTCOMES (POs)

PO-1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO-2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3. Design / Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO- 4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO- 5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO- 6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO- 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO- 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO- 9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11. Project management and finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## COURSE STRUCTURE

## SEMESTER-V

| Sl. | Course Category | Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | PC | BCSPC5010 | Computer Organization & Architecture | 3 | | | 3 | A |
| 2 | PC | BCSPC5020 | Software Engineering | 3 | | | 3 | A |
| 3 | PC | BCSPC5030 | Data Mining & Data Warehousing | 3 | 1 | | 4 | A |
| 4 | PC | BCSPC5040 | Compiler Design | 3 | | | 3 | A |
| 5 | OE | B**OE505* | Open Elective - 1 | 3 | | | 3 | A |
| 6 | HS | BBSHS5061 | Optimization in Engineering | 3 | | | 3 | A |
| 7 | HS | BMGHS5062 | Organizational Behavior | | | | | |
| PRACTICAL / SESSIONAL | | | | | | | | |
| 1 | PC | BCSPC5110 | Computer Organization & Architecture Lab | | | 2 | 1 | A |
| 2 | PC | BCSPC5120 | Software Engineering Lab | | | 2 | 1 | A |
| 3 | PC | BCSPC5130 | Data Mining & Data Warehousing Lab | | | 2 | 1 | A |
| 4 | PC | BTPPC5140 | *Skill development project & hands on training | | | 2 | 1 | A |
| 5 | PC | BTPPC5150 | **Summer Internship | | | | 1 | A |
| Total | | | | **18** | **1** | **10** | **24** | |

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC5010** | **Computer Organization and Architecture** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite: Fundamental of computer and basic mathematics.

**Course Educational Objective**

CEO1: Identify the functional units in a digital computer system,

CEO2: Distinguish between the various ISA styles, trace the execution sequence of an instruction through the processor.

CEO3: Compare different approaches used for implementing a functional unit and evaluate different computer systems based on performance metrics.

CEO4: provide an outline of working principles of components of computer.

**Course Outcome:** At the end of the course, the student should be able to

| | |
|---|---|
| CO1 | ***explain*** and ***illustrate*** the execution cycle of a program. |
| CO2 | ***classify*** the components of digital computer and ***designing*** of control and memory units with performance ***evaluation***. |
| CO3 | ***compute*** different type of binary arithmetic operation. . |
| CO4 | ***identify*** the characteristics of memories and ***explain*** memory and IO devices working process. |

**UNIT:1** **(12 Hours)**

**FUNDAMENTALS OF A COMPUTER SYSTEM:** Functional Units of a Digital Computer ,Hardware ,Software Interface,Translation from a High Level Language to the Hardware Language Instruction Set Architecture, Styles and features, RISC and CISC Architectures ,Performance Metrics ,Amdahl's Law ,Case Studies of ISA.

**UNIT:2** **(12 Hours)**

**BASIC PROCESSING UNIT:**Components of the Processor,Datapath and Control – Execution of a Complete Instruction,Hardwired and Micro programmed Control, Instruction Level Parallelism, Basic Concepts of Pipelining, Pipelined Implementation of Datapath and Contro, Hazards,Structural, Data and Control Hazards,Exception handling. Parallelism and Multiprocessor Architecture ,Flynn's Classification, UMA, NUMA, Distributed Memory Architecture. Array and Vector Processor.

**UNIT:3** **(12 Hours)**

**ARITHMETIC FOR COMPUTERS:**Addition and Subtraction, Fast Adders,Binary Multiplication, Fast Multiplicatiom, Binary Division and its techniques,Floating Point Numbers,Representation, Arithmetic Operations.

**UNIT:4** **(12 Hours)**

**MEMORY AND I/O :**Need for a hierarchical memory system, Types and characteristics of memories ,Memory location and address,Endianness of memory representation,Cache memories,Improving cache performance,Virtual memory ,Memory management techniques, cache mapping and its techniques ,Associative memories. Replacement Algorithms. Accessing I/O devices – Programmed Input/Output, Interrupts, Direct Memory Access ,Interface circuits ,Need for Standard I/O Interfaces like PCI, SCSI, USB.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

**Text Books:**


1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009.
3. Kai Hwang and F.A. Briggs, "Computer Architecture and Parallel Processing", McGraw Hill.


**Ref. Books:**


1. M. Morris Mano, "Computer System Architecture", PHI
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.

3. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 1998.
4. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

## COMPUTER ORGANIZATION & ARCHITECTURE LAB
## (Sub. Code: BCSPC5110)

| | |
|---|---|
| **Course Educational Objective**: the object of the course is to | |
| CEO1: Identify, assembling and disassembling the functional units in a digital computer system, | |
| CEO2: troubleshooting and study of dot matrix printer and component of Computer. | |
| CEO3: design assembly language program and VHDl programs. | |
| **Course Outcome:** At the end of the course, the student should be able to | |
| CO1 | ***identify*** components of digital computer and demonstration of assembling and disassembling of computer. |
| CO2 | ***detect*** the troubles in dot matrix printer, CPU and SMPS. |
| CO3 | ***write*** and ***resolve*** the assembling language programming in 8085 and 8086. |
| CO4 | ***design*** and ***examine*** the Adder, Decoder and MUX in VHDl programming. |
| CO5 | ***write*** and ***resolve*** the representation of floating point numbers and Booth’s algorithm. |

### SYLLABUS

1. (a) Identification of different components of a PC. [CO1]
   (b) Assembling & disassembling of a PC. [CO1]
2. Study of different troubleshooting of a dot matrix printer using LX 1050+ Printer Trainer Module. [CO2]
3. Study of the functions of SMPS using SMPS Trainer Kit. [CO2]
   (a) Study of SMPS with Single Output under Line Regulation.
   (b) Study of SMPS with Multi Output under Line Regulation.
   (c) Study of SMPS with Single Output under Load Regulation.
4. Study of different troubleshooting of CPU using CPU Trainer Module. [CO2]
5. Familiarization of different types of byte addressing instruction using 8085 simulator. [CO3]
6. Study of assembly Language program in PC using 8086 architecture. [CO3]
7. Design of digital circuits (H/A, F/A, Decoder & Encoder) in VHDL using Active VHDL. [CO4]
8. Design of digital circuits (MUX, DEMUX & ALU) in VHDL using Active VHDL. [CO4]
9. Write a C/C++ program to perform signed bit multiplication using Booth’s Algorithm. [CO5]
10. Write a C/C++ program for IEEE-754 floating point representation and perform Addition/Subtraction. [CO5]

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC5020** | **Software Engineering** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: Understand the phases in a software project.

CEO2: Understand fundamental concepts of requirements engineering and analysis modeling.

CEO3: Understand the major considerations for enterprise integration and deployment.

CEO4: Learn various testing and maintenance measures.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Interpreting the key activities for managing a software project and Compare different process models. |
| CO2 | Analyze different types of software requirements and identify the suitable model for the new system. |
| CO3 | Apply systematic procedure for software design. |
| CO4 | Implement and test the software which will meet the software requirement specifications. |

**UNIT:1** **(14 Hours)**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models : The Waterfall Model , Incremental Process Models, The RAD Model, Prototyping Model, V- Model, Spiral Model, Agile and Scrum Model.Software Project Management: Estimation, LoC and FP based Estimation, COCOMO Model, Project Scheduling: Scheduling, Earned Value Analysis, Risk Management.

**UNIT:2** **(10 Hours)**

Software Requirements: Functional and Non-functional, User requirements, System requirements, Software Requirements Document, Requirement Engineering Process: Feasibility Studies, Requirement elicitation and analysis, Requirement validation, Requirements Management, Classical Analysis: structured system analysis, Petri Nets – Decision table, Decision tree, Documentation and Gunning's fog Index.CASE TOOL: Application on Documentation

**UNIT:3** **(10 Hours)**

Design process: Design concepts, Design Model, Design Heuristic Architectural Design: Architectural Mapping using Data Flow Structure Chart design using DFD. Transform Analysis, Transaction Analysis: OOD Modeling Using UML, User Interface Design.
CASE TOOL: Application on Design

**UNIT:4** **(14 Hours)**

Software implementation techniques: coding practices: Refactoring, Code Review, Code Inspection, Driver and Stub Module.Software Testing Fundamentals: Internal and external views of Testing- White Box Testing, Basis path testing, control structure testing. Black Box Testing: Regression Testing, Unit Testing, Integration Testing, Validation Testing, System Testing and Debugging.CASE TOOL: Test-Case Design,Software Reliability Measures and Growth Modeling: SEI CMM: Characteristics of Software Maintenance, Reverse Engineering, Re-engineering.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

**Text Books:**

1. Roger S Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, McGraw Hill International Edition.
2. Rajib mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited.

**Reference Books:**


1. Ian Sommerville, “Software Engineering”, Ninth Edition, Pearson Education Asia, 2011.
2. Pankaj Jalote, “Software Engineering- A Precise Approach”, Wiley India, 2010.
3. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt. Ltd, 2007.
4. Stephen R. Schach, “Software Engineering”, Tata McGraw Hill Publishing Company Limited, 2007.


## SOFTWARE ENGINEERING LAB.
## (Sub. Code: BCSPC5120)

1: Develop requirements specification for a given problem(The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)

2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required)

3: Develop structured design for the DFD model developed

4: Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)

5: Develop Sequence Diagrams.

6: Develop Class diagrams.

7: Develop code for the developed class model using Java.

8: Use testing tool such as Junit.

9: Use a configuration management tool.

10: Use any one project management tool such as Microsoft Project or Gantt Project, etc.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC5030** | **Data Mining & Data Warehousing** | **3** | **1** | **0** | **4** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To understand the data warehouse and mining them to extract knowledge.

CEO2: To understand the concepts of Association Rule Mining, Classification and Clustering applying various algorithms to different datasets.

CEO3: To understand the data warehouse and mining them to extract knowledge.

CEO4: To understand the concepts of Association Rule Mining, Classification and Clustering applying various algorithms to different datasets.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Mine the patterns from the dataset for useful inferences. |
| CO2 | Classify the records, groups the objects/records and predict the class label of datasets. At the end of the course, the student should be able to |
| CO3 | Mine the patterns from the dataset for useful inferences. |
| CO4 | Classify the records, groups the objects/records and predict the class label of datasets. |

**UNIT:1** **(12 Hours)**

Overview: Data warehousing, The compelling need for data warehousing, the Building blocks of data warehouse, data warehouses and data marts, overview of the components, metadata in the data warehouse, trends In data warehousing, emergence of standards, OLAP Vs OLTP, data cube, multidimensional data warehouse.

**UNIT:2** **(12 Hours)**

Introduction to Data mining, Data mining Functionalities, Data preprocessing (data summarization, data cleaning, data integration and transformation, data reduction, data discretization), Mining frequent patterns, associations, correlations (market basket analysis, the apriori algorithm, mining various kinds of association rules, from association mining to correlation analysis).

**UNIT:3** **(12 Hours)**

Classification: classification by decision tree induction, Rule based classification, classification by neural networks, classification by genetic algorithm. Cluster Analysis: types of data in cluster analysis, A categorization of major clustering methods (partitioning methods, hierarchical methods),clustering high dimensional data, outlier analysis Advanced techniques: web mining, spatial mining, temporal mining.

**UNIT:4** **(12 Hours)**

Introduction to the data warehouse project, Data warehousing implementation, Web enabled data warehouse, Data mining applications in (financial data Analysis, retail industry, telecommunication industry, Biological data analysis, intrusion detection, in other scientific applications), Data warehouse project.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

**Text Books:**


1. Data Mining: Concepts and techniques: J.Han and M.Camber, Elsevier.
2. Data warehousing Fundamentals: Paulraj Ponniah, Willey India.


**Ref. Books**


1. Data Mining –a Tutorial based primer by R.J.Roiger, M.W.Geatz, Pearson Education.
2. Data Mining & Data Warehousing Using OLAP: Berson, TMH.
3. Data Warehousing: Reema Thareja, Oxford University Press

**DATA MINING & WAREHOUSING LAB**
**(Sub. Code: BCSPC5130)**

1. Demonstration of preprocessing on dataset student.arff.
2. Demonstration of preprocessing on dataset labor.arff.
3. Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm.
4. Demonstration of Association rule process on dataset test.arff using apriori algorithm.
5. Demonstration of classification rule process on dataset student.arff using j48 algorithm.
6. Demonstration of classification rule process on dataset employee.arff using j48 algorithm.
7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm.
8. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm.
9. Demonstration of clustering rule process on dataset iris.arff using simple k-means.
10. Demonstration of clustering rule process on dataset student.arff using simple kmeans.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC5040** | **Compiler Design** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: To introduce the major concept areas of language translation and compiler design.

CEO2: To enrich the knowledge in various phases of compiler and its use.

CEO3:To provide practical programming skills necessary for constructing a compiler

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Acquire the knowledge of compiler and its features. |
| CO2 | Use the knowledge of patterns, tokens and regex for solving the problems in the field of data mining |
| CO3 | Optimize the performance of a program in terms of speed and space. |
| CO4 | Ability to use different powerful compiler generation tools and derive the machine dependent code. |

**UNIT:1** **(12 Hours)**

Introduction: Overview and phases of compilation. Lexical Analysis: Non-deterministic and deterministic finite automata (NFA & DFA), regular grammar, design of a lexical analyzer, lexical analyzer generator. Lex and flex Syntax Analysis: Role of a parser, context free grammars and context free languages, parse trees and derivations, ambiguous grammar. Top Down Parsing: Recursive descent parsing, LL(1) grammars, non-recursive predictive parsing, error reporting and recovery.

**UNIT:2** **(12 Hours)**

Bottom Up Parsing: Handle pruning and shift reduces parsing, SLR parsers and construction or SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, parsing using ambiguous grammars, error reporting and recovery, parser generator. Syntax Directed Translation**:** Syntax directed definitions (SDD), inherited and synthesized attributes, dependency graphs, evaluation orders for SDD, semantic rules, application of syntax directed translation.

**UNIT:3** **(10 Hours)**

Symbol Table: Structure and features of symbol tables, symbol attributes and scopes. Intermediate Code Generation: DAG for expressions, three address codes - quadruples and triples, types and declarations, translation of expressions, array references, type checking and conversions, translation of Boolean expressions and control flow statements, back patching, intermediate code generation for procedures. Run Time Environment: storage organizations, static and dynamic storage allocations, stack allocation, handlings of activation records for calling sequences.

**UNIT:4** (**10 Hours)**

Code Generations: Factors involved, registers allocation, simple code generation using stack allocation, basic blocks and flow graphs, simple code generation using flow graphsElements of Code Optimization: Objective, peephole optimization, concepts of elimination of local common sub-expressions, redundant and un-reachable codes, basics of flow of control optimization.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

**Text Book:**

1. Compilers – Principles, Techniques and Tools Authors: Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman Publisher: Pearson

Ref. Books:

1. Morden Compiler Design, D. Galles, Pearson Education.
2.Compiler Design in C, Allen I. Holub, PHI

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BBTOE5052** | **Genetic Engineering** | **3** | **1** | **-** | **4** | **-** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To introduce the basic of Genetic Engineering and its application

CEO2: To understand the functions gene transfer to organisms

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Students will obtain knowledge in genomic structure in cells. |
| CO2 | The undergraduate will understand the DNA replication and protein synthesis |
| CO3 | Familiar with the topics of vectors used in gene transfer |
| CO4 | They have the idea on types and application of molecular markers |

**UNIT:1** **(12 Hours)**

Genome Organization Prokaryotes and Eukaryotes, Nuclear genome and Organellar genome, DNA as the genetic material, Central dogma of molecular biology; DNA Replication: Process of DNA replication (Initiation, Elongation and Termination). Gene cloning vectors- Plasmid, bacteriophage, cosmid, BAC, YAC; restriction enzymes

**UNIT:2** **(12 Hours)**

The Relationship between genes and protein, The transcriptions : The basic process, Transcription and RNA Processing in Eukaryotic cells, Encoding genetic information capping, polyadenylation, pre-mRNA splicing, formation of commitment complex, creation of catalytic sites.Translation.

**UNIT:3** **(10 Hours)**

Gene cloning vectors- Plasmid, bacteriophage, cosmid, BAC, YAC; Expression vectors: basic concept, bacteria and yeast based expression vector.

**UNIT:4** **(12 Hours)**

Molecular markers- Types (RFLP, RAPD, AFLP, SCAR, SSR, SNP, EST), Principle and methodology; Application of molecular markers: in diagnostics, gene tagging, gene mapping, Human Genome project, Gene therapy and its applications; DNA vaccines

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1 Biotechnology by P K Gupta
2. Biotechnology by B D Singh

Ref. Books 1. An introduction to genetic engineering to Desmond S.T.Nicholl, Cambridge university press
2. Genetic engineering by Smita Rastgi and Neelam Pathak, Oxford press

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BBTOE5051** | **BIOLOGY FOR ENGINEERING** | **3** | **1** | **-** | **4** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To introduce the basic of biology and its application

CEO2: To understand the functions of living system

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Students will obtain knowledge in the biological processes occurring in the cells. |
| CO2 | The undergraduate will understand the cellular organization in living system |
| CO3 | Study about the cellular metabolism |
| CO4 | Understand the causes and mechanism of cancer biology |

**UNIT:1** **(10 Hours)**

Structural & chemical composition of plant and animal cells, Organization of cell (Prokaryotic and Eukaryotic), Cell Wall & Cell Membrane, Cell Organelles, Endoplasmic reticulum, Nucleus, Cytoskeleton, Molecular Organization of Chromosome (Nucleosome concept).

**UNIT:2** **(12 Hours)**

Cell Cycle, Cell Divisions- Mitosis and Meiosis, Stem Cell (Embryonic and adult types and characteristics), Membrane transport & trafficking, cell death pathways, Cancer Cell Biology (Cause, Cell Characteristics).

**UNIT:3** **(10 Hours)**

Cellular metabolism: Respiration (glycolysis, Krebs cycle, electron transport system). Photosynthesis: light reaction, photosystems, dark reaction ( $C_3$ cycle,$C_4$ cycle, CAM).

**UNIT:4** **(12 Hours)**

Proteins: Structural aspects – General introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins. An introduction to enzyme; How enzyme works; Reaction rate. Enzyme kinetics – Approach to mechanism.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology by P S Verma and VK Agrawal, S. Chand
2. Cell biology and Genetics by P K Gupta Rastogi Publication

Ref. Books :

1. Molecular Biology of the Cell 4th Edition Bruce Alberts
2. The Cell A Molecular Approach Geoffrey M Cooper. Boston University 2nd edition

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| B**OE6053 | **Green Buildings and Energy Conversion** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: This course is designed to enlighten students to the current green building trend and to help them realize the impact and applications of green building as a practice not just a trend. Upon completion of the course:

CEO2: Students should have an understanding of core building science fundamentals.

CEO3: Students will understand and perform some building sustainability concepts

CEO4: Students will understand energy efficiency in relation to cost performance, ROI, etc.

CEO5: Students will understand and perform some weatherization fundamentals.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Importance of the green buildings and its site selection |
| CO2 | Environmentally friendly building materials and technologies |
| CO3 | Integrating renewable energy technologies |
| CO4 | Able to analyze different renewable source with case study. |
| CO5 | Impacts of climatic conditions on green building design |
| CO6 | Able to understand building assessment techniques. |

**UNIT:1** **(12 Hours)**

**Green Buildings:** Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings- Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage

**Environmentally friendly building materials and technologies:** Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime-pozzolana cements, materials from agro and industrial waste, ferro-cement and ferro-concrete, alternative roofing systems, various paints reducing the heat gain of the building, etc.

**UNIT:2** **(12 Hours)**

**Energy and resource conservation:** Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings-water harvesting in buildings – waste to energy management in residential complexes or gated communities.

Use of renewable energy resources: Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar appliances, success case studies of fully solar energy based buildings in India.

**UNIT:3** **(10 Hours)**

**Climate Design:** Local climatic conditions – temperature, humidity, wind speed and direction-impact of climate change on built environment – comforts: the desirable conditions – Principles of thermal design – means of thermal –light and lighting-building acoustics- energy efficient lighting, Ventilation and air quality requirement, various techniques for passive cooling, garden roofs, case studies for passive cooling and thermal comfort.

**UNIT:4** **(12 Hours)**

**Green Building Rating Systems:** Introduction to Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment – Modular wastewater treatment systems for built environment – Building automation and building management systems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books: 1. Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.

2. Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BBSHS5061** | **Optimization in Engineering** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1:

CEO2:

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | |
| CO2 | |
| CO3 | |

**UNIT:1** **(10 Hours)**

Introduction: Historical overview of operations research, fundamentals of OR Modeling Approach. Linear Programming: Basic assumptions, formulation, graphical method, simplex method, duality theory, primal-dual relationships, sensitivity analysis.

**UNIT:2** **(10 Hours)**

Transportation and Assignment Problems: Specific features of transportation problem, streamlined simplex method for solving transportation problems, special features of assignment problems, Hungarian method for solving assignment problems. Integer programming: Special features, binary integer programming models, branch-and-bound technique, cutting-plane method.

**UNIT:3** **(08 Hours)**

Dynamic Programming: Characteristics, principle of optimality, solution procedure, deterministic problems. Concepts relating to queuing systems, basic elements of queuing model, role of Poison & exponential distribution, concepts of birth and death process.

**UNIT:4** **(10 Hours)**

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming Introduction to Genetic Algorithm

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Taha H.A., Operations Research 9th Edition, Prentice Hall of India, New Delhi, 2010.
2.Kanti Swarup., Man Mohan., and Gupta, P.K., Introduction to Operations Research 7thEdition, Sultan chand & Sons, New Delhi, 2005.
3. P.K.Gupta, D.S.Hira, “Operations Research”, S.Chand and Company Ltd
4. Hillier, F.S., and Lieberman G.J., Introduction to Operations Research, 7thEdition, TMH, 2009.
5. Kalyanmoy Deb, “Optimization for Engineering Design”, PHI Learning Pvt Ltd

Ref. Books 1

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BMGHS5062** | **Organizational Behavior** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1:To develop an understanding of the behavior of individuals and groups inside organizations

CEO2: To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.

CEO3: To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | |
| CO2 | |
| CO3 | |
| CO4 | |

**UNIT:1** **(08 Hours)**

**Fundamentals of OB**: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.

**Attitude:** Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.

**Personality and values:** Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.

**UNIT:2** **(08 Hours)**

**Perception:** Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).

**Motivation:** Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

**Foundations of Group Behavior:** The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development.

**Managing Teams:** Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.

**UNIT:3** **(08 Hours)**

**Leadership:** Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership,Meaning and significance of contemporary leadership, Concept of Success stories of today's Global and Indian leaders.

**Organizational Culture** : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

**UNIT:4** **(08 Hours)**

**Organizational Change:** Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change. Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1

Ref. Books

1 Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley

## SEMESTER-VI

| Sl. | Course Category | Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | PC | BCSPC6010 | Computer Networks | 3 | | | 3 | A |
| 2 | PC | BCSPC6020 | Data Analytics | 3 | | | 3 | A |
| 3 | PC | BCSPC6030 | Artificial Intelligence & Expert System | 3 | 1 | | 4 | A |
| 4 | PE | BCSPE6041 | Machine Learning | 3 | | | 3 | A |
| | | BCSPE6042 | Computer Vision | | | | | |
| | | BCSPE6043 | Multimedia Computing | | | | | |
| | | BCSPE6044 | Internet Working Technology | | | | | |
| | | BCSPE6045 | Web Designing | | | | | |
| | | BCSPE6046 | Software Quality Assurance & Management | | | | | |
| 5 | OE | B**OE605* | Open Elective - 2 | 3 | | | 3 | A |
| 6 | HS | BBSHS5061 | Optimization in Engineering | 3 | | | 3 | A |
| | | BMGHS5062 | Organizational Behavior | | | | | |
| **PRACTICAL** | | | | | | | | |
| 1 | PC | BCSPC6110 | Computer Networks Lab | | | 2 | 1 | A |
| 2 | PC | BCSPC6120 | Data Analytics Lab using R | | | 2 | 1 | A |
| 3 | PC | BCSPC6130 | Advanced Lab – I | | | 2 | 2 | A |
| 4 | PC | BTPPC6140 | Soft skills & Employability skills | | | 2 | 1 | A |
| Total | | | | **18** | **1** | **8** | **24** | |

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC6010** | **Computer Networks** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: To discuss the digital data communication techniques

CEO2: Gain knowledge on basic concepts of data communication layers, protocols and performance

CEO3: Understand a few representative protocols and network components

CEO4: To introduce the functions of different layers from deployed examples

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | At the end of the course the students will be able to: |
| CO2 | Describe the hardware and software commonly used in data communications |
| CO3 | Analyse the services and features of various layers of data networks |
| CO4 | Design, implement and analyze simple networks that need data communication. |

**UNIT:1** **(12 Hours)**

**Overview of Data Communications and Networking.**

Networks models – TCP/IP Protocol Suite , OSI model – Layers in OSI Digital Transmission: Line coding, Block coding, Sampling, Transmission mode. Analog Transmission: Modulation of Digital and Analog Data; Transmission Media: Guided Media, Unguided media (wireless) Circuit switching: Circuit switching (Data gram Networks and Virtual circuit networks)

**UNIT:2** **(12 Hours)**

**Data Link Layer**

Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC. Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack, Multiple Access Random Access, Controlled Access, Channelization.

**UNIT:3** **(10 Hours)**

**Local area Network: Ethernet.** Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

**Network Layer:**

Host to Host Delivery: Internetworking, addressing and Routing Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6

**UNIT:4** **(10 Hours)**

**Transport Layer:** Process to Process Delivery: UDP; TCP congestion control and Quality of service. **Application Layer :** Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

TEXT BOOKS:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

Ref. Books : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed. 4. Data communication & Computer Networks: Gupta, Prentice Hall of India Network for Computer Scientists & Engineers: Zheng, Oxford University Press

**COMPUTER NETWORKS LAB**
**(Sub. Code: BCSPC6110)**

**List of Experiments:**

1. Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of network devices in detail
3. Implement Sub-netting concept using Network tool
4. Write a program to find out class of a given IP address, sub-net mask, first & last IP address of that subnet
5. Creating a network by implementing different topologies through Lan Trainer Software supported by Netsim.
6. To create scenario and study the performance of CSMA/CD protocol through simulation.
7. To create scenario and study the performance of token bus and token ring protocols through simulation
8. Implementation and study of stop and wait protocol through analysis
9. IP Addressing, Static and Dynamic Routing
10. Implementation and study of Goback-N and selective repeat protocols through analysis
11. Socket Programming, Network Management/ Monitoring Tools

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC6020** | **Data Analytics** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: Provide an insight into Data pre-processing, summarization, and visualization techniques.
CEO2: Teach role of data analytics in business decision making.
CEO3: Teach Model building and validation using various techniques.

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

| | |
|---|---|
| CO1 | Understand and build regression models and use them for prediction |
| CO2 | Analyze data to infer underlying patterns and formulate recommendations. |
| CO3 | Outline the scope and limitations of several state-of-the-art data analytics methods. |
| CO4 | Implement different data analytics models in a business environment. |

**UNIT:1** **(10 Hours)**

**Predictive Analytics:** Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression , Linear Discriminate Analysis , Logistic regression, Perception learning algorithm.

**UNIT:2** **(10 Hours)**

Neural Networks (NN), Support Vector Machines (SVM) and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest–Neighbor classifiers (Image Scene Classification).

**UNIT:3** **(10 Hours)**

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

**Inferential Statistics and Prescriptive analytics** Assessing Performance of a classification Algorithm (t-test, McNemar's test, Paired t-test, paired F-test),Analysis of Variance, Creating data for analytics through designed experiments. Introduction to big data and Challenges for big data analytics.

**UNIT:4** **(10 Hours)**

Implementation of following methods using R or Mat lab ( One of the class tests with a weight age of 15 marks be used to examine these implementations): Simple and multiple linear regression, Logistic regression, Linear discriminate analysis, Ridge regression, Cross-validation and boot strap, Fitting classification and regression trees, K-nearest neighbors, Principal component analysis, K-means clustering.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

**Text Books**:

1.Trevor Hastie, Robert Tibshirani,Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference,and Prediction,Second Edition , Springer Verlag, 2009.
2. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,2013.
3 E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010.

Ref. Books:

1.C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006
2. L.Wasserman-All of statistics

**DATA ANALYTICS LAB USING R**
**(Sub. Code: BCSPC6120)**

1. Installing R on personal machines. Retrieving R packages. Basics of R, R Studio.
2. Basic data types and operations: numbers, characters and composites.
3. Vectors, creating sequences, common functions.
4. Importing tabular data. Simple summaries of categorical and continuous data.
5. More on data frames and lists. Writing functions in R. If/else statements.
6. A common data cleaning task. For loop, while loops. Using apply () to iterate over data. Using with () to specify environment.
7. Testing for differences in means between two groups QQ plots Tests for 2x2 tables plotting confidence intervals.
8. Linear regression, Diagnosing and interpreting regression.
9. Multiple regression, Diagnosing and interpreting regression.
10. Interpreting categorical variables in regression.
11. Case study.
12. Project work.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC6030** | **Artificial Intelligence and Expert Systems** | **3** | **1** | **0** | **4** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: Provide an introduction to machine intelligence, problem solving, heuristic search

CEO2: Provide an introduction to game playing.

CEO3: Provide and introduction to various knowledge representation techniques, reasoning, and expert systems.

CEO4: Provide an introduction to planning and learning in AI.

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

| | |
|---|---|
| CO1 | Understand and analyze different AI related state space search techniques. |
| CO2 | Outline and model simple knowledge-based systems. |
| CO3 | Apply knowledge representation techniques and identify algorithms for reasoning with knowledge. |
| CO4 | Identify appropriate planning and learning algorithm to enhance AI problem solving. |

**UNIT:1** **(12 Hours)**

What is Artificial Intelligence? AI Technique, Level of the Model, Problem Spaces, and Search: Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs. Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis

**UNIT:2** **(14 Hours)**

**Knowledge Representation:** Representations and Mappings, Approaches to Knowledge Representation, **Using Predicate Logic**: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction. **Using Rules**: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge. **Symbolic Reasoning Under Uncertainty**: Introduction to Nonmonotonic Reasoning, Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Depth-first Search, Breadth-first Search.**Weak and Strong Slot-and-Filler Structures**: Semantic Nets, Frames, Conceptual DependencyScripts, CYC.

**UNIT:3** **(10 Hours)**

**Game Playing**: The Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening.**Planning**: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical PlanningOther Planning Techniques. **Understanding**: What is Understanding, What Makes Understanding Hard?, Understanding as Constraint Satisfaction.

**Natural Language Processing**: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

**UNIT:4** **(10 Hours)**

**Learning**: Rote Learning, Learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. **Expert Systems**: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books 1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009

Ref. Books

1. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPE6041** | **Machine Learning** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: Introduce Basics of Matrices Random Variates and Distributions relevant for the study of Machine Learning Techniques

CEO2: Formulate a well defined machine learning problem with clear Metrics

CEO3: Familiarize with techniques for Dimensionality reduction and Computational Efficiency

CEO4: Understand the notions of Hypotheses Space, Hypotheses Structure and Search

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

| | |
|---|---|
| CO1 | List different categories of Data attributes, Dimensions, Sample sizes |
| CO2 | Understand and Apply Supervised, Unsupervised Learning techniques |
| CO3 | Differentiate classifications based on Logistic and Linear Regression and Function Estimation |
| CO4 | Produce Rules and Associations for impactful recommendations from data |

**UNIT:1** **(14 Hours)**

**Introduction:** Learning Problems ,Designing Learning systems, Perspectives and Issues ,Concept Learning ,Version Spaces and Candidate Elimination Algorithm ,Inductive bias ,Decision Tree learning ,Representation ,Algorithm, Heuristic Space Search.

**Analytical learning and reinforced learning:** Perfect Domain Theories ,Explanation Based Learning, Inductive, Analytical Approaches ,FOCL Algorithm, Reinforcement Learning, Task – Q-Learning, Temporal Difference Learning

**UNIT:2** **(12 Hours)**

Neural networks and genetic algorithms: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

**UNIT:3** **(12 Hours)**

Bayesian and computational learning: Bayes Theorem ,Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier ,Gibbs Algorithm, Naïve Bayes Classifier ,Bayesian Belief Network,EM Algorithm ,Probably Learning ,Sample Complexity for Finite and Infinite Hypothesis Spaces ,Mistake Bound Model.

**UNIT:4** **(10 Hours)**

Instant based learning and learning set of rules: K- Nearest Neighbor Learning ,Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoni, Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rule, Induction as Inverted Deduction ,Inverting Resolution.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1 Tom M. Mitchell,(2013), Machine Learning, McGraw-Hill Education (INDIAN EDITION)

Ref. Books 1 Ethem Alpaydin, (2013), Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPE6042** | **Computer Vision** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To create an awareness of the imaging fundamentals in terms of acquisition, storage and display

CEO2: To gain an insight into the mathematical transforms necessary for binary and gray scale images.

CEO3: To study the quality of the image and study the enhancement of the images in spatial and frequency domains

CEO4: To translate the techniques of gray scale images to 3D/colour images

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

| | |
|---|---|
| CO1 | Understand and Identify typical defects in an image and apply a suitable technique for enhancing the image by removing the defect. |
| CO2 | Interpret and apply methods to automatically extract regions of interest in binary, grayscale or color images. |
| CO3 | Understand and apply different image processing algorithms for different applications |
| CO4 | Identify hardware available for acquisition and viewing of images and infer a suitable imaging modality for a given application. |

**UNIT:1** **(10 Hours)**

**Introduction to Computer Vision:** A brief history of computer vision, the digital camera, Point operators, Linear filtering, Neighborhood operators, basics of frequency domain processing

**UNIT:2** **(10 Hours)**

**Feature detection and matching and segmentation:** points, lines, split and merge, mean-shift ,Introduction to photography

**UNIT:3** **(12 Hours)**

**Computational photography:** Photometric calibration, high dynamic range imaging, super resolution and blur removal, basics of image matting and texture analysis

**UNIT:4** **(14 Hours)**

**Stereo and 3D reconstruction** – stereo: an introduction, epipolar geometry, sparse and dense correspondence, local methods, feature tracking and optical flow , **Recognition:** Object detection, face recognition, category recognition, context and scene understanding

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:1. “Computer Vision: Algorithms and Applications”, Richard Szeliski, 2nd Edition, Springer, 2010.
2. “Computer Vision – A Modern Approach”, Forsythe and Ponce, 2nd Edition Pearson, 2011.
3. “Dictionary of Computer Vision and Image Processing”, R. B. Fisher, T. P. Breckon, K. Dawson Howe, A. Fitzgibbon, C. Robertson, E. Trucco, C. K. I. Williams.Chichester, West Sussex : John Wiley & Sons Inc., 2014

Ref. Books 1

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPE6043** | **Multimedia Computing** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Teach the basic concepts of Multimedia and Hypermedia, World Wide Web and Overview of the Multimedia Software Tools. Exploring multimedia applications.

CEO2: Train students to Understand Graphics and Image Data Representation, Color in Image and Video and types of Video Signals and Basics of Digital Audio.

CEO3: Teach various text, image and video compression standards.

CEO4: Identify the current and future issues related to multimedia technology.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Apply different compression techniques depending on the multimedia object streams, interpret the various standards for multimedia communications & their features. |
| CO2 | Demonstrate multimedia and its applications to potential clients. |
| CO3 | Identify and describe the function of the general skill sets in the multimedia industry. |
| CO4 | Identify the basic hardware and software requirements for multimedia development and playback. |
| CO5 | Design and develop applications and exercise proper design choices and meet Quality of Service requirements. |

**UNIT:1** **(14 Hours)**

**Introduction:** Branch-overlapping Aspects of Multimedia, Content, Global Structure.

**Media and Data Streams:** Medium, Main properties of a multimedia stream, Multimedia System Definition, combination of media, Independence, Computer-supported Integration, Communication system.

**UNIT:2** **(12 Hours)**

**Multimedia:** Traditional Data Streams Characteristics, Data stream Characteristics for Continuous media.

**Sound/Audio:** Basic Sound Concepts, Speech.

**Images and Graphics:** Basic concepts, Computer Image processing.

**Video and Animation:** Basic concepts, Television, Computer-based Animation, Data compression.

**UNIT:3** **(12 Hours)**

**Data Compression:** Storage space, Coding Requirement, Basic Compression Techniques JPEG.

**Multimedia Operating System:** Introduction, Real time, Resource Management, Process Management, File system, Additional operating System Issues.

**UNIT:4** **(10 Hours)**

**Multimedia Communication System:** Application subsystem, Transport Subsystem, quality of Service and Resource Management.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books1: Ralf Steinmetz and Klara Nahrstedt.m Multimedia: Computing, Communications Applicatios, Pearson Education, New Delhi 2006.

Ref. Books :


1. P.K. Andleigh – Multimedia Systems Design, PHI, New Delhi-2005.
2. R. Parekh – Principles of Multimedia, TMH, New Delhi -2006.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPE6045** | **Web Designing** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: To teach students HTML,HTML5 and CSS for designing WebPages

CEO2: To introduce students to the basics of JavaScript as a programming language

CEO3: To familiarize students with the Document Object Model and enable them to create dynamic WebPages that react to user input

CEO4: To teach students about installing and configuring Apache Server and incorporating backend support for their web pages

CEO5: To familiarize students with JQuery & Bootstrap.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Design visually appealing websites using HTML, CSS |
| CO2 | Design solutions for programming questions using JavaScript |
| CO3 | Setup a web server and host a website with backend support |
| CO4 | Use Bootstrap and JQuery to enhance the functionality of their websites |

**UNIT:1** **(12 Hours)**

**Introduction:** Internet, WWW, Web Servers & Browsers, URLS, MIME, http

**HTML, HTML5 & CSS:** Basic Markup, Images, Hyperlinks, List, Tables, Forms, DataList, Canvas, Audio & Video, Geo-location, Local Storage, Web Workers, Offline Web Applications, Drag and Drop.

**UNIT:2** **(12 Hours)**

**JavaScript:** Introduction to client side scripting, JavaScript Basics, Screen Input & Keyboard Output, Functions, Objects, Inheritance, hoisting ,Arrays JavaScript Objects, Accessing & Modifying DOM, Events & Event Handlers - load, mouse, Synthetic Events, key and form related events, event bubbling, cookies. **Apache:** httpd server, request response formats Basics, Configuration, Debugging, htaccess.

**UNIT:3** **(12 Hours)**

**PHP:** Basics, File Handling & System Calls, Strings & Regular Expressions, Arrays, Cookies,Sessions, Functions, Classes Database Access. **Bootstrap:** Grid Systems, Layout, Tables & Forms, Buttons & Images, progress bar, navigations

**UNIT:4** **(10 Hours)**

**JQuery :** Usage, Selecting DOM Elements, Getting and Setting Attributes , Changing Styles.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books 1

**1.** "Learning PHP, MySQL, JavaScript, CSS & HTML5", Robin Nixon, O'Reilly, 3rd Edition, 2014.

**2.** "Programming The World Wide Web", Robert W. Sebesta, Pearson, 7th Edition, 2013.

**3.** "HTML5 Up and Running", Mark Pilgrim, O'Reilly, 1st Edition, 2012.

**4. "**W3 Schools", http://www.w3schools.com

Ref. Books 1

2

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BEEOE6051** | **Renewable Energy Sources** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1: Write theory of sources like solar, wind and also experiments of same.

CEO2: Analyze operating conditions like stand alone and grid connected of renewable sources,

CEO3:Reproduce different Storage Systems, concept of Integration and Economics of Renewable Energy System

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | To develop fundamental understanding about Solar Thermal and Solar Photovoltaic systems. |
| CO2 | To provide knowledge about development of Wind Power plant and various operational as well as performance parameter/characteristics. |
| CO3 | To explain the contribution of Biomass Energy System in power generation. |
| CO4 | To teach different Storage systems, Integration and Economics of Renewable Energy System. |

**UNIT:1** **(06 Hours)**

**Solar Thermal**: Solar radiation at the earth's surface, Solar constant, Spectral distribution, Extraterrestrial Radiation, Solar Terrestrial Radiation, Solar radiation geometry, Computation of cosθ for any location having any orientation, Empirical equations for predicting the availability of solar radiation: Monthly average daily and hourly global and diffuse radiation, Beam and Diffuse radiation under cloudless skies, Solar radiation on tilted surfaces : a)Beam radiation, b)Diffuse radiation, c)Reflected radiation, d)Flux on tilted surface.

Instruments for measuring solar radiation, Devices for thermal collection and storage, Thermal applications, designing and Performance analysis of liquid flat plate collector for given heat removal factor and loss coefficient. Introduction to concentrating solar power (CSP) plants using technologies like a) Parabolic troughs b) Linear Fresnel reflector, c) Paraboloid Dish, etc.

**UNIT:2** **(06 Hours)**

**Solar Photovoltaic:** Introduction to family of solar film technology, Single c-Si, Poly c-Si PV Cell, Module and Array, Array Design (factors influencing the electrical design of the solar array) : a) Sun Intensity, b)Sun Angle, c) Shadow Effect, d) Temperature Effect, e) Effect of Climate, f) Electrical Load Matching, g) Sun Tracking, Peak Power Point Operation, Electrical characteristics of Silicon PV Cells and Modules, PV System Components, Efficiency of PV system, MPPT of solar system, PV system designing, PV powered water pumping.

**UNIT:3** **(06 Hours)**

**Wind Energy System:** Power Contained in Wind, Thermodynamics of Wind Energy, Efficiency Limit for Wind Energy Conversion, Maximum Energy obtained for a Thrust-operated converter (Efficiency limit), Design of Wind Turbine Rotor, Power-Speed Characteristics, Torque-Speed Characteristics, Wind Turbine Control Systems: a) Pitch Angle Control, b) Stall Control, c) Power Electronics Control, d) Yaw Control, Control Strategy, Wind Speed Statistics, Statistical Wind Speed Distributions, Site and Turbine Selection, Extraction of wind energy and wind turbine power. Introduction to Offshore Wind Energy System and its comparison with Wind Energy System,

**UNIT:4** **(06 Hours)**

**Fuel cell and Storage Systems:**

a) Fuel Cells: Operating principles of Fuel Cell, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, Introduction to Fuel Cell Technology and its type, application and limits.

b) Storage systems: Hydrogen storage: Hydrogen production, relevant properties, Hydrogen as an Engine Fuel, methods of Hydrogen storage.

Batteries: Introduction to Batteries, Elements of Electro Chemical Cell, Battery classification, Battery Parameters, Factors affecting battery performance.

Introduction to other storage technologies: pump storage, SMES, compressed air storage

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books


1. S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill
2. Mukund R. Patel, “Wind and Power Solar System”, CRC Press
3. Tony Burton, Nick Jenkins, David Sharpe, “Wind Energy Hand Book-Second Edition”, John Wiley & Sons, Ltd., Publication
4. Godfrey Boyle, “Renewable Energy”, Third edition, Oxford University Press
5. Gilbert M. Masters, “Renewable and Efficient Electrical Power Systems”, Wiley - IEEE Press, August 2004
6. Chetan Singh Solanki, “Solar Photovoltaics-Fundamentals, Technologies and Applications”, PHI Second Edition.
7. H. P. Garg, J. Prakash, “Solar Energy-Fundamentals and Applications”, Tata McGraw hill Publishing Co. ltd., First Revised Edition.


Ref. Books :


1. D.P.Kothari, K.C.Singal, Rakesh Rajan,“Renewable Energy Sources and Emerging Technologies”, PHI Second Edition
2. Paul Gipe, “Wind Energy Comes of Age”, John Wiley & Sons Inc.
   Donald L. Klass, “Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, Academic Press

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCVOE6053** | **AIR & NOISE POLLUTION** | **3** | **0** | **0** | **3** | **A** |

**Pre -Requisite:**

**Course Educational Objective**

CEO1:

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Identify sampling and analysis techniques for air quality assessment |
| CO2 | Describe the plume behavior for atmospheric stability conditions |
| CO3 | Apply plume dispersion modeling and assess the concentrations |
| CO4 | Design air pollution controlling devices |

**UNIT:1** **(8 Hours)**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

**UNIT:2** **(8 Hours)**

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

**UNIT:3** **(10 Hours)**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

**UNIT:4** **(10 Hours)**

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality .Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention

Teaching Methods: Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

**Text Books:**


Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002.

2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.

3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 1996.


Ref. Books:


1. Heumann. W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.
2. Mahajan S.P., "Pollution Control in Process Industries", Tata McGraw Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. "Environmental Engineering", McGraw Hill, New Delhi, 1985.
4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 1998
5. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw Hill, New Delhi, 1991.
6. ThodGodesh, "Air Quality, Lewis India Edition, 2013.

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| BECOE6051 | **INFORMATION THEORY AND CODING** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1:The participants will learn the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.

CEO2:The main purpose of this course is to help students to complete the understanding of the wireless communication system with other advanced courses in wireless communication.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them. |
| CO2 | Describe the real-life applications based on the fundamental theory. |
| CO3 | Calculate entropy, channel capacity, bit error rate, code rate, steady-state probability and so on. |
| CO4 | Implement the encoder and decoder of one block code or convolutional code using any program language. |

**UNIT:1** **(10 Hours)**

Basic Concepts of Information Theory- The concept of Amount of Information, Average Information, Entropy, Information rate, Mutual information; Shannon's Theorem, Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth – S/N Tradeoff; Introduction to Channel Capacity & Coding; Channel Models, Channel Capacity Theorem, Shannon Limit.

**UNIT:2** **(12 Hours)**

Introduction to Error Control Coding- Linear Block Codes- Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code. Cyclic Codes- Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes. BCH Codes- Description of codes; Decoding of BCH codes; Implementation of error connection.

**UNIT:3** **(9 Hours)**

Convolution Codes- Encoding of convolution codes; structural properties of Convolution codes; Distance Properties of convolution codes. Automatic Repeat Request Strategies- Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

**UNIT:4** **(11 Hours)**

Discrete Messages and information content- The Concept of amount of Information, Average Information, Entropy; Information rate, Source coding to increase average information per bit; Shanon-Fano coding; Huffman source coding algorithm, Lempel Ziv source coding algorithm.

**Teaching Methods: Chalk& Board/ PPT/Video Lectures**

**TEXT BOOKS**

1. Information Theory, Coding and Cryptography, Ranjan Bose, TMH Publication
2. Introduction to Error Control Codes, S Gravano, Oxford University Press
3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2ndEdition, 2009.

**REFERENCE BOOKS**

1. Information Coding Techniques, R. Avudaiammal, Tat McGraw-Hill Education Pvt. Ltd., 2ndEdition New Delhi
2. Information Theory, F.M Reza: McGraw Hill
3. Error Control Coding, Shu Lin& J Costeib:, PHI

| Course Code | Course Title | L | T | P | C | QP |
|---|---|---|---|---|---|---|
| **BCSPC7010** | **Computer Graphics** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.

CEO2: Introduce the use of geometric transformations on graphics objects and their application in composite form.

CEO3: Impart frame extraction with different clipping algorithms and transformation to a graphics display device.

CEO4: Introduce projections and visible surface detection techniques for display of 3D scene on 2D screen and rendering of projected objects to naturalize the scene in 2D view.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | To ***explain*** the structure of modern computer graphics systems and ***implement*** its primitives |
| CO2 | To ***design, develop*** and ***model*** key algorithms for modeling and . |
| CO3 | Apply Graphics in greater depth to more complex courses like Image Processing, Virtual, Augmented Reality, etc |
| CO4 | To ***visualize*** surface detection and Virtual reality for a better visual effects. |

**UNIT:1** **(10 Hours)**

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices, monitor and work station.graphics output Primitives: point and line Line, drawing Algorithms: DDA and Bresenham's, Circle drawing Algorithms: Midpoint Circle and Bresenham's filled area primitives.

**UNIT:2** **(12 Hours)**

Two Dimensional Geometric Transformation: Translation, rotation, Scaling, Reflection, Shear, Matrix Representation, Composite Transformations, Transformation between coordinate systems. Window-to- View port Coordinate Transformation. Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland Hodgeman Algorithm).

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation. Projections: Parallel Projection and Perspective Projection.

**UNIT:3** **(10 Hours)**

Object representation: Spline Representation, Bezier Curves and B-Spline Curves. Fractal Geometry: Fractal Classification and Fractal Dimension. Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm

**UNIT:4** **(12 Hours)**

Light pattern and Illumination Models:Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Basic Models, Displaying Light Intensities. Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.
Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing. Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, WileyDreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Ref. Books

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison,

Wesley
2. Procedural Elements of Computer Graphics- David Rogers (TMH)
3. Computer Graphics: Algorithms and Implementations – D.P Mukherjee & Debasish Jana (PHI)
4. Introduction to Computer Graphics & Multimedia – Anirban Mukhopadhyay

**COMPUTER GRAPHICS LAB**

**(Sub. Code: BCSPC7110)**

At the end of the semester student will be able to

**CO1**:- ***Explain*** and implement different types of graphics drawing and scan conversion algorithms.

**CO2**:- ***Apply*** the concepts of 2D and 3D Geometrical Transformations

**CO3**:- ***Design*** clipping and viewing algorithms

CO4:- ***Model*** illumination model with surface elimination and shading

1. Implementation of DDA and Bressenham's line drawing algorithm
2. Implementation of Midpoint and Bressenham's circle drawing algorithm
3. Implementation of 2D transformation
4. Implementation of composite 2D transformation
5. Implementation of Cohen Sutherland 2D line Clipping Algorithm
6. Implementation of Sutherland Hodgeman polygon clipping algorithm
7. Implementation of 3D transformation
8. Implemantation of 3D composite transformation
9. Implementation of B-spline and Bezier curve
10. Implementation of fractrals

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPC7020** | **Real Time System** | **3** | **0** | **0** | **3** | **A** |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |
| CEO1: The primary goal of this course is to meet the basics of real-time systems and enable the students with the knowledge and skills necessary to design and develop embedded | | | | | | |

applications by means of real-time operating systems.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Use the multitasking techniques in real-time systems. |
| CO2 | Use real time scheduling policies in applications |
| CO3 | Design embedded applications using RTOS. |
| CO4 | Use RTOS software mechanisms |

**UNIT:1** **(12 Hours)**

Introduction: What is real time, Applications of Real-Time systems, a basic model of Real Time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints (Using Automata).

Real-Time Task Scheduling: important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

**UNIT:2** **(12 Hours)**

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Stack based PCP and PCP in Dynamic Priority System, Some issues in using a resource sharing protocol. Handling task dependencies.

Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks, Minimization of total communication cost. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

**UNIT:3** **(10 Hours)**

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks. QoS framework, Routing, Resource reservation, Rate control, QoS models.

**UNIT:4** **(8 Hours)**

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, UNIX as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

Case study: RTLinux, Windows CE

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication,2008.

Ref. Books 1.Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7031** | **Advanced Statistical Techniques for Analytics** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To introduce more advanced statistical methods that are used in data analysis and social research.

CEO2: Teach students statistical theories and inference techniques with focuses on statistical theories, probability distributions, bivariate and multivariate analysis.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Demonstrate competency on a variety of well-known distributions and the calculations involved. |
| CO2 | Understand the theories of statistical inferences and apply the appropriate models in different settings to solve real-life problems |
| CO3 | Perform statistical inferences involving two or more populations using statistical software |
| CO4 | Design and perform simple and multiple regression analysis using statistical software |

**UNIT:1** **(12 Hours)**

**INTRODUCTION :** Analyses, Methods, Techniques, Discussion Items on Statistical Methods ,Discussion Items on Statistical Techniques , Statistical Methods and Analyses Revisited , Concepts of Probability , Laplacian Probability , Relative Frequency, Hypothetical Limiting Relative Frequency, Epistemic Probability , Transition to Approaches to Statistical Analysis

**APPROACHES BASED ON RANDOMIZATION** ,Populations, Attributes and Responses, Finite, Physically Existing Populations ,Sampling : The Sampling Frame , Population Statistics as Parameters,Simple Random Sampling, Estimation For Simple Random Samples,The Basic Estimators, Properties of the Estimators, Unequal Probability Samples,Obtaining Samples Through the Use of Restricted Randomization,Inclusion Probabilities and Linear Estimators The Overall Generalization , Interval Estimation

**UNIT:2** **(12 Hours)**

**THE EXPERIMENTAL APPROACH :** Scientific Abstraction and Experiments ,The Nested Syllogism of Experimentation , Randomized Treatment Assignment , Quantifying Differences Among ,Permutation Tests , Toward Inductive Inference , Randomization Tests , Experiments Lacking Random ,Experiments With Constructed Units , Random Selection of

**STATISTICAL MODELING :** Statistical Abstraction : Random Variables , Probability Distributions, Statistical Abstraction.

**UNIT:3** **(12 Hours)**

**FAMILIES OF DISTRIBUTIONS** : Exponential Families and Properties of ,Parameterizations, Exponential Dispersion Families ,Exponential Families for Samples ,Location-Scale Families and Properties

**MODEL SPECIFICATION** : Objectives of Analysis , Additive Error ,Constant Variance ,Linear and Nonlinear Models,Models with Known and Unknown Variance Parameters , Models Based on Response Distributions ,Multiple Random Components ,Stochastic ,

**ESTIMATION AND INFERENCE** : Estimators Based on Sample , Least Squares Estimation , Basic , Modified Likelihood , False Likelihood Functions

**UNIT:4** **(02 Hours)**

**MODEL ASSESSMENT**: Analysis of Residuals, A General Notational Framework, Types of ,Plotting Residuals, Tests With Residuals , Cross Validation : concepts, types , Discrepancy Measures.

**BAYESIAN ANALYSIS:** Bayesian Paradigms, Strict Bayesian Analysis ,Bayesian Analysis of, Sequential Bayes, Prior Distributions, Exchangeability, Conjugate Priors, Non informative

**BASIC ESTIMATION AND INFERENCE**: Point Estimation, Interval Estimation, Model,

| |
|---|
| Predictive Inference Simulation of Posterior Distributions, Fundamental Methods and Principles of Simulation , The Gibbs Sampler , Metropolis Hastings. |
| Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS |
| Text Books 1 Advanced Statistical Methods Mark S. Kaiser Department of Statistics, Iowa State University, Fall 2005 |
| Ref. Books 1<br>2 |

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |

| BCSPE7032 | Advanced Database System | 3 | 0 | 0 | 3 | A |
|---|---|---|---|---|---|---|

Pre -Requisite:

**Course Educational Objective**

CEO1: Learn new ways to query

CEO2: Learn new techniques to model data.

CEO3: Become familiar with the expanding role of database technology.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | ***Apply*** and ***customize*** state-of-the-art implementation techniques for single-node database management systems following modern coding practices. |
| CO2 | ***Identify*** trade-offs among database systems techniques and contrast alternatives for both on-line transaction processing and on-line analytical workloads. |
| CO3 | ***Develop*** and justify design decisions in the context of a high-performance database system. |
| CO4 | ***Implement*** and ***evaluate*** complex, scalable database systems, with emphasis on providing experimental evidence for design decisions. |

**UNIT:1** **(10 Hours)**

Review of Relational Data Model. Reporting and Analytical,databases: Data Warehousing, OLAP, SQL Analytical Functions.,Case Studies (Postgres, Oracle).

**UNIT:2** **(12 Hours)**

Parallel & Distributed Databases and Introduction to NoSQL:Concepts, Parallel and Distributed databases and issues;.Emergence of NoSQL databases, Characteristics of NoSQL,Categories of NoSQL systems, CAP Theorem.

**UNIT:3** **(14 Hours)**

NoSQL Databases: Document databases with example,(MongoDB, CouchDB); Column Oriented databases with example(Cassandra); Key-Values Stores with example (Riak, Voldemort,etc.); Graph databases with example (Neo4J).

**UNIT:4** **(10 Hours)**

Introduction to Big Data: What is Big Data, Hadoop, HDFS, and Spark. Specialty Databases: In-Memory databases for RDBMS (VoltDB) and Key-Value Store (Redis). Specialty databases – Spatial, Temporal, Deductive.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1

2

Ref. Books:


1. “Database System Concepts”, Silberschatz, Korth and Sudarshan,6th Edition, McGraw Hill,2013.
2. “Database Management Systems”, Raghu Ramakrishnan, 3rd Edition, McGraw- Hill, 2014.
3. “Fundamentals of Database Systems”, Elmasri & Navathe, 7th Edition, Pearson Education, 2015.
4. “NoSQL Distilled”, Pramod J. Sadalage and Martin Fowler, Addison Wesley, 2012.
5. “Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement”, Eric Redmond & Jim R. Wilson, O’Reilly, 2012.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7033** | **Cloud Computing** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Understand the rationale behind the cloud computing revolution

CEO2: Introduce various models of cloud computing

CEO3: Understand how to design applications on cloud and the role of security

CEO4: Understand and design distributed systems for scalability

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

| | |
|---|---|
| CO1 | Understand the technical and business rationale behind cloud computing |
| CO2 | Outline the model of cloud computing to use for solving a particular problem |
| CO3 | Design and Build applications for the cloud and understand the security implications |
| CO4 | Understand and Apply the fundamentals of distributed systems design to cloud computing |

**UNIT:1** **(12 Hours)**

Cloud Computing: Introduction, Types of cloud: private, public and hybrid cloud, . Hardware and Infrastructure: IaaS, PaaS, SaaS. public vs private clouds, Benefits and challenges of cloud computing, Virtualization : Types of Virtualization, Implementation Levels , Virtualization Structures , Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices ,Virtual Clusters and Resource management – Virtualization for Data-center Automation. role of virtualization in enabling the cloud,

**UNIT:2** **(14 Hours)**

Cloud infrastructure: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Cloud Applications: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages Benefits and challenges to Cloud architecture, Application availability, performance, security and disaster recovery; next generation Cloud Applications.

**UNIT:3** **(12 Hours)**

Cloud service management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat)

**UNIT:4** **(10 Hours)**

Cloud security: Security Overview , Cloud Security Challenges and Risks, Software-as-a-Service Security ,Security Governance ,Risk Management ,Security Monitoring ,Security Architecture Design ,Data Security ,Application Security, Virtual Machine Security ,Identity Management and Access Control ,Autonomic Security. Cloud based service, applications and development platform

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

**Text Books:**


1. Cloud Computing : A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, 2010 by The McGraw-Hill
2. Gautam Shroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, [ISBN: 978-0521137355],2010
3. Rajkumar Buyya, Christian Vecchiola, S.Tamarai Selvi, ‘Mastering Cloud Computing”, TMGH,2013.


| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |

| BCSPE7034 | Cryptography and Network Security | 3 | 0 | 0 | 3 | A |
|---|---|---|---|---|---|---|

Pre -Requisite:

**Course Educational Objective**

CEO1: Provide an overall view of what Computer & Network Security is all about and generate interest in this field to beable to take this as a further specialization area or a career path.

CEO2: Introduce of Perimeter Security (Firewall, IDS, IPSEC, VPN), Authentication and Access management, Cryptography, Malware, Secure Programming, Applications Security, Security and Privacy Policy.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Understand about Cryptography and Network Security. |
| CO2 | Design and implement various encryption/decryption algorithms. |
| CO3 | Relate different algorithms to real time application. |
| CO4 | Understand and classify different protocols related to web security. |

**UNIT:1 (10 Hours)**

**INTRODUCTION & NUMBER THEORY:**Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality-The Chinese remainder theorem- Discrete logarithms.

**UNIT:2 (14 Hours)**

**BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY:** Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

**HASH FUNCTIONS AND DIGITAL SIGNATURES:** Authentication requirement–Authentication function – MAC – Hash function – Security of hash function and MAC –MD5-SHA-HMAC–CMAC-Digital signature and authentication protocols–DSS–EIGamal–Schnorr.

**UNIT:3 (12 Hours)**

**SECURITY PRACTICE & SYSTEM SECURITY:** Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

**UNIT:4 (10 Hours)**

**E-MAIL, IP & WEB SECURITY:** E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET).

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books


1. “Cryptography and Network Security: Principles and Practice” by William Stallings
2. Cryptography and Network Security” by Behrouz A. Forouzan, Debdeep

| |
|---|
| Mukhopadhya |
| Ref. Books 1 |

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7035** | **Software Testing** | **3** | **0** | **0** | **3** | **A** |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |
| CEO1: Introduce the concepts of Software Quality and types of testing | | | | | | |

| | |
|---|---|
| CEO2: Familiarize the students with different levels of testing | |
| CEO3: Understand the challenges in test management, test automation | |
| CEO4: Gain hands on knowledge of tools, JUnit/JMeter/Selenium/ Bugzilla | |
| **Course Outcome:** At the end of the course, the student will be capable of | |
| CO1 | Apply the concepts of Quality Engineering |
| CO2 | Apply proper testing technique at different phases of development |
| CO3 | Identify difficulties and complexities in Software Quality |
| CO4 | Plan, employ and measure proper Quality approaches applied |

**UNIT:1** **(10 Hours)**

**Basics of software testing and examples:** Basic definitions of software testing, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode , The triangle problem, The NextDate function, commission problem, The Simple Automatic Teller Machine ( SATM) problem.

**UNIT:2** **(10 Hours)**

**Decision table-based testing:** Decision tables, Test cases for the triangle problem, Test cases for the NextDate function, Test cases for the commission problem, Guidelines and observations. **Data Flow testing:** Definition of Use testing, Slice-based testing, Guidelines and observations. **Levels of testing:** Traditional view of testing levels, Alternative life-cycle models, The SATM system, separating integration and system testing. **Integration Testing:** A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations, Case study.

**UNIT:3** **(14 Hours)**

**System testing:** Basic concepts of Threads, requirement specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, guidelines for System testing, Atomic System Functions( ASF) testing examples. **Interaction Testing:** Context of interaction, A taxonomy of interactions, Interaction, composition, and Determinism, Client/Server Testing,. **Issues in object-oriented testing:** Units for object-oriented testing, Implications of composition and encapsulation, inheritance and polymorphism, Levels of object-oriented testing, GUI testing, dataflow testing for object-oriented software, Examples. **Class Testing:** Methods as units, Classes as units.**Exploratory testing:** The context-driven school, Exploring exploratory testing with familiar examples, Exploratory and context-driven testing observations. **Model-based testing:** Testing based on models, appropriate models, Use case-based testing, Commercial tool support for model-based testing

**UNIT:4** **(12 Hours)**

**Object-oriented integration testing:** UML support for integration testing, MM-paths for object-oriented software, A framework for object-oriented dataflow and integration testing. **GUI testing:** The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program. **Object-Oriented System Testing:** Currency converter UML description, UML-based system testing, Statechart-based system testing. **Test-Driven Development:** Test-Driven code cycles, automated test execution, Java and JUnit examples, Pros, cons, and open questions of TDD, Retrospective on MDD versus TDD.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1. Paul C. Jorgensen, (2013), *Software Testing, A Craftsman's Approach*ll, 3rd Edition, Auerbach Publications,

Ref. Books

1. Aditya P Mathur, (2008), *Foundations of Software Testing*, Pearson,
2. Mauro Pezze, Michal Young, (2008), *Software Testing and Analysis – Process, Principles and Techniques*, John Wiley & Sons,

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7041** | **Big Data Using Hadoop** | **3** | **0** | **0** | **3** | **A** |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |
| CEO1: To learn advanced cutting edge and state-of-the-art knowledge and implementation in big data. | | | | | | |
| CEO2: To read and understand research publications in the technical area of big data, beyond that of the traditional textbook level. | | | | | | |

| | |
|---|---|
| CEO3: To conduct independent project and to equip for scholarly research in big data. | |
| CEO4: To explore the next generation of big data tools and applications, and other advanced topics if time permits. | |
| **Course Outcome:** At the end of the course, the student will be capable of | |
| CO1 | Understand the principles and design of alternative storage technologies for Big data. |
| CO2 | Understand and Apply different algorithms for processing Big Data using open source Hadoop, HDFS, MapReduce, Hive, Pig, Mahout, etc. |
| CO3 | Understand and classify different computational issues and infrastructure for Big Data |
| CO4 | Understand the impact of big data for business decisions and strategy. |

**UNIT:1** **(14 Hours)**

**INTRODUCTION TO BIG DATA** :Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce

**INTRODUCTION HADOOP** :Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

**UNIT:2** **(12 Hours)**

**HADOOP ARCHITECTURE** :Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

**UNIT:3** **(8 Hours)**

**HADOOP ECOSYSTEM AND YARN**: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New FeaturesNameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

**UNIT:4** **(10 Hours)**

**HIVE AND HIVEQL, HBASE**: Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase conceptsAdvanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books


1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley,ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012. 6 IT2015 SRM(E&T)
4. Vignesh Prajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.


Ref. Books 1

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7042** | **Data Storage Technology and Networking** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1:learning concepts virtualization technologies

CEO2:Storage area network (SAN) and network attached storage (NAS)

CEO3:How to provide storage security

CEO4: Storage infrastructure management processes

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Implement virtualization technologies |
| CO2 | Provide security to data storage |
| CO3 | Understand the concept behind cloud computing |

**UNIT:1** **(12 Hours]**

Data Storage Fundamentals, Introduction to enterprise IT infrastructure components, server-storage connectivity, virtualization technologies, storage devices such as magnetic disk drive and solid state drive, and the factors to consider for storage investment

**UNIT:2** **(10 Hours)**

Enterprise Storage Solutions Introduction to storage system architecture, RAID, types of storage systems, storage area network, and network attached storage.

**UNIT:3** **(10 Hours)**

Business Continuity and Storage Security Introduction to business continuity, data replication, data backup architecture and methods, and an overview of storage infrastructure security.

**UNIT:4** **(12 Hours)**

Storage Infrastructure Management, Cloud Computing, and Trends in the Storage Industry Introduction to storage infrastructure management processes, cloud computing and cloud storage, and an overview of the technology trends in the storage industry.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Introduction to Data Storage and Management Technologies, Pramod Prasad
2. The Complete Guide to Data Storage Technologies for Network-centric Computing 1st Edition by Franklyn E. Dailey

Ref. Books 1

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7043** | **Wireless Sensor** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Develop an understanding of advanced topics in wireless networking technology, including fundamental network design concepts/algorithms and existing network protocols.

CEO2: Acquire competence to analyze the design principles and communication protocols in wireless ad hoc & sensor networks

CEO3: Examine current problems and proposed solutions in wireless ad hoc & sensor networks and design and optimize communication protocols and algorithms in sensor networks.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Identify the major issues associated with Ad-hoc/sensor networks. |
| CO2 | Identify various protocols as applicable to applications. |
| CO3 | Analyze the design issues in wireless sensor networks |
| CO4 | Develop ideas for pursuing student projects in wireless sensor networking domain |

**UNIT:1** **(10 Hours)**

**OVERVIEW OF WIRELESS SENSOR NETWORKS**

Introduction to wireless sensor networks - Challenges and Constraints - Application of sensor networks - Node architecture - Operating System - Fundamental aspects.

**UNIT: 2** **(12 Hours)**

**ARCHITECTURES**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**UNIT:3** **(4 Hours)**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**UNIT : 4** **(12 Hours)**

**INFRASTRUCTURE ESTABLISHMENT**

Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**SENSOR NETWORK PLATFORMS AND TOOLS**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Ref. Books :

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks Technology, Protocols, And Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7044** | **Satellite Communication** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To calculate the received carrier power at the input of earth station receiver or satellite transponder.

CEO2: To design domestic satellite system using small earth station.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Define And Describe the dynamics of the satellite. |
| CO2 | Calculate orbital parameters, look angles and learn the operation of launching method. |
| CO3 | Analyze the commands monitoring power systems and developments of antennas. |
| | Classify different multiple access techniques like TDMA, CDMA, FDMA, DAMA. |
| CO4 | Design antennas of Uplink and down link Frequency of Satellite real time applications |
| | Judge the impacts of GPS, Navigation, and NGSO constellation design for tracking. |

**UNIT: 1** **(12 Hours)**

**INTRODUCTION TO SATELLITE COMMUNICATION:** Orbital mechanics and parameters look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System ; Transponders,

**SATELLITE LINK DESIGN:** Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

**UNIT:2** **(10 Hours)**

**ANALOG TELEPHONE AND TELEVISION TRANSMISSION**: Energy dispersal, digital transmission

**MULTIPLE ACCESSES**: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA; Spread Spectrum Transmission and Reception; Estimating Channel requirements, SPADE, Random access

**UNIT:3** **(11 Hours)**

**PROPAGATION ON SATELLITE**: Earth paths and influence on link design; Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects.

**SATELLITE ANTENNAS**: Types of antenna and relationships; Basic Antennas Theory – linear, rectangular & circular aperture; Gain, pointing loss,

**UNIT:4** **(07 Hours)**

**EARTH STATION TECHNOLOGY:** Earth station design; Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,

**DESIGN OF SMALL EARTH STATION ANTENNAS:** Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Invited Guest lecture/ Demonstration. etc.

Text Books


1. Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2nd Edition.
2. Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016


Ref. Books


1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI
2. Satellite Communication, Robert M. Gagliardi, CBS Publishers

3. Satellitte Communication Systems, Richharia. BSP BOOKS PVT LTD.
4. Satellitte Communication Engg., MichealKolawole, BSP BOOKS PVT LTD

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7045** | **Object Oriented Analysis and Design** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Introduce the students to Object Oriented Analysis and Modeling using the Unified Modeling Language (UML)

CEO2: Familiarize them with the models used in UML, including static as well as dynamic \ (behavioural) models

CEO3: Make the students appreciate the importance of system architecture and system design in product development

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Use UML to model a complex system by defining actors and use cases and constructing class models |
| CO2 | Analyze the dynamics of a system using Activity, Sequence, State, and Process models |
| CO3 | Depict the architecture of a software system by using component and deployment models, and design a database based on a class model |
| CO4 | Use GRASP and SOLID principles in the design of software |

**UNIT:1** **(10 Hours)**

**INTRODUCTION**: Complexity- Structure of complex of systems, Inherent complexity of software, attributes of a complex system, Evolution of object models – Foundations of Object model, Elements of Object model – Major elements: Abstraction, Encapsulation, Modularity and Hierarchy- Minor elements Typing, Concurrency, Persistence (5+2)

**UNIT:2** **(14 Hours)**

**CLASSES AND OBJECTS** – Nature of an object- Relationships among objects – Nature of class – Relationship among classes – Interplay of Classes and objects- on building quality classes and objects Classification: Importance of Proper Classification- Identifying classes and objects –Key Abstractions and Mechanisms

**METHODOLOGY AND MODELING**: Object Oriented methodologies - Introduction, Survey of some Object oriented methodologies – Rumbaugh, Booch, Jacobson ,Patterns, Frameworks, Unified approach

**UNIT:3** **(12 Hours)**

**UNIFIED MODELING LANGUAGE**: Introduction – Diagram Taxonomy, static and dynamic models

**CLASS DIAGRAM**: Notation- Object diagram, Class interface notation, Binary Association notation, Association Rule, Qualifier, Multiplicity, OR Association, Association Class, N-ary association, Aggregation and Composition, Generalization

**USE CASE MODELING:** Components of a use case diagram- Use case identification and description-construction

**UNIT:4** **(10 Hours)**

**UML DYNAMIC MODELING**: UML Interaction DIAGRAMS: Sequence Diagrams, Collaboration Diagrams- UML State chart diagram, UML Activity diagram, Implementation diagrams: Component diagram, Deployment diagram

**MODEL MANAGEMENT:** Packages and Model Organization, UML Extensibility: Model constraints and comments, note, stereotype – UML metamodel CASE STUDIES: Object Oriented Analysis process, Object oriented Design process - Automatic Teller Machine

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Grady Booch, Robert A.Maksimchuk, Michael. W. Engle, Bobbi J. Young, JIM Conallen, Kelli A. Houston “Object Oriented Analysis and Design with Applications”, Pearson Education Inc., USA, 2010

2. Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, Singapore, 2008.

Ref. Books

1. Rumbaugh J, Blaha M, Premerlani W, Eddy F and Lorensen W, “Object Oriented Modeling and Design”, Prentice Hall of India/ Pearson Education, New Delhi, 2004.

2. Kendall Scott, martin Fowler, “UML Distiled : A brief guide to the standard Object modeling Language “, Addison Wesley, USA, 2009

3. Atul Kahate, “ Objetct Oriented Analysis and Design “, Tata McGraw-Hill , New Delhi 2007. 4. Sudha Sadasivam G., “ Object-Oriented Analysis and Design”, Macmillian India, New Delhi, 2009.

| Title of the Subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE7046** | SECURE SOFTWARE ENGINEERING | **3** | **0** | **0** | **3** | |

Pre -Requisite:

**Course Educational Objective**

CEO1: Students will demonstrate an understanding of the proper contents of a software requirements document for secure software engineering.

CEO2: Students will author a formal specification for secure software systems.

CEO3: Students will be able to identify specific components of a software design that can be targeted for reuse.

CEO4: Students will author a software testing plan and metrics for secure software engineering.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Incorporate requirements into secured software development process and test software for security vulnerability |
| CO2 | Identifying vulnerable code in implemented software and describe attack consequences |
| CO3 | Applying mitigation and implementation practices to construct attack resistant software |
| CO4 | Examining features of different security metrics. |

**UNIT:1** **(10 Hours)**

**Why Is Security a Software Issue?** Introduction, The problem, Software assurance and software security, Threats to software security, Sources of software insecurity, The benefits of detecting software security defects early, Managing secure software development.

**What Makes Software Secure?** Defining properties of secure software, How to influence the security properties of software, How to assert and specify desired security properties.

**UNIT:2** **(12 Hours)**

Requirements Engineering for Secure Software Introduction, Misuse and Abuse Cases, The SQUARE process model: SQUARE sample outputs, Requirements elicitation, Requirements Prioritization. Secure Software Architecture and Design Introduction, Software security practices for architecture and design: Architectural risk analysis.

**Software security knowledge for architecture and design**: Security principles, Security guidelines, and Attack patterns.

**UNIT:3** **(12 Hours)**

Considerations for Secure Coding and Testing Introduction, Code analysis, Coding practices, Software security testing, Security testing considerations throughout the SDLC. Security and Complexity: System Assembly Challenges Introduction, Security failures, Functional and attacker perspectives for security analysis, System complexity drivers and security, Deep technical problem complexity.

**UNIT:4** **(12 Hours)**

Governance, and Managing for More Secure Software Introduction, Governance and security, Adopting an enterprise software security framework, How much security is enough?, Security and project management, maturity of practice.

**Security Metrics:** Defining security metrics, Diagnosing problems and measuring technical security, Analysis techniques, Organize, aggregate, and analyze data to bring out key insights.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books: 1. Software Security Engineering: A Guide for Project Managers, by Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Addison-Wesley , 1st edition, 2008.

2. Security Metrics: Replacing Fear, Uncertainty, and Doubt , by Andrew Jaquith, AddisonWesley , 1st edition , 2007.

Ref. Books:

1. Integrating Security and Software Engineering: Advances and Future Vision, by Haralambos Mouratidis, Paolo Giorgini, IGI Global, 2006.
2. Software Security: Building Security In , by Gary McGraw , Addison-Wesley, 2006
3. The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities, by Mark Dowd, John McDonald, Justin Schuh, Addison-Wesley, 1st edition, 2006
4. Building Secure Software: How to Avoid Security Problems the Right Way by John Viega,Gary McGraw, Addison-Wesley, 2001
5. Writing Secure Code, by M. Howard, D. LeBlanc, Microsoft Press, 2nd Edition, 2003.
6. Exploiting Software: How to break code, by G. Hoglund, G. McGraw, Addison Wesley, 2004.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| BAEOE7051 | **Sensor Technology** | **3** | **0** | **0** | **3** | |
| Pre -Requisite: | | | | | | |

| **Course Educational Objective** | |
|---|---|
| CEO1: | |
| **Course Outcome:** At the end of the course, the student will be capable of | |
| CO1 | Understanding Sensors and there interaction with environment. |
| CO2 | Clear Idea of Physical Principles of Sensing |
| CO3 | Practical implementation of interfacing sensors with micro-controllers |
| CO4 | Analyze and understand various applications of sensors |

**UNIT:1 (08 Hours)**

Sensors Fundamentals and Characteristics Sensors, Signals and Systems; Sensor Classification; Units of Measurements; Sensor Characteristics

**UNIT:2 (14 Hours)**

Physical Principles of Sensing Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements Interface Electronic Circuits Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors

**UNIT:3 (10 Hours)**

Sensors in Different Application Area Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors Sensor Materials and Technologies :Materials, Surface Processing, Nano-Technology.

**UNIT:4 (12 Hours)**

Applications of different sensors.

Chemical Sensors: Blood –Gas and Acid –base physiology Electrochemical sensors, Chemical Fibro sensors, Iron-Selective Field-Effect Transistor (ISFET), Immunologically Sensitive Field Effect Transistor (IMFET) , Integrated flow sensor and Blood Glucose sensors.

Optical Sensors: Fiber optic light propagation, Graded index fibers, Fiber optic communication driver circuits, Laser classifications, Driver circuits for solid –state laser diodes, Radiation sensors and Optical combinations

Biomedical Sensors: Sensors Terminology in human body, Introduction, Cell, Body Fluids

Musculoskeletal system, Bioelectric Amplifiers, Bioelectric Amplifiers for Multiple input Circuits, Differential Amplifiers, Physiological Pressure and other cardiovascular measurements and devices.

Aerospace Sensor: Laser Gyroscope and accelerometers. Sensors used in space and environmental applications.

Electrodes: –Electrodes for Biophysical sensing, Electrode model circuits, Microelectrodes,

ECG, EEG, electrodes ECG signals, waveforms, Standard lead system, Polarization Polarizable, Non polarizable electrodes and body surface recording electrodes. Ultrasonic Transducers for Measurement and therapy – radiation detectors – NIR spectroscopy .

Teaching Method(s): Chalk & Board/ PPT/ Internship/Industry Guest Lecture/ Demonstration.

Text Books :

1. Sensors Hand Book Sabaree Soloman - Sensors Hand Book, McGraw Hill,1998
2. Smith H.M. - Principles of Holography, John Wiley & Sons, New York, 1975
3. J.G. Webster Medical instrumentation Application and Design, Houghton Mifilin Co. 2004

Reference Book:

1. Carr and Brown - Introduction to Medical Equipment Technology, Addison Wesley. 1999
2. Culshaw B and Dakin J (Eds) Optical Fibre Sensors, Vol. 1 & 2 Artech House, Norwood. (1989)-
3. P. Garnell– Guided Weapon Control Systems – Pergamon Press. 1980
4. J. Fraden, Handbook of Modern Sensors:Physical, Designs, and Applications, AIP Press,

Springer
5. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi
6. Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited).

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| BAEOE7053 | **ADVANCE AUTOMATION** | **3** | **0** | **0** | **3** | |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |

| | |
|---|---|
| CEO1: | |
| **Course Outcome:** At the end of the course, the student will be capable of | |
| CO1 | Understand the current voltage characteristics of semiconductor devices |
| CO2 | Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation, |
| CO3 | Design and analyze of electronic circuits, |
| CO4 | Evaluate frequency response |

**UNIT:1** **(09 Hours)**

**Process Control: Introduction:** Process Definition, Feedback Control, PID Control, Multivariable Control. (Chapter 1 of Text Book 1)

**PID Controller Tuning:** Introduction, Zeigler-Nichols Tuning Method (Based on Ultimate Gain and Period, and Process Reaction Curve), Digital PID Controllers. (Chapter 13 of Text Book 2)

**UNIT:2** **(10 Hours)**

**Special Control Structures:** Cascade Control, Feedfroward Control, Feedfroward-Feedback Control Configuration, Ratio Control, Selective Control, Adaptive Control, Adaptive Control Configuration. (Chapter 10 and 11 of Text book 3)

**Actuators:** Introduction, Pneumatic Actuation, Hydraulic Actuation, Electric Actuation, Motor Actuators and Control Valves. (Chapter 8 of Text Book 1)

**UNIT:3** **(09 Hours)**

**Industrial Automation: Programmable Logic Controllers:** Introduction, Principles of operation, Architecture, Programming (Programming Languages, Ladder Diagram, Boolean Mnemonics) (Chapter 5 of Text Book 1)

**UNIT:4** **(10 Hours)**

**Distributed Control:** Distributed vs. Centralized, Advantages, Functional Requirements, System Architecture, Distributed Control Systems (DCS), Communication options in DCS.

**Real-time Programming:** Multi-tasking, Task Management, Inter-task Communication, Real-time Operating System. (Chapter 9 of Text Book 1)

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Krishna Kant, “Computer-Based Industrial Control”, PHI, 2009.
2. M. Gopal, “Digital Control and State Variable Methods” Tata McGraw Hill, 2003.
3. Surekha Bhanot, Process Control: Principles and Applications, Oxford university Press, 2010

Ref. Books:

1.Smith Carlos and Corripio, “Principles and Practice of Automatic Process Control”, John Wiley & Sons, 2006.
2. Jon Stenerson, “Industrial Automation and Process Control”, Prentice Hall, 2003.
3. C. Johnson, “Process Control Instrumentation Technology”, PHI, New Delhi
4. D.R. Coughnowr, “Process System analysis and Control”, McGraw Hill.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8011** | **Information Retrieval** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To understand information retrieval process.

CEO2: To understand concepts of clustering and how it is related to Information retrieval.

CEO3: To deal Storage, Organization & Access to Information Items.

CEO4: To evaluate the performance of IR system.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Student should be able to understand the concept of Information retrieval. |
| CO2 | Student should be able to deal with storage and retrieval process of text and multimedia data. |
| CO3 | Student should be able to evaluate performance of any information retrieval system. |
| CO4 | Student should be able to understand importance of recommender system. |

**UNIT:1** **(12 Hours)**

Introduction to information retrieval: Boolean retrieval, term vocabulary and postings list, index construction and optimization, vector-space model, computing scores, fuzzy string matching, content extraction, introduction to Apache Lucene

**UNIT:2** **(10 Hours)**

Web search: Web search basics, economic model of web search, search user experience, web crawling and indices, link analysis, the PageRank algorithm, building a complete search system using Apache (Nutch, Solr, Lucene)

**UNIT:3** **(10 Hours)**

Recommender systems: Introduction and taxonomy of recommender systems, collaborative filtering (user-user, item-item), and content based recommenders, evaluation of recommender systems, applications using Apache Mahout.

**UNIT:4** **(14 Hours)**

Text Classification and Clustering: Naïve Bayes, Multinomial and Bernoulli models, feature selection, evaluation of classification models, Vector space classification – Rocchio, kNN, SVM classifiers, use of NLP, applications using Apache Mahout , Clustering in information retrieval, clustering algorithms (flat, probabilistic, hierarchical), applications using Apache Mahout

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1**. Text Classification and Clustering:** Naïve Bayes, Multinomial and Bernoulli models, feature selection, evaluation of classification models, Vector space classification – Rocchio, kNN, SVM classifiers, use of NLP, applications using Apache Mahout , Clustering in information retrieval, clustering algorithms (flat, probabilistic, hierarchical), applications using Apache Mahout

Ref. Books 1

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8012** | **Bioinformatics** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To introduce students with Synthesis of DNA and RNA, major databases and applications in Bioinformatics along with classification schema.

CEO2: Study of various data visualization and statistical techniques to discover new patterns in protein structure, through Clustering and Classification

CEO3: Study of various Data Mining and Pattern Matching techniques for knowledge discovery in Bioinformatics Databases through sequence alignment algorithms.

CEO4: Analysis of various simulation tools in Bioinformatics for similarity search and study of prediction algorithms.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Understand basic DNA and RNA structure, features and classification schema for databases, applications in Bioinformatics. |
| CO2 | Use various statistical concepts and visualization tools to discover new patterns in Protein Structures and analyze randomness in data. |
| CO3 | Explore the various Bioinformatics Databases for knowledge discovery given by Data Mining and Pattern Matching techniques through study of various sequence alignment algorithms. |
| CO4 | Offer appropriate solutions for similarity search through similarity search and prediction algorithms. 5. Understand modeling and simulation in bioinformatics with the help of simulation and statistical protocols, basic drug discovery process. |

**UNIT:1** **(14 Hours)**

The Central Dogma ,The Killer Application, Parallel Universes, Watson's Definitio, Top Down Versus Bottom up, Information Flow, Convergence, Databases, Data Management, Data Life Cycle, Database Technology, Interfaces ,Implementation ,Networks , Geographical Scop, Communication Models ,Transmissions Technology, Protocols, Bandwidth ,Topology ,Hardware, Contents ,Security, Ownership,Implementation, Management

**UNIT:2** **(10 Hours)**

The search process, Search Engine Technology, Searching and Information Theory ,Computational methods, Search Engines and Knowledge Management, Data Visualization ,sequence visualization, structure visualization, user Interface,Animation Versus simulation ,General Purpose Technologies.

**UNIT:3** **(12 Hours)**

Statistical concepts , Microarrays ,Imperfect Data, Randomness, Variability,Approximation ,Interface Noise, Assumptions ,Sampling and Distributions,Hypothesis Testing, Quantifying Randomness ,Data Analysis ,Tool selection statistics of Alignment,Clustering and Classification ,Data Mining, Methods ,Selection and Sampling ,Preprocessing and Cleaning , Transformation and Reduction ,Data Mining Methods, Evaluation ,Visualization, Designing new queries, Pattern Recognition and Discovery ,Machine Learning ,Text Mining, Tools.

**UNIT:4** **(12 Hours)**

Pair wise sequence alignment, Local versus global alignment,Multiple sequence alignment, Computational methods, Dot Matrix analysis ,Substitution matrices,Dynamic Programming ,Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming ,Progressive strategies, Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities ,Sequence Databases. Drug Discovery ,components, process, Perspectives ,Numeric considerations, Algorithms ,Hardware, Issues, Protein structure, Ab Initio Method, Heuristic methods, Systems Biolo, Tools, Collaboration and Communications, standards, Issues ,Security, Intellectual property.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

| |
|---|
| 1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education,2003.<br>2. D. E. Krane and M. L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.<br>3. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2003. 4. J. H. Zar, Biostatistical Analysis, 4/e, Pearson Education, 1999. |
| Ref. Books 1 |

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8013** | **Client Server Computing** | **3** | **0** | **0** | **3** | **A** |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |

| | |
|---|---|
| CEO1: Gain Exposure on most common used servers. | |
| CEO2: Understand the concept of client-server development and learn problem solving skills through design scenarios for network environment | |
| CEO3: Develop a client –server based application. | |
| **Course Outcome:** At the end of the course, the student will be capable of | |
| CO1 | Define the underlying concepts in client server development using common access databases |
| CO2 | Devise popular servers with two tier scenarios |
| CO3 | Design and Set up a client /server environment using LAN and WAN Scenarios. |
| CO4 | Describe the concept of middleware, and communication protocols |

**UNIT:1** **(10 Hours)**

**INTRODUCTION :**Client Server Computing, Benefits, Evolution of client server computing, Client Server Applications, Components, Classes of Client Server Computing – Categories of Client Server Computing

**UNIT:2** **(10 Hours)**

**CLIENT/SERVER OPERATING SYSTEMS:** Dispelling the myths, Obstacles upfront and hidden, open systems and standards, factors needed for success. Standards setting organizations

**UNIT:3** **(14 Hours)**

**THE CLIENT AND THE SERVER :**Client Hardware and software, Client components, Client Operating Systems, GUI, X windows and Windowing, Database Access Application Logic, Client Software Products, Client Requirements, Server Hardware, Categories, Features classes of Server Machines, Server Environment, Network management environment, network Computing Environment, Network Operating Systems, Server requirements, Platform Independence, Transaction Processing, Connectivity. Server Data Management and Access Tools

**UNIT:4** **(12 Hours)**

**LIENT SERVER AND INTERNET:** Client server and internet, Web client server, 3 tier client server web style, CGI , the server side of web, CGI and State, SQL database servers, Middleware and federated databases, data warehouses, EIS/DSS to data mining, GroupWare Server , what is GroupWare, components of GroupWare.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:


1. Dawana Travis Dewire, “Client Server Computing”, Tata Mc-Graw Hill Education Pvt. Ltd.,New Delhi, 2003
2. Robert Orfali, Dan Harkey & Jeri Edwards, “Essential Client/Server Survival Guide”,second edition, John Wiley & Sons, Singapore, 2003.


Ref. Books:


1. Eric J Johnson, “A complete guide to Client / Server Computing”, first edition, Prentice Hall,New Delhi, 2001.
2. Smith & Guengerich, “Client /Server Computing”, Prentice Hall, New Delhi, 2002
3. James E.Goldman, Phillip T.Rawles, Julie R.Mariga,“Client/Server Information Systems, A Business Oriented Approach”, John Wiley & Sons, Singapore, 2000.


| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8014** | **Parallel Computing** | **3** | **0** | **0** | **3** | **A** |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |

CEO1: Understand various models of parallel computations such as threads, OpenMP, MPI, clusters.

CEO2: Develop programs using parallel languages and appreciate parallel compilers using parallel architectures.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Design efficient parallel algorithms and applications. |
| CO2 | Analyse the effectiveness of any parallel program. |

**UNIT:1** **(14 Hours)**

Computer Architecture and Systems: Memory Subsystem & Cache , Shared Memory Systems :Memory Consistency Models , Cache Coherence AND Distributed Memory Systems : Message Passing, Network Topologies , Synchronization , Primitives and Implementation: Locking, Barrier, Semaphore , Probs: Deadlock, Livelock, Starvation, Priority Inv., Race Cond,Architecture : Multicore , Manycore , GPU , Vector Machines , Multithreading.

**UNIT:2** **(12 Hours)**

Data/Task Distribution: Load Balancing: Static and Dynamic Graph Partitioning: Algorithms ,Locality in Simulation : cyclic, blocked, block-cyclic data distribution,surface to volume minimization , Exascale challenges : Fault tolerance , Communication (memory hierarchy) , Power management

**UNIT:3** **(12 Hours)**

Languages/Libraries : Data Parallel Languages: CUDA, Global Address Space Languages: UPC, Compiler-aided Parallelization: Open MP, Message-Passing Library: MPI, Performance modeling of Networks: PRAM, Alpha/Beta Model, LogP/LogGP, Roofline Model

**UNIT:4** **(10 Hours)**

Applications/Algorithms : Dense/Sparse Linear Algebra : Matrix Multiplication (Canon's algorithm, SUMMA, Vasily's study, Gaussian Elimination, LU , Sparse GE/LU, sparse matrix storage ,Autotuning , N-Body/Particle Simulations , Barnes Hut , FMM , Finite Difference Approximations to PDEs , Jacobi, SOR, conjugate gradients, Multigrid , FFT , Structured and Unstructured Grids , AMR , Graph Algorithms ,scans on GPU , pointer-jumping , list ranking , parallel prefix

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books


1. James Demmel, CS267 Applications of Parallel Computers Lectures, 2010,
2. John L. Hennessy and David A. Patterson, Computer Architecture~ A quantitative Approach (Fourth Edition), Morgan Kaufman Publishers, San Francisco, CA, 2007
3. David E. Culler, Jaswinder Pal Singh and Anoop Gupta, Parallel Computer Architecture - A Hardware/Software Approach, Morgan Kaufman Publishers, San Francisco, CA, 1999
4. Jack Dongarra et al., Sourcebook of Parallel Computing, Morgan Kaufman Publishers, San Francisco, CA, 2003


Ref. Books 1
2
3

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8015** | **Software for Embedded System** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To discuss about real-time and quality of service system principles.

CEO2: Develop knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware and wide competence from different areas of technology.

CEO3: To educate students to meet current and future industrial challenges and emerging embedded systems engineering trends.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Gain knowledge of architectural aspects, interfacing and programming details for microcontroller |
| CO2 | Familiar with embedded system's hardware components and software tool chain. |
| CO3 | Develop systems with RTOS features like inter process communication, process synchronization techniques, and process scheduling algorithms. |
| CO4 | Design an embedded system, Debug and test it |

**UNIT:1** **(10 Hours)**

**POGRAMMING EMBEDDED SYSTEMS**: Embedded Progra, Role of Infinite loo, Compiling, Linking and locating ,downloading and debugging, Emulators and simulators processor ,External peripherals, Memory testing ,Flash Memory.

**UNIT:2** **(14 Hours)**

**OPERATING SYSTEM:** Embedded operating system,Real time characteristics ,Selection process, Flashing the LED,serial ports, Zilog 85230 serial controlled code efficiency, Code size ,Reducing memory usage ,Impact of C++.

**HARDWARE FUNDAMENTALS**: Buses, DMA ,interrupts, Built-ins on the microprocessor, Conventions used on schematics, Microprocessor Architectures, Software Architectures, RTOS Architectures ,Selecting and Architecture.

**UNIT:3** **(10 Hours)**

**RTOS :**Tasks and Task states, Semaphores, Shared data, Message queues, Mail boxes and pipes, Memory management ,Interrupt routines, Encapsulating semaphore and queues, Hard Real-time scheduling, Power saving.

**UNIT:4** **(10 Hours)**

**EMBEDDED SOFTWARE DEVELOPMENT TOOLS:** Host and target machines, Linkers Locators for Embedded Softwar, Debugging techniques, Instruction set simulators Laboratory tools, Practical example ,Source code.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. David E.Simon, "An Embedded Software Primer", Perason Education, 2003.
2. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8021** | **Pattern Recognition** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To study the Pattern Recognition techniques and its applications

CEO2: To learn the fundamentals of Pattern Recognition techniques

CEO3: To learn the various Statistical Pattern recognition techniques

CEO4: To learn the various Syntactical Pattern recognition techniques

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Understand the major concepts and techniques in pattern recognition. |
| CO2 | Identify classes of images. |
| CO3 | Analyze classifying features in images or patterns |
| CO4 | Design various classification algorithm & pattern recognition systems |

**UNIT:1** **(10 Hours)**

**PATTERN RECOGNITION OVERVIEW:** Pattern recognition, Classification and Description Patterns and feature Extraction with Examples—Training and Learning in PR systems Pattern recognition Approaches

**UNIT:2** **(14 Hours)**

**STATISTICAL PATTERN RECOGNITION**: Introduction to statistical Pattern Recognition supervised Learning using Parametric and Non Parametric Approaches.

**LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING**: Introduction—Discrete and binary Classification problems—Techniques to directly Obtain linear Classifiers -- Formulation of Unsupervised Learning Problems—Clustering for unsupervised learning and classification.

**UNIT:3** **(10 Hours)**

**SYNTACTIC PATTERN RECOGNITION**: Overview of Syntactic Pattern Recognition—Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition—Learning via grammatical inference.

**UNIT:4** **(10 Hours)**

**NEURAL PATTERN RECOGNITION**: Introduction to Neural networks—Feed forward Networks and training by Back Propagation—Content Addressable Memory Approaches and Unsupervised Learning in Neural PR.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Robert Schalkoff, “Pattern Recognition: Statistical Structural and Neural Approaches”, John wiley & sons , Inc,1992.

2. Earl Gose, Richard johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India,.Pvt Ltd, New Delhi, 1996.

3. Duda R.O., P.E.Hart & D.G Stork, “ Pattern Classification”, 2nd Edition, J.Wiley Inc2001

4. Duda R.O.& Hart P.E., “Pattern Classification and Scene Analysis”, J.wiley Inc, 1973.

5. Bishop C.M., “Neural Networks for Pattern Recognition”, Oxford University Press, 1995.

Ref. Books 1

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8022** | **Human Computer Interface** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To stress the importance of a good interface design.

CEO2: To understand the importance of human psychology in designing good interfaces

CEO3: To motivate students to apply HMI in their day – to – day activities.

CEO4: To bring out the creativity in each student – build innovative applications that are user friendly.

CEO5: To encourage students to indulge into research in Machine Interface Design.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Learner will be able to… |
| CO2 | To design user centric interfaces. |
| CO3 | To design innovative and user friendly interfaces. |
| CO4 | To apply HMI in their day-to-day activities. |

**UNIT:1** **(10 Hours)**

Introduction: Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields. The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error;

**UNIT:2** **(14 Hours)**

Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals. **GUI** : benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.

**UNIT:3** **(12 Hours)**

perception, Gesalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time**. Interaction styles** menus; windows; device based controls, screen based controls;

**UNIT:4** **(10 Hours)**

**Communication**: text messages; feedback and guidance; graphics, icons and images; colours

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:


1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale “Human Computer Interaction”, Prentice Hall.
2. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication.
4. Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.
5. Donald A. Normann, “Design of everyday things”, Basic Books; Reprint edition 2002.


Ref. Books


1. Donald A. Norman, “The design of everyday things”, Basic books.
2. Rogers Sharp Preece, “Interaction Design:Beyond Human Computer Interaction”, Wiley.
3. Guy A. Boy “The Handbook of Human Machine Interaction”, Ashgate publishing Ltd.

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8023** | **Social Networking** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: Provide students background on concept of various types and kinds of Social Networks, their structural properties and related measures

CEO2: Train students to observe and measure unique aspects of network formation and growth of social networks

CEO3: Enable students to understand social phenomena such as diffusion and cascades.

CEO4: Expose students to Strategic Networks, the incentive model for connection formation

CEO5: Expose students to Game theory and Games on Networks , concepts related to strategies and optimality

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Model a given scenario/problem as a network, evaluate the type and kind of such a network and measure structural properties of that network. |
| CO2 | Apply algorithms to detect communities and decipher phenomena peculiar to social networks such as small worlds and power laws |
| CO3 | Model a social process such as spread of information and diseases using diffusion model. |
| CO4 | Model and analyze strategic networks and measure networkproperties. |

**UNIT:1** **(10 Hours)**

**Background and Fundamentals of network analysis:** Introduction to Networks and Examples, Ego-centric Networks, Exchange Networks, Graph-Theory, Directions and Weights, Adjacency Matrices, homophily, Tie-strengths and structural holes**.** Representing and Measuring Networks: Degree distribution, diameters, path-lengths, centrality, closures, clustering

**UNIT:2** **(10 Hours)**

**Models of Network formation:** Random Networks, Small World,Growing Random Networks, Growth Models, Distribution of expected degrees, Preferential attachment, Fat tails, Power Laws, Fat Tails, Scale-free networks, Affiliation Networks, Cliques and Cores, Cohesion, Communities and Community Detection Algorithms

**UNIT:3** **(12 Hours)**

**Implications of Network Structure:** Diffusion through Networks:-The Bass Model, Diffusion in Random networks, Giant Components, Models to study disease and information spreads, Cascades and Contagions , Assortativity, Percolation and Robustness of Networks, Effects of communities and centralities on diffusion

**UNIT:4** **(14 Hours)**

**Strategic Networks and Games on Networks:** Economic Game Theoretic Models of Network Formation, Connections Model, Pair-wise Stability, Efficient and Pareto-efficient networks, Externalities and Coauthor Models, Pair-wise Nash Stability, Complements and Substitutes.

Introduction to Games, Reasoning about behavior in a Game, Prisoner's Dilemma, Best response and Dominant Strategies, Nash Equilibrium, Multiple equilibriums:Co-ordination Games, Hawk-Dove Game, Mixed Strategies, Pareto Optimality and Social Optimality**.**

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

| Text Books 1<br>2 |
|---|
| Ref. Books:<br>1.“Introduction to Social Network Methods”, Robert A. Hanneman, University of California Riverside, 2005.<br>2.“Social and Economic Networks”, Mathew O Jackson, Princeton University Press, 2008.<br>3.“Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, D. Easley and J. Kleinberg, Cambridge University Press, 2010. |

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |

| BCSPE8024 | Cyber Security | 3 | 0 | 0 | 3 | A |
|---|---|---|---|---|---|---|

Pre -Requisite:

**Course Educational Objective**

CEO1: Understand the essentials of information security.

CEO2: Learn the algorithms for implementing security

CEO3 To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Students shall be able to understand what are the common threats faced today |
| CO2 | What is the foundational theory behind information security |
| CO3 | What are the basic principles and techniques when designing a secure system |
| CO4 | How today's attacks and defenses work in practice |

**UNIT:1** **(14 Hours)**

Introduction to security- Cyber Intrusions and Security: Cyberbullies, Online Reputation Attacks, Reputation Management, Protecting from Cyberbullies, Phishing, Recognizing Phishing trip, Protection from Phisher's hook up, Online Shopping Basics, Hijackers, Ensuring Safe Shopping, Security Tokens, Cookies, Making cookies work for you, tips for staying Safe and Social, Meeting People Online, Liars, Creeps, Cyberstalkers, Protecting yourself from creeps, Internet Monitoring CIA triad-Case studies- security attacks-issues related to social networking – Guidelines

**UNIT:2** **(12 Hours)**

METHODS TO SECUREYOURSELF IN THE CYBER WORLD AND SECURE TRANSACTIONS: Why and What of Reversible and Irreversible Cryptographic mechanisms? -Applications of Digital Signature - Good password practices, What is E-commerce?–Online banking security- Online shopping fraud-Guidelines and Recommendations

**UNIT:3** **(10 Hours)**

EVERYDAY SECURITY: Connecting your laptop, mobile devices, PDAs to Internet-Managing your browser - Face book Security-E-mail security, Safe guarding from Viruses, Antivirus.

**UNIT:4** **(10 Hours)**

CYBER SECURITY LAWS AND COMPETENT AUTHORITIES: Indian IT Act, 2008 - What is Cyber Forensics? – Functions of cybercrime cell ,Responding to a cyber attack

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. "Information Security Awareness Handbook, ISEA, Department of Electronics and Information Technology", Government of India, 2010
2. Cyber Security by Godbole, Wiley India

Ref. Books 1

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCSPE8025** | **Software Project Management** | **3** | **0** | **0** | **3** | **A** |

Pre -Requisite:

**Course Educational Objective**

CEO1: To outline the need for Software Project Management

CEO2: To highlight different techniques for software cost estimation and activity planning.

CEO3: At the end of the course the students will be able to practice Project Management principles while developing software.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Develop increased awareness in project planning, scheduling, tracking, risk analysis and Project cost estimation. |
| CO2 | Apply the report writing techniques and standards to project report. |
| CO3 | Monitoring the progress of projects and to assess & evaluate the risk of project. |
| CO4 | To identify the factors that influence people's behavior in a project environment and selection of appropriate people for the project and to improve group working. |

**UNIT:1** **(10 Hours)**

**Project evaluation and project planning**: Importance of Software Project Management ,Activities Methodologies, types of Software Projects ,Setting objectives ,Management Principles ,Management Control , Project portfolio Management, Cost-benefit evaluation technology , Strategic program Management , Stepwise Project Planning.

**UNIT:2** **(12 Hours)**

**Project life cycle and effort estimation**: Engineering and production stages, inception, Elaboration, construction, transition phases. Process Models, Choice of Process models, Rapid Application development ,Agile methods, Extreme Programming ,SCRUM ,Managing interactive processes ,Basics of Software estimation: Effort and Cost estimation techniques, COSMIC Full function points , COCOMO II A Parametric Productivity Model ,Staffing Pattern.

**UNIT:3** **(14 Hours)**

**Activity planning and risk management and control :** Objectives of Activity planning, Project schedules ,Activities Sequencing and scheduling ,Network Planning models , Forward Pass & Backward Pass techniques, Critical path (CRM) method ,Risk identification ,Assessment, Monitoring , PERT technique ,Monte Carlo simulation ,Resource Allocation, Creation of critical patterns, Cost schedules. Framework for Management and control, Collection of data Project termination ,Visualizing progress, Cost monitoring ,Earned Value Analysis, Project tracking ,Change control, Software Configuration Management ,Managing contracts, Contract Management.

**UNIT:4** **(10 Hours)**

**Staffing in software projects** :Managing people , Organizational behavior, Best methods of staff selection, Motivation ,The Oldham, Hackman job characteristic model, Ethical and Programmed concerns, Working in teams, Decision making ,Team structures, Virtual teams , Communications genres ,Communication plans**.** Process Automation**:** Automation Building blocks, The Project Environment.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books 1


1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.
3. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.

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|---|
| 4. Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013. |
| Ref. Books 1. Royce, “Software Project Management”, Pearson Education, 1999.<br>2. Jalote, “Software Project Management in Practice”, Pearson Education, 2002. |

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |

| BCSPE8026 | Software Usability Engineering | 3 | 0 | 0 | 3 | A |
|---|---|---|---|---|---|---|

Pre -Requisite:

**Course Educational Objective**

CEO1: To introduce the need for human-computer-interaction study or human-centered software design.

CEO2: To explain usability engineering lifecycle for designing a user-friendly software

CEO3:To familiarize information, interaction and GUI design process for enhancing user-experience:

CEO4: To develop usability evaluation skills for software testing.

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Justify the need to study human-computer-interaction or human-factors while designing software. |
| CO2 | Discuss the process of designing user-friendly software based on usability engineering guidelines |
| CO3 | Apply interaction design and UI design process in enhancing user-experience of an application. |
| CO4 | Conduct usability evaluation of user-interfaces or software applications. |

**UNIT:1** **(12 Hours)**

**HCI AND USABILITY** :What is HCI design? Disciplines contributing to HCI, Psychology of everyday things, Importance of human factors in design, Need Satisfaction curve of technology, Levels of human computer interaction What is Usability? benefits and cost savings, usability slogans, attributes of system acceptability, definition of usability, usability trade-Offs , categories of users and individual user differences, generations of user interfaces, scenario-based usability engineering case study - A Virtual Science Fair.

**THE USABILITY ENGINEERING LIFECYCLE** :know the user, user-profile questionnaire, field-study◊User research and requirements analysis methods, contextual inquiry and analysis, hierarchical task analysis, ethnography, cultural probe, affinity diagramming, persona, scenarios of use, use cases. setting usability criteria or goals, participatory design (getting users involved),◊Iterative Design guidelines and heuristic evaluation, prototyping and scenarios , examples of problem scenarios, iterative design, interface evaluation, meta methods. simple and natural dialogue, speak the users' language, minimize user memory◊Usability Heuristics load, consistency, feedback, clearly marked exits, shortcuts, good error messages, prevent errors, help and documentation, heuristic evaluation.

**UNIT:2** **(8 Hours)**

**INFORMATION DESIGN AND INTERACTION DESIGN** : Information architecture concepts, stages of action in human-computer◊Information design interaction, perceiving information, interpreting information, making sense of information. selecting system goal, planning action sequence, executing action sequence, study of information and interaction design Goals of UID, User Interface Models , conceptual model and mock-ups of GUI,User Interface Design choosing prototyping alternatives - paper prototyping, rapid prototyping, storyboarding, wireframes, Cost/benefit of good interface design , Case Study.

**UNIT:3** **(12 Hours)**

**USABILITY EVALUATION** :Developing usability specifications for evaluation - case study, criteria for user feedback techniques, formative and summative techniques of evaluation heuristic evaluation, user-interface guideline reviews,◊Usability Inspections (testing without users) cognitive walkthrough, model-based analysis developing usability or test specifications with case study , test◊Usability Testing (testing with users) goals and test plans , getting test users, choosing experimenters, ethical aspects of tests with human subjects, test tasks, stages of a test, performance measurement, thinking-aloud testing, usability laboratories, remote evaluation, observation, user satisfaction questionnaire (rating scale), interviews,◊Methods beyond testing system usability scale (SUS), focus groups, logging actual use, user feedback, choosing a methods.

**UNIT:4** **(14 Hours)**

**USER-INTERFACE AND USABILITY STANDARDS**: User benefits, vendor benefits, dangers of standards, principles of good UI design, national international standards, internationalization - international GUI, guidelines for internationalization , localization and multilocale interfaces, UI standards - control standards, window standards, dialog box standards, message box standards, device interaction standards, feedback standards, developing style guides and toolkits , user documentation- manuals, tutorials, information in the interface

**RECENT ADVANCES AND TRENDS** : Theoretical solutions, technological solutions, CAUSE tools, emerging paradigms of user interaction collaborative systems, ubiquitous computing , intelligent user-interfaces , simulation and virtual reality , case study , usability issues in organizations- case studies , organizational roles and structures , ethics of usability, web analytics.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:


1. Nielsen, J. (1994), “Usability Engineering”, Elsevier.
2. Rosson, M. B., & Carroll, J. M. (2001), “ Usability Engineering: Scenario-Based development of human-computer interaction”, Elsevier.
3. Mayhew, D. (1999), “The Usability Engineering Lifecycle: A Practitioner's Handbook for user interface design”, Morgan Kaufmann


Ref. Books:


1. Cooper A. et. al. (2007), “ The Essentials of Interaction Design”, Wiley
2. Cooper, A. (1995),” The Essentials of User Interface Design”, IDG Books, New Delhi
3. Schneiderman, B. (2005), “ Designing the User Interface”, Pearson Education, New Delhi
4. Dix A. et. al.(1993), “ Human - Computer Interaction”, Prentice Hall, USA

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BCHOE8032** | **POLLUTION AND ITS CONTROL** | **3** | **0** | **0** | **3** | |

Pre -Requisite:

**Course Educational Objective**

CEO1:

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Explain about the different types of solid waste |
| CO2 | Understand the various collection and disposal method |
| CO3 | Apply the knowledge to utilize solid waste in different way. |
| CO4 | Develop new method for degradation process of solid waste |

**UNIT:1**

Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards.Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

**UNIT:2**

Industrial wastewater Management: – Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

**UNIT:3**

Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling. Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal method

**UNIT:4**

Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods. Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

**Text Books:**

1: Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003.

2: Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.

**Ref. Books:** 1. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill

| Title of the subject | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | | L | T | P | C | QP |
| BECOE8031 | **SATELLITE COMMUNICATION** | **3** | **0** | **0** | **3** | |
| Pre -Requisite: | | | | | | |
| **Course Educational Objective** | | | | | | |
| CEO1: | | | | | | |
| **Course Outcome:** At the end of the course, the student will be capable of | | | | | | |
| CO1 | Understand the motion of satellite in the orbit and its link design. | | | | | |
| CO2 | Compute the coverage angle, angle of visibility and consequently determine the coverage area. | | | | | |
| CO3 | Demonstrate the impacts of GPS, Navigation, constellation design for tracking and launching with various multiple access techniques like TDMA, CDMA, FDMA, and DAMA | | | | | |
| CO4 | Relate the coverage area with the beam width of satellite antenna and analyze the propagation on satellite with hydrometric and non-hydrometric effect. | | | | | |
| CO5 | Design antenna systems to accommodate the needs of a particular satellite system. | | | | | |
| CO6 | Able to study the design of Earth station and tracking of the satellites. | | | | | |

**UNIT:1**

INTRODUCTION TO SATELLITE COMMUNICATION: Orbital mechanics and parameters look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System ; Transponders,

SATELLITE LINK DESIGN: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

**UNIT:2**

ANALOG TELEPHONE AND TELEVISION TRANSMISSION: Energy dispersal, digital transmission

MULTIPLE ACCESSES: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA; Spread Spectrum Transmission and Reception; Estimating Channel requirements, SPADE, Random access

**UNIT:3**

PROPAGATION ON SATELLITE: Earth paths and influence on link design; Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects.

SATELLITE ANTENNAS: Types of antenna and relationships; Basic Antennas Theory – linear, rectangular & circular aperture; Gain, pointing loss,

**UNIT:4**

EARTH STATION TECHNOLOGY: Earth station design; Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,

DESIGN OF SMALL EARTH STATION ANTENNAS: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

TEXT BOOKS

1. Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2nd Edition.
2. Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016

Ref. Books:

1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI
2. Satellite Communication, Robert M. Gagliardi, CBS Publishers
3. Satellites Communication Systems, Richharia. BSP BOOKS PVT LTD.

4. Satellites Communication Engg., MichealKolawole, BSP BOOKS PVT LTD

| Title of the Subject | | | | | | |
|---|---|---|---|---|---|---|
| Course Code | | L | T | P | C | QP |
| **BMEPE8014** | **ADVANCED COMPUTER GRAPHICS AND SOLID MODELING** | **3** | **0** | **0** | **3** | |

Pre -Requisite:

**Course Educational Objective**

CEO1: To Introduce various Graphics Applications in real world scenario Introduce advanced techniques for creating, manipulating, and editing solid models.

CEO2: Refine solid modeling, assembly modeling, and engineering drawing skills using commercial software.

CEO3: Introduce computer animation as a technical presentation method.

CEO4: To be learn more about 2D, 3D and Curve applications Applying efficient graphics technique to solve engineering problems

**Course Outcome:** At the end of the course, the student will be capable of

| | |
|---|---|
| CO1 | Explain about graphics primitives and work with coordinate spaces, coordinate conversion, and transformations of graphics objects. |
| CO2 | Analyse line, circle, ellipse and character generation algorithms. |
| CO3 | Explain various 3D projections and current models for curves and surfaces. |
| CO4 | Apply appropriate techniques and by using modern tools, to generate & analyse 3D solid models in order to solve Mechanical Engineering problems. |

**UNIT:1** **(10 Hours)**

Introduction: Computer I/O devices- Video display devices- Refresh CRT - Raster scan display - Color CRT monitor - Co-ordinate representation - Ggraphic displays in engineering workstations - 2D graphics Transformations- 3D geometry, primitives and transformations

**UNIT:2** **(8 Hours)**

Basic raster graphics algorithm for drawing 2D primitive - Output characteristics: Aspect ratio - Line drawing algorithm - DDA algorithm - Circle generation algorithm - Mid point circle algorithm - Ellipse generation algorithm

**UNIT:3** **(10 Hours)**

Classification of Geometric Modeling - Wire frame, Surface and Solid Modeling, applications -representation of curves and surfaces - Parametric form - Design of curved shapes- Cubic spline - Bezier curve - B-spline curve - Design of Surfaces - features of Surface Modeling

**UNIT:4** **(10 Hours)**

Introduction to 3-D modelling - Generation of various 3D Models through Protrusion - revolve, shell sweep - Creation of various features - Study of parent child relationships - Feature based and Boolean based modeling - Constructive solid geometry.
Standards for computer graphics (GKS) and Data exchange standards: IGES, STEP - Data structures for Entity storage - Data structures for interactive modeling.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Saxena, A., Sahay, B., Computer Aided Engineering Design, Springer, 2005
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Ref. Books:

1. Anand, V. B., Computer and Geometric Modeling for Engineers, John Wiley & Sons.
2. Hoffmann, C.M., Geometric & Solid Modeling, An Introduction, Morgan Kaufman.
3. Computer Graphics, Z. Xiang, R. A. Plastock, Schaum's Outlines, McGrow Hill