Detailed Syllabus for B.Tech. (Computer Engineering) – 3rd Semester

(2023 Batch)

Course Code: 05 BSC06	Engineering Mathematics III (Statistical Foundations of Computer Science)	Credit: 3-1-0: 4

Pre-requisites: NA

Course Objectives:

- Apply statistical methods to data for inferences.
- Access online resources for R and import new function packages into the R workspace.
- Perform descriptive analytics over large scale data and apply appropriate statistical tests using R.
- Explore data-sets to create testable hypotheses and identify appropriate statistical tests.

Course Contents

Unit 1 Introduction to Probability

Events and outcomes. Probability rules Sample space and events, The axioms of probability. Conditional probability, Independence, Bayes' Rule, Law of Total Probability Elementary theorems of probability.

Unit 2 Probability Distributions:

Population; Random variables, Joint and marginal distributions; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance, Correlation and Covariance. Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions.

Unit 3 Testing of Hypothesis:

Simple and Composite hypothesis; Critical Region; Level of Significance; Type I and Type II Errors; Best Critical Region; Neyman-Pearson Theorem; Application to Normal Population; Likelihood Ratio Test; Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means; $\chi 2$—Test of Goodness of Fit (application only). Simple idea of Bivariate distribution; Correlation and Regression; and simple problems.

Unit 4 Stochastic Process & Queuing Theory:

Probability Distributions: Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process; Markov Chains: Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains.

Unit 5 Introduction to Data Science and data visualization:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

R Programming Structures, Control Statements, Loops, - Looping Over Non-vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, Doing Math and Simulation in R, Math Functions.

Text Books:

1. Norman Matloff, "*The Art of R Programming*", Cengage Learning
2. Bhat, B. R. (2000): Stochastic Models: Analysis and Applications, New Age International Publishers.
3. Mark smart, “Probability Theory: Introduction to random variables and probability distributions
4. Klenke Achim “Probability Theory: A Comprehensive Course (Universitext) Paperback – January 1, 2013”
5. Geoffrey Grimmett, “Probability and Random Processes”, Oxford Press.

Course Code: 05 PCC01	Fundamentals of Computer Science	Credit: 2-0-0: 2

Pre-requisites: NA

Course Objectives

- To understanding of basic concepts of computer science and engineering.
- To learn the basic components of Computer and their requirements.
- To understand basics of computer and working with OS.
- To develop working skills with productivity tools and graphics designing.
- To acquire basics about the digital systems.
- To introduce the basic Networking Concept and Internet.

Course Contents

UNIT I Introduction to Computer

Generations of Computer (I-V); Block Diagram of a Computer; Functions of the Different Units- Input unit, Output unit, Memory unit, CPU (ALU+CU).

UNIT II Input & Output Devices

Keyboard, Point and draw devices, mouse, joystick, track ball, light pen; Data Scanning devices - image scanner, OCR, OMR, MICR, Bar code reader, card reader; Voice Recognition Device, Digitizers; Output Devices- Monitor, Printer, laser printer, dot-matrix printer, ink jet printer, Projector.

UNIT III Memories (Brief Introduction)

[Memory hierarchy]: Registers [Types of Registers]; Cache Memory; Primary Memory- RAM, SRAM, DRAM, ROM, Firmware; Secondary Memories: Hard disk- tracks, sectors, clusters, cylinders; Floppy [data storage mechanism];

UNIT IV Software, Computer Languages and Number System

System Software: Operating System- function and types; Program Language Translators- Assembler, Compiler, Interpreter; Utility Programs; Communication Software; Performance Monitoring Software.

Application Software: Software hierarchy and dependence between the different layers.

Computer Languages: Machine language, Assembly language, High level language

Digital Number System: Number System Conversion; Arithmetic Operations-Boolean, Octal, Hexadecimal, etc.

UNIT V Networking & Web Designing

The need and use of Computer Networks. Concepts of Networking-LAN, WAN, MAN. ISP's in India and their responsibilities. Video Conference, downloading and uploading files. Introduction to HTML, Basic tags, Formatting tags, Stylesheets, Table handling, Lists, Hyperlinks in HTML.

UNIT VI Cloud Computing

Introduction, Advantages & Disadvantages, Cloud Computing Technologies, Types of Clouds, Cloud Computing Models (Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS)), Virtualization.

Text Books:

1. Sinha K P, Sinha P., Computer Fundamentals, BPB Publication, 2017.
2. Rajaraman V., Adabala N., Fundamentals of Computers, PHI, 2014.
3. Bartee Thomas C., Digital Computer Fundamentals, McGraw Hill Education India, 2001.
4. Goel A., Computer Fundamentals, Pearson, 2010.
5. Rajaraman V., Adabala N., Fundamentals of Computers, Sixth Edition, PHI, 2015.

Reference Books:

1. Bartee Thomas C., Digital Computer Fundamentals, McGraw Hill Education India, 2001.
2. Goel A., Computer Fundamentals, Pearson, 2010.
3. Rajaraman V., Adabala N., Fundamentals of Computers, Sixth Edition, PHI, 2015.
4. Jain Satish, Iyer G M, Web Designing and Publishing, BPB Publications, 2020.
5. Kundu Sudakshina, Fundamentals of Computer Networks, Second Edition, PHI, 2008.

Course Code: 05 PCC03	Object Oriented Programming	Credit: 3-0-0: 3

Pre-requisites: Programming for Problem Solving, Introduction to C Programming

Course Objectives:

- To learn program in an object-oriented programming language, focusing those who already have some experience with another programming language, and who now wish to move on to an object-oriented one.
- Learning object-oriented programming language namely, Java.
- To learn the principles of the object-oriented programming paradigm specifically including abstraction, encapsulation, inheritance and polymorphism using Java.
- To use java standard API library to write complex programs.
- To develop interactive programs using applets.

Course Contents

UNIT I Introduction

Basic features & concepts of Object-Oriented Programming, (OOP), Benefits, Languages and Applications of OOPs.

UNIT II Java Basics

History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT III Inheritance, Packages and Interfaces

Definition, single, multilevel, multiple, hierarchical and hybrid inheritances, virtual base classes, abstract classes.

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing an interface, applying interfaces, variables in an interface and extending interfaces. Exploring packages – Java.io, java.util.

UNIT IV Exception handling and multithreading

Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT V Strings

Creating and manipulating string objects, accessing characters in strings.

Text Books:

1. Balagurusamy Elappa., Programming with JAVA: A primer, Tata McGraw Hill, 4th Edition, 2010.
2. Schildt Herbert., Java 2: The complete reference, Tata McGraw Hill, 5th Edition, 2009.

Reference Books:

1. Bhaskar V. Vijaya & Reddy P. Venkata Subba., Object-oriented programming through JAVA, Mumbai Scitech Publication, 2007.

Course Code: 05 BSC07	Environmental Science	Credit: 2-0-0: 0

Pre-requisites: NA

Course Objectives:

- Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
- Estimate the population - economic growth, energy requirement and demand.
- Analyse material balance for different environmental systems.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify the major pollutants and abatement devices for environmental management and sustainable development.

Course Contents

UNIT I Introduction to Environmental Science:

Environment and society, major environmental issues: Ozone layer depletion, Acid rains, global climate change etc., sustainable development, Environmental impact assessment, environmental management Natural Resources Utilization and its Impacts: Energy, minerals, water and land resources, Resource consumption, population dynamics, urbanization.

UNIT II Ecology and Biodiversity:

Energy flow in ecosystem, food chain, nutrient cycles, eutrofication, value of biodiversity, biodiversity at global, national and local levels, threats for biodiversity, conservation of biodiversity.

UNIT III Water Pollution:

Sources, types of pollutants and their effects, water quality issues, contaminant transport, self-purification capacity of streams and water bodies, water quality standards, principles of water and wastewater treatment.

UNIT IV Air Pollution:

Sources, classification and their effects, Air quality standards, dispersion of pollutants, control of air pollution, automobile pollution and its control. Solid Waste Management: Sources and characteristics of solid waste, effects, Collection and transfer system, disposal methods.

Text Books:

1. G.B. Masters, "Introduction to Environmental Engineering and Science", Pearson Education, 2013.
2. Gerard Kiely, "Environmental Engineering", McGraw Hill Education Pvt. Ltd., Special Indian Edition, 2007.

3. W P Cunningham, M A Cunningham, "Principles of Environmental Science, Inquiry and Applications", Tata McGraw Hill, 8th Edition, 2016.

Reference Books:

1. M. Chandrasekhar, "Environmental Science", Hi Tech Publishers, 2009.

Course Code: 05 PCC02	Data Structures	Credit: 3-0-0: 3

Pre-requisites: CS - Fundamental of Computer Science, CS - Programming for Problem Solving

Course Outcomes

- Develop programs to implement linear data structures such as stacks, queues, linked lists, etc
- Apply the concept of trees, hashing algorithms and analysing their performance
- Utilize the suitable graph algorithms in different real-world scenarios
- Solve optimization problems with the suitable algorithmic design techniques
- Comprehend the implementation of sorting and searching algorithms

Course Contents

UNIT I Introduction

Performance of algorithms: Basic concepts, Mathematical Background, Complexity Analysis, Space and time complexity, asymptotic notations, Stacks and Queues: Representations and applications.

UNIT II Linked List, Stacks, and Queues

Linear Data Structures: Arrays: one dimensional, multi-dimensional, Sparse Matrix, Elementary Operations

Stacks: Representation, elementary operations and applications such as infix to postfix, postfix evaluation, parenthesis matching

Queues: Simple queue, circular queue, de-queue, elementary operations and applications.

Linked lists: Linear, circular and doubly linked lists, elementary operations and applications such as polynomial manipulation.

UNIT III Non-Linear Data Structure - Trees

Non-Linear Data Structures: Trees: Binary tree representation, tree traversal, complete binary tree, heap, binary search tree, height balanced trees like AVL tree and 2-3 tree, tries, red-black tree, B-tree, B+ tree, m-way Search tree, other operations and applications of trees.

UNIT IV Non-Linear Data Structure - Graphs

Representation of graphs - BFS - DFS - Topological sort – String Representation and manipulations - Pattern matching. Adjacency list, graph traversal, path matrix, connected components.

UNIT V Sorting & Searching

Sorting: Selection sort, bubble sort, quick sort, merge sort, heap sort, insertion sort, selection sort, radix sort. Searching: linear and binary search. Hashing: hash tables, hash functions, and open addressing.

Textbooks:

- J. P. Tremblay, P. G. Sorenson, “An Introduction to Data Structures with Applications”, Second Edition, Tata McGraw Hill, 1981.
- M. Tenenbaum, Augestien, “Data Structures using C”, Third Edition, Pearson Education, 2007.
- Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Addison-Wesley Educational Publishers, 2006.
- Lipschutz S., Data Structure, McGraw Hill Education, 2014.
- Srivastava S.K., Srivastava D., Data Structures Through C In Depth, BPB Publications, 2004

Reference Books:

- Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Universities Press (I) Pvt. Ltd., 2008.
- Drozdek A., Data Structures and Algorithms in C++, Cengage Learning, 2012.
- Radhakrishnan M., Srinivasan V., Data Structures Using C, BPB Publications, 2008.
- Aho A.V., Hopperoft J.E., UIlman J.D., Data Structures and Algorithms, Pearson, 1998.
- Tanenbaum A.M., Data Structures using C, Pearson Education, 2009.

Course Code: 05 PCC02	Data Structures Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

1. To provide an experimental foundation for the theoretical concepts introduced
2. To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. (a)Write a program to implement dynamic arrays with operations like insertion, deletion, and resizing. (b) Given an array, write a function to find the maximum and minimum elements. (c)Write a program to implement stack using arrays and evaluate a given postfix expression.
2. Write a program to implement circular queue using arrays
3. Write a program to implement double ended queue (de queue) using arrays
4. Write programs for applications based on stacks and queues.
5. Write programs to implement the following data structures and their applications - Single linked list (b) Double linked list
6. Write programs to implement a stack and a queue using linked lists
7. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) delete a node with given key (f) applications of BST
8. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.
9. Implement the following sorting algorithms: (a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort (e) Radix sort (f) Shell sort
10. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS
11. Write programs to find out a minimum spanning tree of graph by applying - Prim's algorithm (b) Kruskal's algorithm c) any other algorithms
12. Write a program to implement Dijkstra's algorithm using priority queue.

Course Code: 05 ESC08	Computer Integrated Manufacturing	Credit: 3-1-0: 4

Pre-requisites: Engineering Drawing & Computer Graphics

Course Objectives

- To comprehend basic difference between CIM and Automation.
- To study the concepts of computer aided process planning and cellular manufacturing.
- To study flexible manufacturing system and AGVs in industrial environment.
- To prepares students for learning various rapid prototyping processes.
- To understand the basic foundation of robotics and its industrial application.

Course Contents

UNIT I Introduction

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control Introduction to CAD/CAM – Concurrent Engineering - CIM concepts – Computerised elements of CIM system –Types of production - Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In Time Production.

UNIT II Computer Aided Process Planning

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning –Material Requirement planning Control Systems-Shop Floor Control Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) - Simple Problems.

UNIT III Cellular & Flexible Manufacturing

Cellular manufacturing, Group Technology (GT), Flexible Manufacturing Systems, Automated Guided Vehicle Systems.

UNIT IV 3D PRINTING:

Additive manufacturing process, difference with traditional manufacturing, process cycle in additive manufacturing, classification, materials, tessellation, slicing, Rapid tooling.

UNIT V Industrial Robotics:

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications.

Text Books:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

3. Chua Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2003.
4. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010

List of Experiments/Activities

1. Introduction to CATIA V5
2. Working with sketcher module of CATIA V5
3. Working with Part design module of CATIA V5
4. Working with advanced modeling tools (Sweep, Blend & Swept Blend)
5. Assembly modelling in CATIA V5
6. Working with DMU kinematics module of CATIA V5
7. Generating, editing and modifying drawings in Drafting workbench CATIA V5
8. Intro to 3D printing and developing a part on SLA Apparatus.
9. 3D printing of part on FDM apparatus.

Course Code: 05 HSMC02	Universal Human Value - 2	Credit: 2-1-0: 3

Pre-requisites: NA

Course Objectives

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Contents

UNIT I Introduction to Value Education

Right Understanding, Relationship and Physical Facility, Understanding Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self.

UNIT III Harmony in the Family and Society

Harmony in the Family - the Basic Unit of Human interaction, 'Trust' - the Fundamental Value in Relationship, 'Respect'-as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, and Vision for the Universal Human Order.

UNIT IV Harmony in the Nature / Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

UNIT V Implications of the Holistic Understanding - a Look at Professional Ethics:

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education. Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems, and Management Models-Typical Case Studios.

Text Books:

1. “A Foundation Course in Human Values and Professional Ethics”, R R Gaur, R Asthana, G P Bagaria, Excel Books, New Delhi, 2019.
2. A.N. Tripathi, “Human Values”, New Age New Delhi, Intl. Publishers, 2004.