
# Fergusson College (Autonomous), Pune

Learning Outcomes-Based Curriculum

for 3/4 years B**.** Sc. /B. Sc. (Honours) Programme

as per guidelines of

**NEP-2020**

for

# F.Y B. Sc. (Computer Science)

With effect from Academic Year

**2023-2024**

| Programme Outcomes for B. Sc. Programme | |
|---|---|
| **PO1** | **Disciplinary Knowledge:**<br>Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work. |
| **PO2** | **Critical Thinking and Problem solving:**<br>Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions. |
| **PO3** | **Social competence:**<br>Display the understanding, behavioural skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally. |
| **PO4** | **Research-related skills and Scientific temper:**<br>Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research. |
| **PO5** | **Trans-disciplinary knowledge:**<br>Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem. |
| **PO6** | **Personal and professional competence:**<br>Performing dependently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics. |
| **PO7** | **Effective Citizenship and Ethics:**<br>Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility. |
| **PO8** | **Environment and Sustainability:**<br>Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |
| **PO9** | **Self-directed and Life-long learning:**<br>Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes. |

| PSO No. | Program Specific Outcomes (PSOs)<br>Upon completion of this programme the student will be able to |
|---|---|
| **PSO1** | **Academic Competence:**<br>(i) Understand various concepts of Computing, Statistics, Mathematics and Electronics appropriately to the discipline.<br>(ii) Recommend computing solutions to solve the problems in different domains |
| **PSO2** | **Personal and Professional Competence:**<br>(i) Apply the fundamental knowledge for professional software development as well as to acquire new skills.<br>(ii) Develop strong problem solving, analyzing and decision-making abilities. Identify the information and apply their disciplinary knowledge and professional skills to design components , system or processes to meet required specification |
| **PSO3** | **Research Competence:**<br>(i) Apply programming languages, tools and techniques to conduct research and demonstrate appropriate emerging skills to seek solutions to problems in various interdisciplinary fields.<br>(ii) Integrate Computer Science, Electronics, Mathematical and Statistical knowledge to explore different domains' data for experimental and research purpose |
| **PSO4** | **Entrepreneurial and Social Competence:**<br>(i) Use the knowledge and skills necessary to support their career in software development, web development, databases and entrepreneurship in recent trends like data analytics, artificial intelligence, Image processing, Networking, Embedded systems etc.<br>(ii) Develop software based solutions for industry as well as research and development and develop skills required for social interaction. |

# Fergusson College (Autonomous), Pune
## Proposed First Year Curriculum as per NEP 2020
### Department of Computer Science
### Structure for Major / Minor

| Semester | Paper | Paper Code | Paper Title | Type | Credits |
|---|---|---|---|---|---|
| I | Major | CSC-101 | Problem Solving Principles Using C | Theory | 4 |
| | | CSC-100 | Computer Science Practical -1 | Practical | 2 |
| | OE-1 | CSC-120 | IT Literacy | Theory | 2 |
| | OE-2 | CSC-121 | Basics of Linux | Theory | 2 |
| | Minor | MTS-115 | Foundation of Mathematics | Theory | 2 |
| | | MTS-116 | Mathematics Practical – 1 | Practical | 2 |
| | OR | | | | |
| | Minor | ELS- 115 | Basic Digital Electronics | Theory | 2 |
| | | ELS- 116 | Electronics Practical – 1 | Practical | 2 |
| | OR | | | | |
| | Minor | STS-115 | Fundamental of Statistics | Theory | 2 |
| | | STS-116 | Statistics Practical - 1 | Practical | 2 |
| | SEC | CSC-140 | Basics of Databases | Skill | 2 |
| II | Major | CSC-151 | Relational Database Management System | Theory | 4 |
| | | CSC-150 | Computer Science Practical – 2 | Practical | 2 |
| | OE-3 | CSC-170 | Data Handling using Excel | Theory | 2 |
| | OE-4 | CSC-171 | Web Page Designing | Theory | 2 |
| | Minor | MTS-165 | Graph Theory | Theory | 2 |
| | | MTS-166 | Mathematics Practical - 2 | Practical | 2 |
| | OR | | | | |
| | Minor | ELS- 165 | Sequential Logic Circuits | Theory | 2 |
| | | ELS- 166 | Electronics Practical – 2 | Practical | 2 |
| | OR | | | | |
| | Minor | STS-165 | Introduction to Probability and Statistics | Theory | 2 |
| | | STS-166 | Statistics Practical –2 | Practical | 2 |

**** OE – Open Elective, SEC- Skill Enhancement Course***

## Teaching and Evaluation (Only for FORMAL education courses)

| Course Credits | No. of Hours per Semester Theory/Practical | No. of Hours per Week Theory/Practical | Maximum Marks | CE 40 % | ESE 60% |
|---|---|---|---|---|---|
| 1 | 15 / 30 | 1 / 2 | 25 | 10 | 15 |
| 2 | 30 / 60 | 2 / 4 | 50 | 20 | 30 |
| 3 | 45 / 90 | 3 / 6 | 75 | 30 | 45 |
| 4 | 60 / 120 | 4 / 8 | 100 | 40 | 60 |

| F.Y B.Sc (Computer Science) – Semester I | | |
|---|---|---|
| **CSC-101** | **Problem Solving Principles using C (Major- Theory)** | **Credits: 04 Hours : 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify and define appropriate solutions to problems in the field of computer science and other related disciplinary areas. | 1 |
| CO2 | Illustrate the solutions to the problems in the form of simple algorithms and flowcharts | 2 |
| CO3 | Apply various computer programming language concepts and strategies to write and execute efficient and structured computer programs | 3 |
| CO4 | Analyze and compile the programs to detect any errors, debug and correct the programs. | 4 |
| CO5 | Test and perform critical evaluation of the program outcome to validate the program logic. | 5 |
| CO6 | Integrate the concepts of control structures, functions, arrays, pointers and strings to create more complex programming solutions | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Problem Solving Principles**<br>1.1 What is Problem Solving?<br>1.2 Problem solving using computer<br>1.3 Algorithm<br>1.4 Flowchart | **04** |
| **II** | **Introduction to Programming Languages**<br>2.1 Computer Software and Classification<br>2.2 Computer Languages: Machine Language, Assembly Language, High-Level Language<br>2.3 Compiler and Interpreter | **02** |
| **III** | **Overview of C**<br>3.1 History of C<br>3.2 Features of C<br>3.3 Structure of a C Program<br>3.4 C Program Development Lifecycle<br>3.5 First C Program<br>3.6 Applications of C | **03** |

| | | |
|---|---|---|
| **IV** | **Fundamentals of C**<br>4.1 Character Set in C<br>4.2 C Tokens<br>4.3 Keywords, Identifiers, Variables<br>4.4 Constants: Integer, Character, Float<br>4.5 Datatypes<br>4.6 Operators, Precedence and Associativity of Operators<br>4.7 Input and Output operations<br>4.8 Escape Sequences | **10** |
| **V** | **Decision Making: Branching and Looping**<br>5.1 Introduction to Decision Making<br>5.2 Branching Statements<br>5.3 Simple if statement<br>a. if..else statement<br>b. nested if..else<br>c. else..if ladder<br>d. switch-case<br>5.4 Conditional operator<br>5.5 Looping Statements<br>5.6 while statement<br>5.7 do..while statement<br>5.8 for loop<br>5.9 Nested loops<br>5.10 Jump Statements: break, continue, goto, exit() | **12** |
| **VI** | **Functions**<br>6.1 What is function?<br>6.2 Advantages of functions<br>6.3 Standard Library Functions<br>6.4 User-defined functions: Declaration, Definition, Function call, parameter<br>6.5 Passing<br>6.6 return statement<br>6.7 Scope of variables<br>6.8 Storage Classes<br>6.9 Recursion | **10** |
| **VII** | **Arrays**<br>7.1 What is an array?<br>7.2 Types of array: One Dimensional, Two-Dimensional, Multi-Dimensional<br>7.3 Array declaration, initialization, accessing array elements<br>7.4 Passing array to function | **07** |
| **VIII** | **Pointers**<br>8.1 Pointer declaration, initialization, Dereferencing pointers, Pointer arithmetic<br>8.2 Pointer to pointer, Arrays and pointers, Array of Pointers<br>8.3 Functions and pointers – passing pointers to functions, function returning pointers<br>8.4 Dynamic memory allocation | **07** |
| **IX** | **Strings**<br>9.1 Declaration and initialization<br>9.2 String input/output, format specifiers<br>9.3 Standard library functions<br>9.4 Strings and pointers, Array of strings<br>9.5 Command Line Arguments | **05** |

**Learning Resources:**


1. Behrouz A. Forouzan and Richard F. Gilberg: Computer Science: A Structured Programming Approach using C Third Edition, Thomson Course Technology publication
2. Brian W. Kernighan and Dennis M. Ritchie: The C Programming Language, Second Edition, Prentice Hall Publication
3. Byron S Gottfried, Schaum's Outlines Programming With C, Second Edition, Tata McGraw Hill
4. Yashavant Kanetkar: Let Us C, Seventh Edition, PBP Publications
5. E Balagurusamy: Programming in ANSI C, Fourth Edition, TMH


| F.Y B. Sc (Computer Science) – Semester I | | |
|---|---|---|
| **CSC-100** | **Computer Science Practical -1 (Major-Practical)** | **Credits : 02 Hours : 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Define algorithms and flowcharts for given problems in C programming. | 1 |
| CO2 | Illustrate the use of simple data types, operators and control structures in C programming. | 2 |
| CO3 | Implement various standard library and execute the dynamic memory management techniques using the concept of pointers | 3 |
| CO4 | Divide the programs into separate modules by writing user defined functions | 4 |
| CO5 | Evaluate the programs to test and validate the output | 5 |
| CO6 | Design and write programs to implement the concepts of functions, arrays, pointers and strings in C programming | 6 |

| Sr. No. | Title of Experiment / Practical |
|---|---|
| 1. | Defining algorithms and flowcharts for a given problem statements |
| 2. | Use of data types, simple operators |
| 3. | Decision making statements (if-else and switch case) |
| 4. | Use of loops |
| 5. | Use of Nested Loops |
| 6. | Menu driven programs using Standard Library Functions |
| 7. | Use of User Defined Functions |
| 8. | Recursive functions |
| 9. | Use of Arrays |
| 10. | Use of pointers |
| 11. | Concept of strings, array of strings and String operations using pointers |
| 12. | Case Study |

| F.Y B.Sc (Computer Science) – Semester I | | |
|---|---|---|
| **CSC-120** | **IT Literacy**<br>**(OE-1 Theory)** | **Credits: 02**<br>**Hours: 30** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | State the characteristics of computer and identify the components of computer system. | 1 |
| CO2 | Understand various office tools and strategies to execute efficient and structured office work. | 2 |
| CO3 | Classify types of computer software, computer generations. | 3 |
| CO4 | Explain about internet and email management. | 4 |
| CO5 | Select and use the appropriate software application to complete a particular task such as a word Processing skills. | 5 |
| CO6 | Develop the strong ability and execute the collaborative work using google drive. | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Computer Basics**<br>1.1 Introduction to computer<br>1.2 Characteristics of computer<br>1.3 Computer generations<br>1.4 Basic operation of computer<br>1.5 Block diagram of Computer<br>1.6 Computer software | **04** |
| **II** | **Office tools**<br>2.1 Introduction<br>2.2 Objective<br>2.3 Word Processing Basics<br>2.4 Opening Word Processing Package<br>2.5 Title Bar, Menu Bar, Toolbars & Sidebar<br>2.6 Creating a New Document<br>2.7 Opening and Closing Documents<br>2.8 Save and Save As, Print Document<br>2.9 Using The Help<br>2.10 Page Setup, Print Preview, Printing of Documents, PDF file and Saving a Document as PDF file<br>2.11 Document manipulation & Formatting, Text Selection, Cut, Copy and Paste, Font, Color, Style and Size selection, Alignment of Text, Undo & Redo, Spelling & Grammar, Shortcut Keys | **08** |
| **III** | **Basics of Internet**<br>3.1 Introduction, Objectives<br>3.2 Internet & WWW<br>3.3 Website Address and URL<br>3.4 Applications of Internet<br>3.5 Modes of Connecting Internet (Hotspot, Wi-Fi, LAN | **06** |

| | | |
|---|---|---|
| | Cable, Broadband, USB Tethering)<br>3.6 Popular Web Browsers (Internet Explorer/Edge, Chrome, Mozilla Firefox etc)<br>3.7 Exploring the Internet | |
| **IV** | **e-mail**<br>4.1 Introduction to Gmail Window<br>4.2 How to add contacts (E-Mail)/Edit contacts<br>4.3 Details of Compose dialog box fields- To, CC, BCC, Subject etc., Compose an e-mail, add attachment and add signature, How to add more than one recipients at a time (from excel file)+Comma, Separated list(notepad)<br>4.4 e-mail Formatting<br>4.5 How to send Reply/Forward the mail<br>4.6 e-mail Settings: download (set directory/drive other than C drive), signature etc. Inbox: all options<br>4.7 Managing E-mail | **06** |
| **V** | **Collaborative work using Drive**<br>5.1 Folder(Creating new Folder)<br>5.2 File Upload, Folder Upload,<br>5.3 Creating, sharing and collaborative working with : Google Sheet and Google Doc, Google Form | **06** |

**Learning Resources:**

1. P.K. Sinha , "Computer Fundamentals" , BPB publications, 8th Edition
2. MICROSOFT WORD & POWERPOINT FOR BEGINNERS & POWER USERS 2021: The Concise Microsoft Word & PowerPoint A-Z Mastery Guide for All Users Paperback – May 11, 2021by Tech Demystified (Author)

**e- Resources:**

1. https://support.microsoft.com/
2. http://nptel.ac.in
3. https://swayam.gov.in

| F.Y B.Sc (Computer Science) – Semester I | | |
|---|---|---|
| **CSC-121** | **Basics of Linux**<br>**(OE- 2 Theory)** | **Credits : 02**<br>**Hours: 30** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify the basics of Unix and features of Linux Operating system. | 1 |
| CO2 | Understand the concepts of vi editor and basic Linux commands. | 2 |
| CO3 | Apply the knowledge of Linux commands. | 3 |
| CO4 | Integrate the concepts of Linux installation. | 4 |
| CO5 | Test the commands to identify the users and manage permissions. | 5 |
| CO6 | Develop the strong ability to use the Linux commands. | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Overview of Unix and Linux Operating System**<br>1.1 Introduction<br>1.2 History of Linux<br>1.3 Features of Linux<br>1.4 Linux Architecture<br>1.5 What is Linux?<br>1.6 Log in, Log out, Change password | **04** |
| **II** | **Basics about Linux installation**<br>2.1 System configuration<br>2.2 Configure and manage local storage<br>2.3 Create and configure file systems<br>2.4 Mounting external device<br>2.5 Setting folder and file permissions | **06** |
| **III** | **Working with Basic Linux Commands**<br>3.1 vi editor – command mode, insert mode, replace mode<br>3.2 Deleting character or line<br>3.3 Copying line, replacing characters<br>3.4 Searching particular line, line number<br>3.5 Save or abort the file in vi<br>3.6 Commands such as date, mkdir, chdir, cd, rmdir, cat | **10** |
| **IV** | **Shell Interface and commands at shell prompt**<br>4.1 cp, mv, rm, pwd, wc, grep, yppasswd, cal, clear utility<br>4.2 File creation at prompt<br>4.3 Appending file at prompt<br>4.4 Overwriting the contents of file | **10** |

**Learning Resources:**

1. Daniel J. Barrett, Linux Pocket Guide: Essential Commands, "O'Reilly Media, Inc.", 2016
2. Wale Soyinka, Linux Administration: A Beginner's Guide - 7th Edition

3. Jason Cannon, Linux Administration, CreateSpace Independent Publishing Platform
4. Stephen Figgins, Linux in a Nutshell: A Desktop Quick Reference

**e-resouces:**

1. https://www.tutorialspoint.com/unix/index.htm

| F.Y B. Sc (Computer Science) – Semester I | | |
|---|---|---|
| **MTS - 115** | **Foundation of Mathematics (Minor Theory)** | **Credits : 02 Hours : 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Recall the fundamentals of logic and operands. | 1 |
| CO2 | Discuss concepts of relation and functions. | 2 |
| CO3 | Apply the counting principle on real life situations. | 3 |
| CO4 | Explain different methods of mathematical proofs by using logical reasoning | 4 |
| CO5 | Determine the solutions of recurrence relations. | 5 |
| CO6 | Integrate basic concepts of logic, Recurrence and counting principles. | 6 |

| Unit No. | Title of Unit and Contents | No. of hours |
|---|---|---|
| **I** | **Statements and Logic**<br>1.1 Statements<br>1.2 Statements with quantifiers<br>1.3 Compound Statements<br>1.4 Implications<br>1.5 Proofs in Mathematics | **05** |
| **II** | **Sets, Relations and Functions**<br>2.1 Sets, Operations on Sets, Power Set, Cartesian product of Sets, Graphical representation of sets<br>2.2 Relations, types of Relations.<br>2.3 Equivalence relations.<br>2.4 Partition of a set and equivalence classes.<br>2.5 Digraphs of relations, matrix representation and composition of Relations.<br>2.6 Transitive closure and Warshall's Algorithm.<br>2.7 Types of functions (One – One, Onto, Bijective). | **10** |
| **III** | **Counting Principles**<br>3.1 Cardinality of a finite set.<br>3.2 The Sum Rule, the Product Rule, the Inclusion-Exclusion Principle. | **05** |

| | | |
|---|---|---|
| | 3.3 Statement of Pigeonhole Principle, Its Applications. | |
| **IV** | **Recurrence Relation**<br>4.1 Introduction to Recurrence Relations, Formation.<br>4.2 Linear Recurrence Relations with constant coefficients.<br>4.3 Homogeneous Solutions.<br>4.4 Particular Solutions.<br>4.5 Total Solutions. | **10** |

**References:**


1. Kenneth Rosen, 'Discrete Mathematics and its applications', Seventh Edition by Tata McGraw Hill.
2. Kolman, Busby, Ross, Rehman, 'Discrete Mathematical Structures', Sixth edition, by Prentice Hall.
3. C. L. Liu, 'Elements of Discrete Mathematics', Fourth edition, by Tata McGraw Hill.


| **F.Y B. Sc (Computer Science) – Semester I** | | |
|---|---|---|
| **MTS-116** | **Mathematics Practical – 1**<br>**(Minor- Practical)** | **Credits : 02**<br>**Hours : 60** |
| **On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify basic commands of scilab | 1 |
| CO2 | Represent 2D and 3D graphs using scilab. | 2 |
| CO3 | Implement the fundamentals of logic and operands. | 3 |
| CO4 | Analyse solutions of linear equations using scilab | 4 |
| CO5 | Determine the solution of various problems by using different Numerical techniques in scilab. | 5 |
| CO6 | Integrate concepts of Discrete mathematics in various fields. | 6 |

| **Unit No.** | **Title of Unit and Contents** |
|---|---|
| **1** | Scilab- I( Data types, Special matrices, Operations on Matrices, Solving system of L.E.) |
| 2 | Scilab – II (Defining polynomials, plotting of 2-D and 3-D graphs)) |
| 3 | Introduction to Scilab programming-I ( if , while, for loop) |
| 4 | Basic Scilab programming-II |
| 5 | Regula Falsi method to find root of a function f(x) = 0 using Scilab. |
| **6** | Newton Raphson method to find root of a function f(x) = 0 using Scilab. |
| **7** | Trapezoidal rule to find Integration ( using Scilab) |
| **8** | Simpson's 1/3 $^{rd}$ rule to find Integration ( using Scilab) |

| | |
|---|---|
| **9** | Simpson's 3/8 $^{th}$ rule to find Integration ( using Scilab) |
| **10** | Statements and Logic |
| **11** | Sets, Relations and Functions |
| **12** | Counting Principles |
| **13** | Recurrence Relation |
| **14** | Student Activity - I |
| **15** | Student Activity - II |

| **F.Y B. Sc (Computer Science) – Semester I** | | |
|---|---|---|
| **ELS-115** | **BASIC DIGITAL ELECTRONICS (Minor – Theory)** | **Credits : 02 Hours : 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify logic gates with symbols and truth tables. | 1 |
| CO2 | State De Morgan's theorems and laws of Boolean Algebra | 1 |
| CO3 | Discuss circuit diagram and working of different logic circuits. | 2 |
| CO4 | Use the various rules and laws of Boolean Algebra for designing digital circuits. | 3 |
| CO5 | Modify (simplify) digital circuits using K-map. | 3 |
| CO6 | Differentiate basic digital circuits. | 4 |

| Unit No. | Unit title and Contents | No. of Hours |
|---|---|---|
| **I** | **Logic gates** Introduction to analog signals and digital signals, Positive and Negative logic, Logic gates: definition, symbols, truth tables, Boolean expressions, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates | **03** |
| **II** | **Number system and codes** Decimal, binary, octal, hexadecimal number systems, Conversion of numbers from one number system to another including decimal / binary points, Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction BCD | **08** |

| | | |
|---|---|---|
| | code numbers and their limitations, gray code, ASCII code | |
| **III** | **Boolean Algebra**<br>Rules and laws of Boolean algebra, logic expression, De Morgan's theorems, their proof, Sum of products form (min. terms), Product of sum form (max. terms), Simplification of Boolean expressions using Boolean algebra and Karnaugh map upto 4 variables. | **08** |
| **IV** | **Arithmetic and logical circuits**<br>Half adder, Full adder circuit and its operation, Parallel binary adder, Half Subtractor, and full Subtractor | **04** |
| **V** | **Combinational Circuits**<br>Multiplexer(2:1 and 4:1), De-multiplexer (1:2 and 1:4), Encoder, Priority encoder, Decoder, BCD to seven segment decoder | **07** |

**Learning Resources:**


1. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
2. Modern Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital System Design, Morris Mano, Pearson Education (2014)
4. Digital Computer Electronics, Malvino
5. Digital Principals, Schaum's outline series, Tata McGraw Hill (2006)
6. Fundamentals of Logic Design, Charles H. Roth, Jr. and Larry L. Kinney
7. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education


| **F.Y B. Sc (Computer Science) – Semester I** | | |
|---|---|---|
| **ELS-116** | **Electronics Practical – 1**<br>**(Minor Practical)** | **Credits : 02**<br>**Hours : 60** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Recall the circuit diagrams using different symbols of logic gates | 1 |
| CO2 | Discus the working of circuits used in experiments. | 2 |
| CO3 | Carry out the experiment to achieve the given objectives. | 3 |
| CO4 | Analyze observations of each experiment. | 4 |
| CO5 | Validate observed outputs with expected theoretical outputs. | 5 |

Any 10 Experiments

| Sr. No. | Title of Experiment / Practical |
|---|---|
| 1 | Study of logic gates |
| 2 | Binary to gray code and gray to binary code conversion |
| 3 | Verification of De-Morgan's Theorems |
| 4 | Interconversion of logic gates using NAND gate |
| 5 | Interconversion of logic gates using NOR gate |
| 6 | Study of Half adder and full adder |
| 7 | Study of Half Subtractor and full Subtractor |
| 8 | Study of multiplexer and demultiplexer |
| 9 | Simplification of Boolean expressions using Boolean algebra and Karnaugh map and its implementation using logic gates |
| 10 | 4-bit Parallel Adder |
| 11 | BCD to seven segment decoder |
| 12 | Study of priority encoder IC 74148 |
| 13 | Construction of 1- bit comparator |
| 14 | Implementation of Boolean Functions using Multiplexer |
| 15 | Octal to binary Encoder |

Or Any Other Equivalent Experiment

| F.Y B. Sc (Computer Science) – Semester I | | |
|---|---|---|
| **STS 115** | **Fundamentals of Statistics (Minor –Theory)** | **Credits : 02 Hours : 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Describe basic features of the data. | 1 |
| CO2 | Summarize and interpret the data using different graphs. | 2 |
| CO3 | Examine data and represent in the form of table and graph. | 3 |
| CO4 | Analyze the statistical measures used in various fields. | 4 |
| CO5 | Determine chance of an event based on prior knowledge of conditions related to that event. | 5 |
| CO6 | Develop analytical thinking by using the ability to see a problem or solution from different points of view. | 6 |

| Unit No. | Title of Unit and Contents | No. of hours |
|---|---|---|
| **I** | Data condensation and Graphical methods<br>1.1 Raw data, attributes and variables, discrete and continuous variables.<br>1.2 Presentation of data using frequency distribution and cumulative frequency distribution. (Construction of frequency distribution is not expected)<br>1.3 Graphical Presentation of frequency distribution – histogram, stem and leaf chart, less than and more than type ogive curves.<br>1.4Numerical problems related to real life situations. | 6 |
| **II** | Measures of central tendency and dispersion<br>2.1 Measures of Central tendency: Mean, Mode, Median. Examples where each one of these is most appropriate.<br>2.2 Partition values: Quartiles, Box-Plot.<br>2.3Variance, Standard Deviation, Coefficient of Variation.<br>(Section 2.1 to 2.3 should be covered for raw data, ungrouped frequency distribution and exclusive type grouped frequency distribution) | 10 |
| **III** | Counting Principles, Sample spaces and Events<br>3.1Counting Principles<br>3.2Permutation<br>3.3Combination.<br>3.4Deterministic and non-deterministic models.<br>3.5 Random Experiment, Sample Spaces (finite and countably infinite)<br>3.6 Events: types of events, Operations on events. | 4 |

| | | |
|---|---|---|
| **IV** | Basic Theory of Probability<br>4.1 Probability - classical definition, probability models, axioms of probability, probability of an event.<br>4.2 Theorems of probability (with proof)<br>i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$<br>iii) $P(A) \leq P(B)$ when $A \subset B$<br>iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$<br>4.3 Numerical problems related to real life situations. | 10 |

**References:**


1. Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
2. Fundamentals of Applied Statistics (4th Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 2014.
3. Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
4. A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.


| **F.Y B. Sc (Computer Science) – Semester I** | | |
|---|---|---|
| **STS -116** | **Statistics Practical – 1**<br>**(Minor Practical)** | **Credits : 02**<br>**Hours : 60** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify the methods and procedures of summarizing information by using summary statistics such as measures of central tendency, dispersion, skewness kurtosis using R | 1 |
| CO2 | Articulate the data, its types and summarize information in the data using different measures. | 2 |
| CO3 | Articulate sample space for a certain random experiment and identify events and their types. | 2 |
| CO4 | Illustrate different real-life situations to find probability of different types of events, the theorems of probability. | 3 |
| CO5 | Analyse different concepts of statistics using R software. | 3 |
| CO6 | Create different frequency distributions for real life data | 6 |

| **Unit No.** | **Title of Unit and Contents** |
|---|---|
| **1** | Diagrammatic Representation |
| 2 | Methods of Classification (Inclusive and Exclusive) and construction of frequency distributions |
| 3 | Introduction to R |
| 4 | Graphical methods using R |
| 5 | Measures of Central Tendency |

| | |
|---|---|
| **6** | Measures of Dispersion |
| **7** | Measure of Central Tendency and Dispersion using R |
| **8** | Counting Principles |
| **9** | Permutation and Combination |
| **10** | Sample spaces and events |
| **11** | Basic probability theory I |
| **12** | Basic probability theory II |
| **13,14&15** | Applications of statistical techniques to real life data. |

| **F.Y B.Sc (Computer Science) – Semester I** | | |
|---|---|---|
| **CSC -140** | **Basics of Databases (SEC)** | **Credits : 02 Hours : 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Identify the data and the concepts of file system and database system. | 1 |
| CO2 | Discuss different databases, applications, data models in the field of computer science along with other areas and develop the design of databases. | 2 |
| CO3 | Apply the knowledge of database concepts with normalization to draw ER diagram. | 3 |
| CO4 | Integrate the concepts of set operations and joins. | 4 |
| CO5 | Test the features of good relational database design with entities, attributes and relationship. | 5 |
| CO6 | Develop the strong ability to use the database concepts for drawing ER diagram for developing system or application. | 6 |

| **Unit** | **Contents** | **No. of Hours** |
|---|---|---|
| **I** | **Introduction to DBMS**<br>1.1 Introduction<br>1.2 Basic Concepts and Definition: Data, Information, Data versus Information, Data Warehouse, Metadata, Data Item or Field, Records, Data Dictionary, Database, Database System<br>1.3 Database Users and Database Administrator, Functions and Responsibilities of DBA<br>1.4 File System versus Database System<br>1.5 View of Data<br>1.6 Database Languages<br>1.7 Schemas, Sub-schemas and Instance<br>1.8 3-Level Architecture: Internal Level, Conceptual Level, External Level | 10 |

| | | |
|---|---|---|
| | 1.9 Data Independence: Physical Data Independence, Logical Data Independence<br>1.10 Structure of a DBMS<br>1.11 Functions of DBMS<br>1.12 Data Models | |
| **II** | **Database design and ER Model**:<br>2.1 Overview<br>2.2 ER – Model<br>2.3 Constraints<br>2.4 E-R Diagrams, ERD Issues, Weak Entity Sets<br>2.5 Codd's Rules<br>2.6 Relational database model: Logical view of data, keys, integrity rules<br>2.7 Relational Database design: Features of good relational database design<br>2.8 Atomic domain and Normalization 1NF, 2NF, 3NF, BCNF | 10 |
| **III** | **Relational algebra:**<br>3.1 Introduction<br>3.2 Basic operations: Selection and projection, set operations, renaming, Joins, Division | 06 |
| **IV** | **Other Databases**<br>4.1 Introduction to Parallel and distributed Databases<br>4.2 Centralized Database<br>4.3 Introduction to Object Based Databases: NoSQL Database, Big Data Databases | 04 |

**Learning Resources:**


1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, Tata McGraw-Hill Education
2. Elmasri and Navathe, Fundamentals of Database Systems, 4th Edition
3. S. K. Singh, Database Management System: Concepts, design & applications, Pearson publication
4. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
5. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence: by Pramod J.Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
6. MongoDB: The Definitive Guide, Kristina Chodorow, Michael Dirolf, O'Reilly Publications

# SEMESTER – II

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **CSC -151** | **Relational Database Management System (Major-Theory)** | **Credits : 04 Hours : 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Outline the fundamental concepts of relational database management system. | 1 |
| CO2 | Explain various methods of database security and access control techniques. | 2 |
| CO3 | Illustrate the transaction management and recovery management techniques adopted in relational database management systems. | 3 |
| CO4 | Understand data security and different data recovery techniques. | 4 |
| CO5 | Validate the queries by implementing error and exception handling techniques. | 5 |
| CO6 | Develop the ability to write queries, stored procedures, stored functions, triggers, cursors and views. | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Structured Query Language (MySQL)**<br>1.1 Introduction<br>1.2 Basic operations<br>1.3 Set operations<br>1.4 Aggregate functions<br>1.5 Null values<br>1.6 Nested Sub-queries<br>1.7 Modifications to Database, DDL commands with examples<br>1.8 SQL mechanisms for joining relations (inner joins, outer joins and their types)<br>1.9 Examples on SQL (case studies) | 12 |
| II | **Relational Database Design**<br>2.1 Procedural Language: Data types, Language structure<br>2.2 Controlling the program flow, conditional statements, Loops<br>2.3 Views<br>2.4 Stored Functions, Stored Procedures<br>2.5 Handling errors and exceptions<br>2.6 Cursors<br>2.7 Concepts of Triggers | 18 |

| | | |
|---|---|---|
| III | **Transaction concepts and concurrency control**<br>3.1 Describe a transaction<br>3.2 properties of transaction<br>3.3 State of the transaction<br>3.4 Executing transactions concurrently associated problem in concurrent execution<br>3.5 Schedules, types of schedules<br>3.6 Concept of Serializability, precedence graph for Serializability, Ensuring serializability by locks<br>3.7 Different lock modes, 2PL and its variations<br>3.8 Basic timestamp method for concurrency, Thomas Write Rule, Locks with multiple granularity, dynamic database concurrency (Phantom Problem), Timestamps versus locking<br>3.9 Deadlock handling methods, Detection and Recovery(Wait for graph), Prevention algorithms (Wound-wait, Wait-die) | 12 |
| IV | **Database Integrity and Security Concepts**<br>4.1 Domain constraints, Referential Integrity<br>4.2 Introduction to database security concepts, Methods for database security, Discretionary access control method, Mandatory access control, Role based access control for multilevel security<br>4.3 Use of views in security enforcement<br>4.4 Overview of encryption technique for security<br>4.5 Statistical database security | 10 |
| V | **Crash Recovery**<br>5.1 Failure classification<br>5.2 Recovery concepts<br>5.3 Log base recovery techniques (Deferredand Immediate update), Checkpoints<br>5.4 Recovery with concurrent transactions (Rollback, checkpoints, commit), Database backup and recovery from catastrophic failure | 08 |

**Learning Resources:**


1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, ISBN:9780071289597, Tata McGraw-Hill Education
2. An Introduction to Database Systems, C J Date, Addison-Wesley
3. Database Systems: Concepts, Design and Application, S.K.Singh, Pearson, Education


**e-resources :**

1. https://www.javatpoint.com
2. https://tutorialspoint.com

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **CSC -150** | **Computer Science Practical –2 (Major Practical)** | **Credits : 02 Hours : 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Define different keys and understand there concepts | 1 |
| CO2 | Illustrate the concept of table level and column level constraints | 2 |
| CO3 | Implement different types of queries and aggregate functions | 3 |
| CO4 | Analyze insert, update, delete records and learn Data Manipulation Language | 4 |
| CO5 | Validate the queries by implementing error and exception handling techniques | 5 |
| CO6 | Design and write cursors, triggers, views for different databases | 6 |

| Sr. No. | Title of Experiment / Practical |
|---|---|
| 1. | Using basic Linux commands and VI Editor |
| 2. | Create table, Primary key, Referential integrity, and Primary Key constraints |
| 3. | Constraints, Alter Table |
| 4. | Insert, Delete and Update Statement |
| 5. | To Query the tables using aggregate functions |
| 6. | Nested Queries |
| 7. | Control Structures |
| 8. | Stored Functions |
| 9. | Exception Handling |
| 10. | Views |
| 11. | Cursors |
| 12. | Triggers |

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **CSC -170** | **Data Handling using Excel**<br>**(OE-3 Theory)** | **Credits: 02**<br>**Hours: 30** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Understand and remember basic principles of data | 1 |
| CO2 | Build various graphs in Excel | 2 |
| CO3 | Apply analysis techniques to datasheets in Excel | 3 |
| CO4 | Analyze Excel functions and techniques for data analysis | 4 |
| CO5 | Test filters and learn how to use Charts to streamline workflow in | 5 |
| CO6 | Integrate different features of excel to create effective design principles and present data | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Introduction to Excel** :<br>1.1 About Microsoft Excel<br>1.2 Uses of Excel, Excel software<br>1.3 Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar<br>1.4 The Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheet | 02 |
| **II** | **Basic Spreadsheet Handling :**<br>2.1 Selecting Columns & Rows<br>2.2 Changing Column Width & Row Height<br>2.3 Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows<br>2.4 Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula<br>2.5 Use of paste and paste special | 02 |
| **III** | **Functions in Excel:**<br>3.1 Text Functions<br>3.2 Date time Functions<br>3.3 Logical Functions<br>3.4 Advanced paste special techniques<br>3.5 Using Ranges, Selecting Ranges, Entering Information Into a Range<br>3.6 Using AutoFill | 03 |

| | | |
|---|---|---|
| **IV** | **Creating Basic and Advanced Formulas:**<br>4.1 Using Formulas<br>4.2 Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper,Lower<br>4.3 Using AutoSum, Concatenate<br>4.4 Vlookup, Hlookup<br>4.5 Match, Countif, Text, Trim | 05 |
| **V** | **Spreadsheet Charts:**<br>5.1 Creating Charts<br>5.2 Different types of chart<br>5.3 Formatting Chart Objects<br>5.4 Changing the Chart Type<br>5.5 Showing and Hiding the Legend<br>5.6 Showing and Hiding the Data Table | 05 |
| **VI** | **Data Analysis:**<br>6.1 Sorting<br>6.2 Filter<br>6.3 Text to Column<br>6.4 Data Validation | 03 |
| **VII** | **PivotTables:**<br>7.1 Creating PivotTables<br>7.2 Manipulating a PivotTable<br>7.3 Using the PivotTable Toolbar<br>7.4 Changing Data Field<br>7.5 Properties<br>7.6 Displaying a PivotChart<br>7.7 Setting PivotTable Options<br>7.8 Adding Subtotals to PivotTables | 05 |
| **VIII** | **Spreadsheet Tools:**<br>8.1 Moving between Spreadsheets<br>8.2 Selecting Multiple Spreadsheets<br>8.3 Inserting and Deleting Spreadsheets Renaming Spreadsheets<br>8.4 Splitting the Screen, Freezing Panes<br>8.5 Copying and Pasting Data between Spreadsheets<br>8.6 Hiding, Protecting worksheets | 03 |
| **IX** | **Making Macros:**<br>9.1 Recording Macros<br>9.2 Running Macros<br>9.3 Deleting Macros | 02 |

**Learning Resources:**

1. https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel
2. https://www.futurelearn.com/courses/a-beginners-guide-to-data-handling-and-management-in-excel
3. https://support.microsoft.com/en-us/office/analyze-data-in-excel
4. https://www.analyticsvidhya.com/blog/2021/11/a-comprehensive-guide-on-microsoft-excel-for-data-analysis/

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **CSC -171** | **Web Page Designing (OE-4)** | **Credits : 02 Hours : 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Describe different web technologies and application development issues and trends | 1 |
| CO2 | Develop the skill & knowledge of Web page design | 2 |
| CO3 | Apply CSS styles to web page | 3 |
| CO4 | Explain different components and technologies of World Wide Web as a platform. | 4 |
| CO5 | Design websites using several front end web technologies | 5 |
| CO6 | Compare various web technologies | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **I** | **Overview:**<br>1.1 Introduction to web technology. What is Web Development?<br>1.2 Introduction to Web server, web browser, Web Protocols (HTTP, TCP/IP Model, UDP, FTP, SMTP, SOAP)<br>1.3 Web development: Frontend, backend<br>1.4 Front End Frameworks and Libraries: HTML, CSS, JavaScript<br>1.5 Back End Frameworks and Technology: PHP, Node JS, Python, Ruby, Java, DBMS | 04 |
| **II** | **Introduction to HTML:**<br>2.1 HTML features<br>2.2 HTML Structure<br>2.3 HTML Tags<br>2.4 Commenting Codes<br>2.5 Formatting and Fonts<br>2.6 Anchors, Hyperlinks<br>2.7 HTML Backgrounds<br>2.8 HTML Lists, Tables, Frames<br>2.9 HTML Forms<br>2.10 HTML Graphics<br>2.11 HTML SVG-Basics<br>2.12 HTML Canvas Basics | 14 |
| **III** | **Introduction to CSS:**<br>3.1 Need for CSS<br>3.2 Introduction to CSS<br>3.3 Basic Syntax and structure<br>3.4 Inline styles | 12 |

| | | |
|---|---|---|
| | 3.5 Embedding Style sheets<br>3.6 Linking External Style<br>3.7 Background Styles<br>3.8 Manipulating Text<br>3.9 Margins and Padding<br>3.10 Positioning using CSS | |

**Learning Resources:**


1. DT Editorial Services, "HTML 5 Black Book", Dreamtech Press, 2010 3.
2. Kogent Learning Solutions Inc.,"Web Technologies, Black Book", Dreamtech Press, 2009
3. P.J. Deitel & H.M. Deitel, "Internet & World Wide Web How to Program (4thEdition)", Pearson –Prentice Hall, 2000


| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **MTS-165** | **Graph Theory**<br>**(Minor Theory)** | **Credits : 02**<br>**Hours : 30** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Define and explain the basic concepts of graphs, including vertices, edges, degree, paths, and cycles. | 1 |
| CO2 | Identify the different graphs based on their properties. | 1 |
| CO3 | Demonstrate proficiency in representing graphs using various methods, including adjacency matrix, adjacency list, and incidence matrix. | 2 |
| CO4 | Understand and apply algorithms related to tree traversal, such as in-order, pre-order, and post-order traversal. | 2 |
| CO5 | Evaluate properties of graphs, including Eulerian and Hamiltonian paths/cycles, using different algorithms. | 3 |
| CO6 | Apply graph theory concepts to solve real-world problems such as network design, transportation planning, and social network analysis. | 3 |

| Unit No. | Title of Unit and Contents | No. of hours |
|---|---|---|
| **I** | **Introduction to Graphs and Operations on Graphs**<br>1.1 Definition and examples of graph, degree of a vertex, Hand shaking lemma and its corollaries.<br>1.2 Types of graphs: Simple graph, Complete graph, bipartite graph, Regular graph, Null graph.<br>1.3 Isomorphism of graphs.<br>1.4 Adjacency and Incidence Matrix of a Graph.<br>1.5 Vertex induced subgraph, Edge induced subgraph, Vertex deleted subgraph, Edge deleted subgraph.<br>1.6 Union of two graphs, Intersection of two graphs, Product of two graphs, Ring Sum of two graphs.<br>1.7 Fusion of vertices, Complement of a graph. | 4 |
| **II** | **Connected Graphs**<br>2.1 Walk, Trail, Path, Cycle: Definitions and elementary properties.<br>2.2 Connected Graphs: definition and properties. | 8 |

| | | |
|---|---|---|
| | 2.3 Distance between two vertices, eccentricity, centre, radius and diameter of a graph.<br>2.4 Isthmus, Cut vertex : Definition and properties.<br>2.5 Cutset, edge connectivity, vertex connectivity.<br>2.6 Weighted Graph and Dijkstra's Algorithm. | |
| **III** | **Eulerian and Hamiltonian Graphs**<br>3.1 Seven Bridge Problem, Eulerian Graph: Definition and Examples. Necessary and Sufficient condition.<br>3.2 Fleury's Algorithm.<br>3.3 Hamiltonian Graph : Definition and Examples, Necessary Condition.<br>3.4 Introduction to Chinese Postman Problem and Travelling Salesman Problem. | 3 |
| **IV** | **Trees**<br>4.1 Definition, Properties of trees.<br>4.2 Centre of a tree.<br>4.3 Binary Tree: Definition and properties.<br>4.4 Tree Traversal.<br>4.5 Spanning Tree : Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm. | 8 |
| **V** | **Directed Graphs**<br>5.1 Definition, Examples, Elementary Terminologies and properties.<br>5.2 Special Types of Digraphs.<br>5.3 Connectedness of digraphs.<br>5.4 Network and Flows: definition and examples. | **7** |

**Learning Resources:**

**1)** 'Graph Theory with applications to Engineering and Computer Science', D Narsingh, Prentice Hall publication.

**2)** 'A first look at Graph Theory', John Clark, Derek Allen Holton, Allied Publishers Ltd.

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **MTS-166** | **Mathematics Practical -2 (Minor Practical)** | **Credits : 02 Hours : 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Describe the basic concepts of graph theory. | 1 |
| CO2 | State formulae of different numerical interpolation techniques. | 1 |
| CO3 | Understand the concepts of different types of graphs. | 2 |
| CO4 | Discuss different methods to solve Ordinary differential equations. | 2 |
| CO5 | Solve interpolation problems by different numerical techniques.. | 3 |
| CO6 | Apply graph theory concepts to solve real-world problems such as network design, transportation planning, and social network analysis. | 3 |

| Unit No. | Title of Unit and Contents |
|---|---|
| **1** | Introduction to Graph |
| 2 | Connected Graphs. |
| 3 | Eulerian and Hamiltonian Graphs |
| 4 | Trees. |
| 5 | Directed Graphs. |
| **6** | Solution to ODE by Euler's Method (By Scilab). |
| **7** | Solution to ODE by Runge-kutta of $2^{nd}$ order (By Scilab). |
| **8** | Solution to ODE by Runge-kutta of $4^{th}$ order (By Scilab). |
| **9** | Newton's Forward Interpolation ( Using Scilab ) |
| **10** | Newton's Backward Interpolation ( Using Scilab ) |
| **11** | Newton's Divided Interpolation ( Using Scilab ) |
| **12** | Lagrange's Interpolation ( Using Scilab ) |
| **13** | Student Activity -I |
| **14** | Students Activity - II |
| **15** | Students Activity – III |

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **ELS-165** | **Sequential Logic Circuits (Minor-Theory)** | **Credits:** 2 **Hours:** 30 |
| | **Course Outcomes (COs) On completion of the course, the students will be able to:** | **Bloom's Cognitive Level** |
| CO1 | Describe the fundamental concepts of sequential logic circuits. | 1 |
| CO2 | Discuss the design of sequential circuits. | 1 |
| CO3 | Differentiate synchronous and asynchronous logic circuits. | 2 |
| CO4 | Explain multi bit shift register, counter and their ICs. | 2 |
| CO5 | Classify digital memories used in computer system. | 3 |
| CO6 | Demonstrate memory organization. | 3 |

| Unit | Contents | No. of hours |
|---|---|---|
| **I** | **Flip flops** Difference between combinational and sequential circuits, the Concept of clock and types, synchronous and asynchronous circuits, Latch, S-R-latch, D-latch, Difference between latch and flip-flop, S-R, J-K, and D flip-flop their operation and truth tables, race around condition, Master-slave JK flip flop, T flip flop, and their operation using timing diagram and truth tables | 10 |
| **II** | **Sequential Circuits** The basic building block of the counter, Ripple counter, up counter, down counter, Up- Down counter, Concept of modulus counters, Decade counter, Shift registers: SISO, SIPO, PISO, PIPO, Ring counter, Universal 4-bit shift register | 10 |
| **III** | **Memory organization** Memory Architecture, Types of memory, Memory parameters (Access time, speed, capacity, cost), Concept of Address Bus, Data Bus, Control Bus, Memory Hierarchy, Memory address map Vertical & horizontal Memory expansion (increasing the capacity, increasing word size) | 10 |

**References:**


1. Modern Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
4. Computer Architecture: Morris Mano

| F. Y. B.Sc. (Computer Science) Semester II | | |
|---|---|---|
| **ELS-166** | **Electronic Science Practical-2 (Minor Practical)** | **Credits: 2 Hours: 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's Cognitive Level** |
| CO1 | Recall the circuit diagrams required to complete experiments. | 1 |
| CO2 | Illustrate circuits of individual experiments. | 2 |
| CO3 | Carry out the experiment to achieve the given objectives. | 3 |
| CO4 | Analyse observations of each experiment. | 4 |
| CO5 | Validate observed outputs with expected theoretical outputs. | 5 |

Any 10 Experiments

| Expt. No. | Title of the Experiment |
|---|---|
| 1 | Study of R-S and D Latch |
| 2 | Study of R-S and D flip-flops |
| 3 | Testing of flip-flops using ICs |
| 4 | Shift register IC 7495: SISO, SIPO |
| 5 | Shift register IC 7495: PIPO, PISO |
| 6 | Modulo (2, 5, 10) counter using IC 7490 |
| 7 | Modulo (3, 4, 7) counter using IC 7490 |
| 8 | Study of Up counter IC 74192/93 |
| 9 | Study of Down counter IC 74192/93 |
| 10 | Three-bit synchronous counter |
| 11 | Rolling display |
| 12 | Diode Matrix ROM |
| 13 | Study of RAM |
| 14 | Study of IC7493 as Asynchronous Counter |
| 15 | Study of 16 X 4 ROM |

Or Any Other Equivalent Experiment

| F.Y B.Sc (Computer Science) – Semester II | | |
|---|---|---|
| **STS-165** | **Introduction to Probability and Statistics (Minor Theory)** | **Credits: 2 Hours: 30** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| CO1 | Describe basic features of the data. | 1 |
| CO2 | Discuss shape and size of the data. | 2 |
| CO3 | Compute chance of an event based on prior knowledge of conditions that might be related to the event. | 3 |
| CO4 | Compare different data sets and conclude the best fit. | 4 |
| CO5 | Evaluate the computational techniques related to advanced probability. | 5 |
| CO6 | Build predictive models for the data. | 6 |

| Unit | Contents | No. of Hours |
|---|---|---|
| **Unit -I** | **Moments**<br>1.1Raw and Central moments: definition, computations for ungrouped and grouped data (only up to first four moments)<br>1.2 Relation between raw and central moments up to fourth order (without proof)<br>1.3 Numerical problems related to real life situations | 3 |
| **Unit -II** | **Measures of Skewness and Kurtosis**<br>2.1 Concept of symmetric frequency distribution, skewness, positive and negative skewness<br>2.2 Measures of Skewness-Pearson's measure, Bowley's measure ($\beta 1$, $\gamma 1$)<br>2.3 Kurtosis of a frequency distribution, measure of kurtosis ($\beta 2$, $\gamma 2$) based upon moments, type of kurtosis: leptokurtic, platykurtic and mesokurtic<br>2.4 Numerical problems related to real life situations. | 5 |
| **Unit –III** | **Correlation and Linear Regression**<br>3.1 Bivariate data, Scatter diagram.<br>3.2 Correlation, Positive Correlation, Negative correlation, Zero Correlation<br>3.3 Karl Pearson's coefficient of correlation (r), limits of r ($-1 \leq r \leq 1$), interpretation of r, Coefficient of determination ($r^2$)<br>3.4 Meaning of regression, difference between correlation and regression.<br>3.5 Concept and equation of regression line of Y on X.<br>3.6 Concept of residual plot and mean residual sum of squares.<br>3.7 Numerical Problems. | 6 |
| **Unit -IV** | **Non-Linear Regression**<br>4.1Second degree curve<br>4.2 Growth curve models of the type | 4 |

| | | |
|---|---|---|
| | i) $Y = ae^{bX}$ ii) $Y = ab^{X}$ iii) $Y = aX^{b}$<br>4.3 Logistic model $Y = k / (1+e^{a+bx})$<br>4.4 Numerical problems related to real life situations. | |
| **Unit –V** | **Advanced Theory of Probability**<br>5.1Concepts and definitions of conditional probability, multiplication theorem $P(A \cap B)=P(A).P(B\|A)$<br>5.2 Bayes' theorem (without proof)<br>5.3 Concept of Posterior probability, problems on posterior probability.<br>5.4 Definition of sensitivity of a procedure, specificity of a procedure. Application of Bayes' theorem to design a procedure for false positive and false negative.<br>5.5 Concept and definition of independence of two events.<br>5.6 Numerical problems related to real life situations. | 12 |

**References:**

1. Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
2. Fundamentals of Applied Statistics (4th Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 2014.
3. Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
4. A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.

| **F.Y B.Sc (Computer Science) – Semester II** | | |
|---|---|---|
| **STS 166** | **Statistics Practical -2 (Minor Practical)** | **Credits: 2 Hours: 60** |
| **Course Outcomes (COs) On completion of the course, the students will be able to:** | | **Bloom's cognitive level** |
| **CO1** | Identify different real-life situations to find probability of different types of events using advanced theory of probability. | 1 |
| **CO2** | Discuss various applications of statistical measures using R software. | 2 |
| **CO3** | Execute the computational techniques using R software. | 3 |
| **CO4** | Analyse different concepts of statistics using R software. | 4 |
| **CO5** | Validate the fundamental knowledge and represent using R software. | 5 |
| **CO6** | Write a program using R to build different regression models for the given data and estimate the error. | 6 |

| **Sr. No.** | **Title of Experiment / Practical** |
|---|---|
| **1** | Computation of moments |
| **2** | Computation of moments using R |
| **3** | Measures of skewness and kurtosis -I |
| **4** | Measures of skewness and kurtosis -II |
| **5** | Measures of skewness and kurtosis using R |
| **6** | Correlation and Regression |
| **7** | Correlation and Regression using R |

| | |
|---|---|
| **8** | Fitting of Second degree and Exponential curves, verification using R |
| **9** | Conditional probability |
| **10** | Independence of events |
| **11** | Applications of Multiplication and Bayes' theorem |
| **12** | Sensitivity and Specificity |
| **13,14&15** | Applications of statistical techniques to real life data. |