
# Fergusson College (Autonomous)

# Pune

# Learning Outcomes-Based Curriculum

# For

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

With effect from June 2019

## Programme Structure

| Semester | Course Code | Course Title | Course | No. of credits |
|---|---|---|---|---|
| First Year – Semester I | STC1101 | Descriptive Statistics | TCore-1 | 2 |
| | STC1102 | Probability theory and discrete probability distributions | TCore-2 | 2 |
| | STC1103 | Statistics Practical - I | PCore-1 | 2 |
| | ELC1101 | Fundamentals of Logic Circuit Design | TCore-3 | 2 |
| | ELC1102 | Sequential Logic Circuits | TCore-4 | 2 |
| | ELC1103 | Electronics Practical - I | PCore-2 | 2 |
| | CSC1101 | Basic Programming using C | TCore-5 | 2 |
| | CSC1102 | Database Management System: SQL | TCore-6 | 2 |
| | CSC1103 | Computer Science Practical - I | PCore-3 | 2 |
| | CSC1104 | Computer Science Practical - II | PCore-4 | Grade |
| | MTC1101 | Discrete Mathematics | TCore-7 | 2 |
| | MTC1102 | Algebra | TCore-8 | 2 |
| | MTC1103 | Mathematics Practical - I | PCore-5 | 2 |
| First Year – Semester II | STC1201 | Multiple Regression, Time Series and Simulation | TCore-1 | 2 |
| | STC1202 | Continuous Probability Distributions and Inference | TCore-2 | 2 |
| | STC1203 | Statistics Practical - II | PCore-1 | 2 |
| | ELC1201 | Computer Instrumentation | TCore-3 | 2 |
| | ELC1202 | Computer Organization | TCore-4 | 2 |
| | ELC1203 | Electronics Practical - II | PCore-2 | 2 |
| | CSC1201 | Advance Programming using C | TCore-5 | 2 |
| | CSC1202 | Relational Database Management System: PL / SQL | TCore-6 | 2 |
| | CSC1203 | Computer Science Practical - III | PCore-3 | 2 |
| | CSC1204 | Computer Science Practical - IV | PCore-4 | Grade |
| | MTC1201 | Graph theory | TCore-7 | 2 |
| | MTC1202 | Calculus | TCore-8 | 2 |
| | MTC1203 | Mathematics Practical - II | PCore-5 | 2 |

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| Second Year – Semester III | ELC2301 | 8051 Microcontroller | TCore-1 | 3 |
| | ELC2302 | Communication Principles | TCore-2 | 3 |
| | ELC2303 | Electronics Practical III | PCore-1 | 2 |
| | CSC2301 | Data Structures | TCore-3 | 3 |
| | CSC2302 | Web Technologies | TCore-4 | 3 |
| | CSC2303 | Computer Science Practical – I (Lab on Data Structures) | PCore-2 | 2 |
| | CSC2304 | Computer Science Practical – II (Lab on Web Technologies) | PCore-3 | Grade |
| | MTC2301 | Applied Algebra | TCore-5 | 3 |
| | MTC2302 | Numerical Techniques | TCore-6 | 3 |
| | MTC2303 | Mathematics practical | PCore-4 | 2 |
| Second Year – Semester IV | ELC2401 | ARM 7 Based LPC 2148 Microcontroller | TCore-1 | 3 |
| | ELC2402 | Advanced Communication and Networking | TCore-2 | 3 |
| | ELC2403 | Electronics Practical IV | PCore-1 | 2 |
| | CSC2401 | Exploring OOP's using Java | TCore-3 | 3 |
| | CSC2402 | PHP Programming | TCore-4 | 3 |
| | CSC2403 | Computer Science Practical – III (Lab on Java) | PCore-2 | 2 |
| | CSC2404 | Computer Science Practical – IV (Lab on PHP Programming) | PCore-3 | Grade |
| | MTC2401 | Computational Geometry | TCore-5 | 3 |
| | MTC2402 | Operation Research | TCore-6 | 3 |
| | MTC2403 | Mathematics practical | PCore-4 | 2 |
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| Third Year - Semester V | CSC3501 | System Programming Concepts | TCore-1 | 3 |
| | CSC3502 | Advance Java | TCore-2 | 3 |
| | CSC3503 | Design And Analysis of Algorithms | TCore-3 | 3 |
| | CSC3504 | Software Development | TCore-4 | 3 |
| | CSC3505 (Elective –I) **OR** | Data Analytics | DElect-1 | 3 |

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| | CSC3506 (Elective –II) | Digital Image Processing | DElect-2 | 3 |
| | CSC3507 (Elective –I) **OR** CSC3508 (Elective – II) | Android Programming | DElect-3 | 3 |
| | | Artificial Intelligence | DElect-4 | 3 |
| | CSC3511 | Computer Science Practical – I (Lab on System Programming ) | PCore-1 | 3 |
| | CSC3512 | Computer Science Practical – II (Lab on Advance Java) | PCore-2 | 3 |
| | CSC3513 | Computer Science Project – I | PCore-3 | 3 |
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| Third year - Semester VI | CSC3601 | Operating System Concepts | TCore-1 | 3 |
| | CSC3602 | Python Programming | TCore-2 | 3 |
| | CSC3603 | Theoretical Computer Science | TCore-3 | 3 |
| | CSC3604 | Computer Networks | TCore-4 | 3 |
| | CSC3605 (Elective –I) **OR** CSC3606 (Elective – II) | Big Data Analytics | DElect-1 | 3 |
| | | Biometrics | DElect-2 | 3 |
| | CSC3607 (Elective –I) **OR** CSC3608 (Elective –II) | e-Commerce | DElect-3 | 3 |
| | | Internet of Things | DElect-4 | 3 |
| | CSC3611 | Computer Science Practical – III (Lab on Operating System Concepts) | PCore-1 | 3 |
| | CSC3612 | Computer Science Practical – IV (Lab on Python) | PCore-2 | 3 |
| | CSC3613 | Computer Science Project – II | PCore-3 | 3 |

**Programme learning outcomes relating to B.Sc. in Computer Science**

| | |
|---|---|
| PO1 | Apply the knowledge of Computing, Statistics, Mathematics and Electronics; appropriate to the discipline |
| PO2 | Inculcate strong problem solving, analysis and decision-making abilities |
| PO3 | Discuss and implement various programming languages |
| PO4 | Explore the architecture, construction and design of computing |
| PO5 | Design, develop and implement computer systems to meet the expected requirements |
| PO6 | Apply the fundamental knowledge for professional software development as well as to acquire new skills |
| PO7 | Inculcate an effective functioning as a member of a team to develop and implement solutions |
| PO8 | Provide group building opportunities and leadership skills |
| PO9 | Learn to apply software development life cycle and develop an ability to manage the execution of project plan in an effective way. |
| PO10 | Enhance analytical and critical thinking skills |
| PO11 | Develop written and oral communication skills for presentation and report writing |
| PO12 | Study real life problems, design computing systems appropriate to its solutions that are technically sound, economically feasible and socially acceptable |
| PO13 | Develop time management and organization skills |
| PO14 | Acquire the knowledge and skills necessary to support their career in software development and databases as well as in recent trends like data analytics, artificial intelligence, Image processing etc. |

Course Code: STC1101

Subject Name: Descriptive Statistics

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Learning to describe basic features of the data in a study. | Blackboard Teaching |
| Provide brief summary about the sample using different measures. | Provide classroom assignments |
| Try to infer about the behaviour of population from the sample. | |
| To fit predictive models for the sample data. | |

| Unit No. | Title and Contents |
|---|---|
| **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<br>1.3 frequency distribution. (Construction of frequency distribution is not expected)<br>1.4 Graphical Presentation of frequency distribution –histogram, stem and leaf chart, less than and more than type ogive curves.<br>**1.5** Numerical problems related to real life situations. |
| **II** | **Measures of central tendency and dispersion**<br>2.1 Measures of Central tendency: Mean, Mode, Median. Examples<br>2.2 where each one of these is most appropriate.<br>2.3 Partition values: Quartiles, Box-Plot.<br>2.4 Variance, Standard Deviation, Coefficient of Variation. (Section 2.1 to should be covered for raw data, ungrouped frequency distribution and exclusive type grouped frequency distribution) |
| **III** | **Moments**<br>3.1 Raw and Central moments: definition, computations for ungrouped and grouped data (only up to first four moments).<br>3.2 Relation between raw and central moments upto fourth order.<br>**3.3** Numerical problems related to real life situations. |
| **IV** | **Measures of Skewness and Kurtosis**<br>4.1 Concept of symmetric frequency distribution, skewness, positive and negative skewness.<br>4.2 Measures of skewness-Pearson's measure, Bowley's measure ($\beta_1$, $\gamma_1$).<br>4.3 Kurtosis of a frequency distribution, measure of kurtosis ($\beta_2$, $\gamma_2$) |

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| | based upon moments, type of kurtosis: leptokurtic, platykurtic and mesokurtic.<br>**4.4** Numerical problems related to real life situations. |
| **V** | **Correlation and Linear Regression**<br>5.1 Bivariate data, Scatter diagram.<br>5.2 Correlation, Positive Correlation, Negative correlation, Zero Correlation Karl Pearson's coefficient of correlation (r), limits of r ($-1 \leq r \leq 1$), interpretation of r, Coefficient of determination ($r^2$)<br>5.3 Meaning of regression, difference between correlation and regression.<br>5.4 Fitting of line $Y = a+bX$<br>5.5 Concept of residual plot and mean residual sum of squares.<br>5.6 Numerical Problems. |
| **VI** | **Non-Linear Regression**<br>6.1 Second degree curve<br>6.2 Growth curve models of the type<br>i) $Y = ae^{bX}$ ii) $Y = ab^X$ iii) $Y = aX^b$<br>6.3 Logistic model $Y = k / (1+e^{a+bx})$<br>**6.4** Numerical problems related to real life situations. |

**Learning Resources:**


1. Fundamentals of Applied Statistics (3rd Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 1987.
2. An Introductory Statistics, Kennedy and Gentle.
3. Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
4. Introduction to Linear Regression Analysis, Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Wiley

Course Code: STC1102

Subject Name: Probability Theory and Discrete Probability Distributions

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Develop analytical thinking by using the ability to see a problem or solution from different points of view. | Blackboard Teaching |
| To help make informed judgments based on a pattern of data observed previously. | Provide classroom assignments |
| To apply different forms of probability distribution when the values of observed data are discrete. | |

| **Unit No.** | **Title and Contents** |
|---|---|
| I | **Detailed Review / Revision of Theory of Probability**<br>1.1 Counting Principles, Permutation, and Combination.<br>1.2 Deterministic and non-determination models.<br>1.3 Random Experiment, Sample Spaces (finite and countably infinite)<br>1.4 Events: types of events, Operations on events.<br>1.5 Probability - classical definition, probability models, axioms of probability, probability of an event.<br>1.6 Theorems of probability (with proof)<br>i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$<br>ii) $P(A) \leq P(B)$ when $A \subset B$<br>iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$<br>1.7 Numerical problems related to real life situations. |
| II | **Advanced Theory of Probability**<br>2.1 Concepts and definitions of conditional probability, multiplication theorem $P(A \cap B)=P(A).P(B\|A)$<br>2.2 Bayes' theorem (without proof)<br>2.3 Concept of Posterior probability, problems on posterior probability.<br>2.4 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>2.5 Concept and definition of independence of two events. |

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| | 2.6 Numerical problems related to real life situations. |
| III | **Discrete Random variable**<br>3.1 Definition of random variable and discrete random variable.<br>3.2 Definition of probability mass function, distribution function and its properties.<br>3.3 Definition of expectation and variance, theorem on expectation.<br>3.4 Determination of median and mode using p.m.f.<br>3.5 Numerical problems related to real life situations. |
| IV | **Standard Discrete Probability Distributions**<br>4.1 Discrete Uniform Distribution: definition, mean, variance.<br>4.2 Bernoulli Distribution: definition, mean, variance, additive property.<br>4.3 Binomial Distribution: definition, mean, variance, additive property.<br>4.4 Geometric Distribution (p.m.f $p(x) = pqX$, $x = 0,1,2.....$): definition, mean,variance.<br>4.5 Poisson Distribution: definition, mean, variance, mode, additive property, limiting case of B(n, p)<br>4.6 Illustration of real life situations.<br>4.7 Numerical problems related to real life situations. |

**Learning Resources:**


1. Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
2. Fundamentals of Applied Statistics (3rd Edition), Gupta and Kapoor, S.Chand and Sons, New Delhi, 1987.
3. Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
4. Probability, Statistics, Design of Experiments and Queuing theory with applications Computer Science, Trivedi K.S. ,Prentice Hall of India, New Delhi,2001.
5. A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.
6. Introduction to Discrete Probability and Probability Distributions, Kulkarni M.B., Ghatpande S.B., SIPF Academy, 2007.

Course Code: STC1103

Subject Name: Statistics Practical - I

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| To enhance the computational techniques. | Blackboard Teaching |
| To use R software for studying the different concepts in Statistics. | Provide practice assignments. |

| | **Title of Experiment/ Practical** |
|---|---|
| 1 | Introduction to R and graphical methods using R |
| 2 | Measures of Central Tendency, verification using R |
| 3 | Measure of Dispersion, verification using R |
| 4 | Measures of Skewness and Kurtosis, verification using R |
| 5 | Basic Probability Theory |
| 6 | Advanced Theory of Probability |
| 7 | Fitting of Binomial, Poisson and Geometric distribution. Verification using R |
| 8 | Correlation and Linear Regression, verification using R |
| 9 | Model Sampling from Discrete Probability Distributions, verification using R |
| 10 | Fitting of Second degree and Exponential curves, verification using R |

Course Code: ELC1101

Subject Name: Fundamentals of Logic Circuit Design

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Acquire the skills of logic circuit design using logic gates. | Chalk board explanation |
| Evaluate various number systems and codes used in programs development. | Traditional lecture method along with ICT |
| Solve and implement complex Boolean expressions using minimisation techniques. | Problem solving using Boolean laws and K- Map |
| Design, analyse and implement combinational, arithmetic and logic circuits. | Chalk board explanation |

| Unit No. | Title of Unit and Contents |
|---|---|
| I | **Logic gates**<br>Introduction to analog signals and digital signals, Positive and Negative logic, pulse waveform<br>Logic gates : definition, symbols, truth tables, Boolean expressions, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates Universal logic gates. |
| II | **Number system and codes**<br>Decimal, binary, octal, hexadecimal number systems, Conversion of number from one number system to another including decimal / binary points, Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction<br>BCD code numbers and their limitations, Addition of BCD numbers, Conversion of BCD to decimal and vice-versa, Excess-3 code, Gray code, binary to gray and gray to binary conversion, Concept of parity, Error detection using parity |
| 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 up to 4 variables. |
| IV | **Arithmetic and logical circuits**<br>Half adder, Full adder circuit and its operation, Parallel binary adder, Half Subtractor and full Subtractor, Comparator |
| V | **Combinational Circuits** |

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| | Multiplexer(2:1 and 4:1), Demultiplexer (1:2 and 1:4), Tree Multiplexing, Tree De-Multiplexing, Encoder , Priority encoder, Decoder, Active high output and active low output BCD to seven segment decoder |

Learning Resources:


1. Digital Principals, Schaum's outline series, Tata McGraw Hill (2006)
2. Digital System Design, Morris Mano, Pearson Education (2014)
3. Digital Computer Electronics, Malvino
4. Fundamentals of Logic design, Charles H. Roth, Jr. and Larry L. Kinney

Course Code: ELC1102

Subject Name: Sequential Logic Circuits

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Concept of clock, asynchronous and synchronous circuits. | Question answer method |
| Acquire skill to analyse different Flip flops, and ICs (Integrated Circuits). | Demonstration, Interactive discussions |
| Application of flip flops in shift registers and in data communication. | Traditional lecture method and Power Point Presentation |
| Working of counters, sequential memory address generation. | Chalk board explanation |
| Memory hierarchy, need of memory hierarchy in computer system and types of memories used in computer. | Traditional lecture method along with ICT |

| Unit No. | Unit title and Contents |
|---|---|
| I | **Flip flops**<br>Difference between combinational and sequential circuits, Concept of clock and types, synchronous and asynchronous circuit, 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 |
| II | **Sequential Circuits**<br>Basic building block of counter, Ripple counter, up counter, down counter, Up-Down counter, Concept of modulus counters, Decade counter, IC 7490,<br>Shift registers: SISO, SIPO, PISO, PIPO, Ring counter,<br>Universal 4-bit shift register, IC 7495 |
| III | **Memory organization**<br>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<br>Vertical & horizontal Memory expansion (increasing the capacity, increasing word size) |

Learning Resources:


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

Course Code: ELC1103

Subject Name: Electronics Practical - I

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Acquire skills to draw and understand circuit diagrams using standard symbols of Electronic components, devices, power sources and logic gates. | Demonstration |
| Acquire skills to handle Multimeter as measuring instrument. | Demonstration and Hands on |
| Apply Boolean Laws, De Morgan's theorems to construct combinational and sequential circuits. | Demonstration and Hands on |
| Design and analyse different circuits using ICs. | Demonstration and Hands on |
| Acquired knowledge of construction of basic logic gates using semiconductor devices. | Demonstration and Hands on |

**Any 10 Experiments from the following list**

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Study of discrete Logic gates |
| 2 | Study of logic gate using ICs |
| 3 | NAND gate as universal gate |
| 4 | Conversion and verification of a Boolean expression into logic circuit using logic gate IC's |
| 5 | Design a Half Adder and Full Adder |
| 6 | Design a Half Subtractor and Full Subtractor |
| 7 | Verification of De Morgan's theorems |
| 8 | Multiplexer (4:1) and De-Multiplexer(1:4) |
| 9 | Interfacing Thumbwheel switch to seven segment display |
| 10 | Study of Flip flop ICs : IC 7474, IC 74776, IC 74279 |
| 11 | Study of Modulo counter using IC 7490 |
| 12 | Study of Shift register IC 7495 (SISO –right, left shift and PIPO) |
| 13 | Study of up/down counter IC 74192/93 |
| 14 | Rolling display |

Course Code: CSC1101

Subject Name: Basic Programming using C

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Analyse a problem and develop the solution to solve the problem | Chalk board explanation |
| Learn and design algorithm development for problem solving | Traditional lecture method along with ICT |
| Learn block structured programming concepts | Live demonstration of concepts using DLP |
| Understand and develop programming skills using C programming language | Problem solving using algorithm and flowchart |
| Apply the strategies useful in debugging | Problem solving using program writing |

| Unit No. | Title of Unit and Contents |
|---|---|
| I | **Programming Languages and Tools**<br>1.1 Machine language<br>1.2 Assembly language<br>1.3 High level languages<br>1.4 Compilers and Interpreters<br>1.5 Algorithms<br>1.6 Flowcharts |
| II | **Introduction to C**<br>2.1 History and C as middle level language.<br>2.2 C as procedure-oriented programming<br>2.3 Structure of a C program<br>2.4 Application Areas<br>2.5 C Program development life cycle<br>2.6 Sample programs |
| III | **C Tokens**<br>3.1 Keywords<br>3.2 Identifiers<br>3.3 Variables<br>3.4 Constants – character, integer, float, string,<br>3.5 escape sequences<br>3.6 Data types – built-in and user defined(enumerated)<br>3.7 Operators and Expressions Operator types<br>3.8 (arithmetic, relational, logical, assignment, |

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| | bitwise, conditional, other operators), precedence and associativity rules |
| IV | **Control Structures**<br>4.1 Decision making structures *if*, *if-else*, *switch*<br>4.2 Loop Control structures *while*, *do-while* and *for*<br>4.3 Nested structures<br>4.4 *break*, *continue* and *goto* |
| V | **Functions**<br>5.1 What is a function?<br>5.2 Advantages of Functions<br>5.3 Standard library functions<br>5.4 User defined functions: Declaration, definition, function call, parameter passing (by value), return keyword<br>5.5 Scope of variables, storage classes<br>5.6 Recursion |
| VI | **Arrays**<br>6.1 Array declaration, initialization<br>6.2 Types – one, two and multidimensional<br>6.3 Passing arrays to functions |

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. Yashavant Kanetkar, Let Us C, Seventh Edition, PBP Publications
4. E Balagurusamy, Programming in ANSI C, Fourth Edition, Tata McGraw Hill

Course Code: CSC1102

Subject Name: Database Management System: SQL

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Familiarise with database concepts and applications. | Question answer method |
| Design data models, schemas and instances. | Interactive discussions |
| Implement the relational database design and data modelling using entity-relationship (ER) model. | Presentation and Hands-on session |
| Acquaint with the concepts of constraints and relational algebra operations | Demonstration method |
| Implement SQL: Data definition, constraints, schema, queries and operations in SQL | Problem solving |

| Unit No. | Title of Unit and Contents |
|---|---|
| I | **Introduction to DBMS**<br>1.1 File system Vs DBMS<br>1.2 Data models (Relational, Hierarchical, Network)<br>1.3 Abstraction and Levels of abstraction<br>1.4 Data independence<br>1.5 Structure of DBMS<br>1.6 Users of DBMS<br>1.7 Advantages of DBMS |
| II | **Database design and ER Model**:<br>2.1 Introduction to ER – Model<br>2.2 Constraints, E-R Diagrams, ERD Issues,<br>2.3 Weak Entity Sets, Codd's Rules<br>2.4 Relational database model: Logical view of data, keys, integrity rules.<br>2.2Relational Database design: Features of good relational database design<br>2.3Functional dependencies (Basic concepts, F+, Closure of an Attribute set, Concept of a Super Key and a primary key (Algorithm to derive a Primary Key for a relation)<br>2.4Concept of Decomposition<br>2.5 Desirable Properties of Decomposition (Lossless Join & Dependency Preservation)<br>2.6 Atomic domain and Normalization 1NF, 2NF, 3NF, BCNF |

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|---|---|
| III | **Structured Query Language (PostgreSQL)**<br>3.1 Introduction<br>3.2 Set operations<br>3.3 Aggregate functions<br>3.4 Null values<br>3.5 Nested Sub-queries<br>3.6 Modifications to Database<br>3.7 DDL commands with examples<br>3.8 SQL mechanisms for joining relations (inner joins, outer joins and their types)<br>3.9 Examples on SQL (case studies)<br>3.10 Introduction to PL/SQL<br>3.10.1 Views |
| IV | **Relational algebra:**<br>4.1 Introduction<br>4.2 Basic operations: Selection and projection, set operations, renaming, Joins, Division |

Learning Resources:


1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, Tata McGraw-Hill Education
2. Korry Douglas, PostgreSQL, ISBN:9780672327568
3. John Worsley, Joshua Drake Practical PostgreSQL (B/CD), Shroff/O'reilly
4. Joshua D. Drake, John C Worsley, Practical Postgresql, O'Reilly Publication
5. Richard Stones, Neil Matthew, Beginning Databases with PostgreSQL From Novice to Professional, 2nd Edition Apress
6. Elmasri and Navathe, Fundamentals of Database Systems, 4th Edition
7. S. K. Singh, Database Management System: Concepts, design & applications, Pearson publication

Course Code: CSC1103

Subject Name: Computer Science Practical - I

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Familiarize with the use of the C programming language to implement various algorithms and develops the basic concepts and terminology of programming in general. | Programming assignments |
| Read, understand and trace the execution of programs written in C language. | Programming assignments |
| Learn to write structured C programs which is the foundation of any programming language. | Programming assignments |
| Perceive writing and use of functions and to implement function calls, and parameter passing options. | Programming assignments |
| Learn the concept and implementation of arrays. | Programming assignments |

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Use of data types, simple operators |
| 2 | Decision making statements (if-else and switch case) |
| 3 | Use of loops |
| 4 | Menu driven programs using standard library functions |
| 5 | Use of user defined functions |
| 6 | Recursive functions |
| 7 | Use of arrays (1-d arrays) and functions |
| 8 | Use of arrays (2-d arrays) and functions |
| 9 | Programs based on the concepts of Control Structures |
| 10 | Programs based on the concepts of Control Structures and Arrays |

Course Code: CSC1104

Subject Name: Computer Science Practical - II

Credits: Grade

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Transform an information model into a relational database schema | Programming assignments |
| To use a data definition language and/or utility to implement the schema using a DBMS. | Programming assignments |
| Implement SQL: Data definition, constraints, schema, queries and operations in SQL | Programming assignments |
| Analyse an information storage problem and derive an information model expressed in the form of an entity relation diagram | Programming assignments |
| Demonstrate an understanding of normalization and apply the knowledge to the normalization of a database. Formulate, using relational algebra, solutions to a broad range of query problems. | Programming assignments |

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Using basic Linux commands |
| 2 | Using vi editor |
| 3 | To create simple tables , with only the primary key constraint ( as a table level constraint & as a field level constraint) (include all data types) and create more than one table, with *referential integrity* constraint, *Primary Key* constraints |
| 4 | To create one or more tables with c*heck*, *unique* and *not null* constraint And to drop a table from the database and to alter the schema of a table in the Database |
| 5 | To insert / update / delete records using tables created in previous Assignments. ( use simple forms of *insert* / *update* / *delete* statements) |
| 6 | To query the tables using simple form of select statement |
| 7 | To query table, using set operations (*union*, *intersect*) |
| 8 | To query tables using simple and nested queries ( use of e*xcept*, *exists*, *not exists*) |
| 9 | Simple query handling |
| 10 | Nested query handling |

Course Code: MTC1101

Subject Name Discrete Mathematics

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| Using basic concepts of Discrete mathematics. | Blackboard Teaching |
| Application of counting principle in permutations, combinations and probability. | Provide classroom assignments |
| Understanding of induction principle. | |
| Able to do operations on boolean algebra. | |

| Unit No. | Title and Contents |
|---|---|
| I | **Counting Principle**<br>Cardinality of sets, Basics of Counting: Addition rule, Product rule, Inclusion and Exclusion Principle, Mathematical Induction:1st and 2nd principle of induction. |
| II | **Lattices and Boolean Algebra**<br>Introduction to relation, equivalence relation, Poset, Hasse diagram, Lattices, Complemented lattice, Bounded lattice and Distributive lattice, Boolean Functions, Boolean variable, Boolean Functions of degree n, Boolean identities, Definition of Boolean Algebra. Representation of Boolean Functions. Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form. |
| III | **Recurrence Relations**<br>Recurrence Relation, Formation. Linear Recurrence Relations with constant coefficients. Homogeneous Solution. Particular Solution,Total Solution.(Introduction of Solving Recurrence Relation through generating Functions. |
| IV | **Introduction to Graphs and Operations on Graphs**<br>Definition and examples of graph, Handshaking lemma and it's corollaries. Types of graph, Complete graph, bipartite graph, Regular graph, Null graph. Isomorphism of graphs, Adjacency and Incidence Matrix of a Graph. Vertex induced subgraph, Edge induced subgraph, Vertex deleted subgraph, Edge deleted subgraph, Union of two graphs, Intersection of two graphs, Product of two graphs, Ring Sum of two graphs, Fusion of vertices, Complement of a graph. |

Learning Resources:


1. Kenneth H.Rosen. Discrete Mathematics and its applications. (7th edition) McGraw-Hill Higher Education, 2017.
2. Bernard Kolman, Robert C.Busby , and Sharon cutler Ross. *Discrete Mathematical Structures* (6th edition). Prentice-Hall, Inc. Upper Saddle River, NJ, USA, 2003.
3. John Clark and Derek Holton, A first look at Graph Theory, 2013.

Course Code: MTC1102

Subject: Algebra

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| It promotes Abstract and Analytical thinking. | Black board teaching. |
| Knowledge of basic group theory and its relevance in coding theory. | Provide classroom assignments. |
| Compute power of integers modulo prime, using Fermat's theorem and further using this in finding public key. | |

| Unit | Title and Contents |
|---|---|
| I | **Divisibility in Integers**<br>Division Algorithm (without proof), Divisibility and its properties, prime numbers. Definition of G.C.D and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers. Euclidean Algorithm (Without proof). Relatively prime integers, Euclid Lemma and its generalization, Congruence relations and its properties, Residue Classes: Definition, Examples, addition and multiplication modulo n and composition tables, Euler's and Fermat's Theorems (Without proof), Chinese Remainder Theorem. |
| II | **Binary Operations and Groups**<br>Definition of binary operation, properties of binary operations and examples. Definition of group, examples. Subgroups, finite and infinite groups. Permutation groups. Cyclic groups, Definition and Examples of Normal Subgroups. Definition and Examples of Quotient groups. |
| III | **Coding Theory and RSA**<br>Introduction to coding: Weight, Hamming distance, Encoding, Parity check matrix, Generator Matrix, Decoding and error correction, Public key cryptography. |

Learning Resources:


1. Burton, D. Elementary number theory. 6th ed. New York: McGraw-Hill, 2008.
2. Lidl, Rudolf. and Pilz, Gunter. Applied abstract algebra, 2nd edition, Gunter Pilz Springer New York, 2004.
3. J.B. Fraleigh, A First Course in Abstract Algebra, Seventh Ed., Pearson Education Inc., 2017.

Course Code: MTC1103

Subject: Mathematics Practical - I

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| The computational exercises develop basic techniques and tests understanding of concepts. | Black board teaching. |
| To enhance mathematical ability. | Provide classroom assignments. |
| Able to use softwares like Scilab and geogebra to implement different Mathematic concepts. | Taking Practice of questions related to theoretical topics as well. |

| **Sessions** | **Title of Experiment / Practical** |
|---|---|
| 1 | Scilab I: Basic Commands. |
| 2 | Scilab II: Functions, Graphs. |
| 3 | Scilab III: Introduction to Scilab Programming. |
| 4 | Recurrance Relation. |
| 5 | Divisibility. |
| 6 | Finding roots by using Regula-falsi Method (Theory + Scilab Programming). |
| 7 | Finding roots by using Newton Raphson Method (Theory + Scilab Programming). |
| 8 | Lattices and Boolean Algebra. |
| 9 | Coding Theory. |
| 10 | Student Activity. |

Course Code: STC1201

Subject: Multiple Regression, Time Series and Simulation

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| To fit advanced predictive models. | Blackboard Teaching |
| Study data related to time and predict its future behaviour. | Provide classroom assignments |
| To study different models of forecasting. | |
| To strengthen the skill set required for data analysis . | |

| Unit No. | Title and Contents |
|---|---|
| **I** | **Multiple and Partial Correlation and Regression (for trivariate data)**<br>**1.1** Yule's notation and concept of multiple regression.<br>**1.2** Fitting of multiple regression plane.<br>**1.3** Partial regression coefficient, interpretation.<br>1.4 Multiple correlation coefficient, concept, definition, computation and interpretation.<br>1.5 Partial correlation coefficient, concept, definition, computation and interpretation.<br>1.6 Numerical Problems |
| **II** | **Time Series**<br>2.1 Meaning and Utility.<br>2.2 Components of Time Series.<br>2.3 Additive and Multiplicative models.<br>2.4 Methods of estimating trend: moving average method, least squares method and exponential smoothing method.<br>2.5 Elimination of trend using additive and multiplicative models.<br>2.6 Measurement and estimation of seasonal variations using link relative method and ratio to trend method<br>2.7 Simple time series models: AR (1), AR (2).<br>**2.8** Numerical problems related to real life situations. |
| **III** | **Non parametric tests**<br>3.1 Run test<br>3.2 Sign test.<br>3.3 Kolmogrov - Smirnov test<br>3.4 Mann – Whitney test<br>**3.5** Numerical problems related to real life situations. |

| | |
|---|---|
| **IV** | **Simulation**<br>4.1 Introduction to Simulation, merits and demerits.<br>4.2 Monte Carlo Simulation<br>4.3 Pseudo-random number generator, requisites of a good random number generator, testing these requirements by using various test of hypothesis using Run test, goodness of fit test, Sign test etc.<br>4.4 Model Sampling from uniform and exponential distribution.<br>4.5 Model sampling from Normal distribution using Box-Muller transformation.<br>**4.6** Numerical problems related to real life situations. |
| **V** | **Queueing Model**<br>5.1 M/M/1 : FIFO as a application of exponential distribution, Poisson distribution and Geometric distribution.<br>5.2 Interarrival rate ($\lambda$) service rate ($\mu$), traffic intensity ($\rho = \lambda/\mu < 1$), queue discipline,<br>5.3 probability distribution of number of customers in queue,<br>5.4 average queue length, average waiting time in (i) queue (ii) system. |

Learning Resources:


1. Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
2. Statistical Methods, J. Medhi, New Age International, 1992.
3. Time Series Methods, Brockell and Devis, Springer, 2006.
4. Time Series Analysis,4th Edition, Box and Jenkin, Wiley, 2008.
5. Simulation and Modelling Analysis,Kelton and Law, Tata McGraw Hill, 2007.
6. System Simulation with Digital Computer, Narsingh Dev, Prentice Hall, 2003.

Course Code: STC1202

Subject: Continuous Probability Distributions and Inference

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| To apply different forms of probability distribution when the values of observed data are continuous | Blackboard Teaching |
| How to use sample data to answer research questions | Provide classroom assignments |
| To study how hypothesis ensures the entire research process remains scientific and reliable | |

| Unit No. | Title and Contents |
|---|---|
| **I** | **Continuous Random Variable**<br>1.1 Definition of continuous random variable (r.v.),<br>1.2 Probability density function (p.d.f.),<br>1.3 Cumulative distribution function (c.d.f.), its properties.<br>1.4 Calculation of mean, mode, median, variance, standard deviation for continuous r. v.<br>1.5 Numerical problems related to real life situations. |
| **II** | **Standard Continuous Probability Distributions**<br>2.1 Uniform Distribution: statement of p.d.f., mean, variance, nature of probability curve.<br>2.2 Exponential Distribution: statement of p.d.f. of the form, $f(x) = (1/\theta)\, e(-x/\theta)$, mean, variance, nature of probability curve, lack of memory property.<br>2.3 Normal Distribution: statement of p.d.f., identification of parameters, nature of probability density curve, standard normal distribution, symmetry, distribution of aX+b, aX+bY+c where X and Y are independent normal variables, computations of probabilities using normal probability table, normal approximation to binomial and Poisson distribution, central limit theorem (statement only), normal probability plot.<br>2.4 Pareto Distribution: p.d.f., mean, variance, applications.<br>2.5 Numerical problems related to real life situations. |
| **III** | **Testing of hypothesis**<br>3.1 Definitions: population, statistic, SRSWR, SRSWOR, random sample from a probability distribution, parameter, statistic, standard |

| | |
|---|---|
| | error of estimator.<br>3.2 Concept of null hypothesis and alternative hypothesis, critical region, level of significance, type I and type II error, one sided and two sided tests, p-value. |
| **IV** | **Large Sample Tests**<br>4.1 $H_o$: $\mu = \mu_o$ Vs $H_1$: $\mu \neq \mu_o$, $\mu < \mu_o$, $\mu > \mu_o$ (One sided and two-sided tests)<br>4.2 $H_o$: $\mu_1 = \mu_2$ Vs $H_1$: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$(One sided and two-sided tests)<br>4.3 $H_o$: $P = P_o$ Vs $H_1$: $P \neq P_o$, $P < P_o$, $P > P_o$ (One sided and two-sided tests)<br>4.4 $H_o$: $P_1 = P_2$ Vs $H_1$: $P_1 \neq P_2$, $P_1 < P_2$, $P_1 > P_2$ (One sided and two-sided tests)<br>4.5 Numerical problems related to real life situations. |
| **V** | **Tests based on t, Chi-square and F-distribution**<br>5.1 $H_o$: $\mu = \mu_o$ Vs $H_1$: $\mu \neq \mu_o$, $\mu < \mu_o$, $\mu > \mu_o$ (One sided and two-sided tests)<br>5.2 $H_o$: $\mu_1 = \mu_2$ Vs $H_1$: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$(One sided and two-sided tests)<br>5.3 Paired t-test.<br>5.4 Chi square test for goodness of fit<br>5.5 Test for independence of attributes (m X n contingency table)<br>5.6 Test for significance of variation for a population. (One sided and two sided tests)<br>5.7 Test for equality of population variances (One sided and two sided tests)<br>5.8 Numerical problems related to real life situations. |

Learning Resources:


1. A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.
2. Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
3. Probability, Statistics, Design of Experiments and Queuing theory with applications Computer Science, Trivedi K.S., Prentice Hall of India, New Delhi, 2001.
4. Common Statistical Tests, Kulkarni M.B., Ghatpande S.B., Gore S.D., Satyajeet Prakashan, Pune, 1999.

Course Code: STC1203

Subject: Statistics Practical - II

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| To develop inferential techniques using different computational exercises. | Blackboard Teaching |
| To use R software for validating the results studied in computational exercises. | Provide practice assignments. |

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Multiple Regression, Multiple and Partial Correlation Coefficient, verification using R |
| 2 | Time Series-I |
| 3 | Time Series-II |
| 4 | Model Sampling from Continuous probability distributions, verification using R |
| 5 | Fitting of Normal distribution, verification using R |
| 6 | Computations of probabilities of Normal and Exponential distributions, verification using R |
| 7 | Large sample tests of hypothesis |
| 8 | Non-parametric tests, verification using R |
| 9 | Tests based on chi-square distribution, verification using R |
| 10 | Tests based on t and F distributions, verification using R |

Course Code: ELC1201

Subject Name: Computer Instrumentation

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Analyse different sensors and their operation in the application circuits. | Presentation and Discussion |
| Design and working of Analog to Digital and Digital to Analog converters. | Chalk Board method |
| Construction of amplifier using semiconductor devices | Chalk Board & Using ICT |
| Design and analyse different Electronic systems in which sensors are used. | Using ICT |

| Unit No. | Unit title and Contents |
|---|---|
| I | **Sensors**<br>1.1 Definition of sensors and transducers<br>1.2 Classification of sensors: Active and passive sensors<br>1.3 Specifications of sensor: Accuracy, range, linearity, sensitivity, resolution, reproducibility.<br>1.4 Temperature sensors (LM-35 and AD590), piezoelectric humidity sensor, optical sensor (LDR), displacement sensor (LVDT), Passive Infrared sensor (PIR), Touch sensor, Ultrasonic sensor<br>1.5 Applications of Sensor. |
| II | **Signal Conditioning Circuits**<br>2.1 Introduction to signal conditioning, Transistor amplifier,<br>2.2 Operational Amplifier: Characteristics of Op-Amp, Inverting and Non inverting amplifier, Concept of virtual ground, Three OP-amp instrumentation amplifier,<br>2.3 Filters: active and passive filters, Op-Amp based filters: Low Pass Filter, High Pass Filter, Concept of Band Pass Filter, Band reject filter, Notch Filter |
| III | **Data Converters:**<br>3.1 Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters of DAC: Linearity, resolution, accuracy<br>3.2 Analog to Digital Converter: Flash ADC, Successive approximation ADC and dual slope ADC<br>3.3 Parameters of ADC: Linearity, resolution, conversion time, accuracy, ADC/DAC IC's (ADuC 814, IC 0808). |

Learning Resources:

1. Sensors & Transducers: Dr. A. D. Shaligram: CTC publications
2. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad: PHI: 4th Ed.
3. Digital Principles and applications: Malvino Leach, Saha

Course Code: ELC1202

Subject Name: Computer Organization

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Ability to understand basic structure of computer and organization of ALU, Memory unit and Input Output Unit. | Traditional lecture method along with PPT & ICT |
| Understand the basics of organizational and architectural issues of a digital Computer. | Traditional lecture method along with PPT & ICT |

| Unit No. | Unit title and Contents |
|---|---|
| I | **Memory organization**<br>Basic structure of computer system<br>Associative Memory, Cache memory,<br>Cache mapping techniques: direct, associative, set associative<br>virtual memory, virtual memory mapping (paging and segmentation). |
| II | **Register and stack Organization**<br>Register based CPU organization<br>stack organization: concept of PUSH, POP, Top of Stack and Stack pointer,<br>Ascending and Descending stack,<br>Register stack, Memory stack |
| III | **Input output organization**<br>Need of interface, Block diagram of general I/O interface,<br>Working concepts like polling, Daisy chain, interrupt initiated data transfer.<br>Concept of DMA, DMA transfer, DMA Controller<br>General block diagram of UART<br>Serial communication standards RS-232. |
| IV | **Microprocessor**<br>Evolution of Microprocessor (8086 to Pentium 4)<br>Concept of RISC & CISC, Von- Neumann & Harvard Architecture<br>Concept of pipeline, 8086 Architecture |

Learning Resources:


1. Computer system Architecture: Morris Mano, Pearson Publication
2. Computer Organization and Architecture: Designing for Performance, W. Stallings, Eighth Edition, Pearson
3. Microprocessors and Interfacing: Douglas V. Hall, Mcgraw Hill Higher Education

Course Code: ELC1203

Subject Name: Electronics Practical - II

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Design of: 4 bit ALU, Read Only Memory(ROM), parallel priority interrupt system, Temperature sensing system, Instrumentation amplifier | Demonstration and Hands-on circuit design |
| Wired communication, read and write operation of RAM memory. | Demonstration and Hands on writing & reading data |
| Construction of filter circuits, fastest ADC, R-2R ladder DAC. | Hands-on circuit design |
| Design of DC power supply and PWM based SMPS. | Hands-on circuit design |
| Components of Motherboard. | Demonstration using ICT |
| Acquire skill of application circuit design and Presentation | Hands-on circuit design and Presentation |

**Any Eight Experiments from the following list:**

| Expt. No. | Title of Experiment / Practical |
|---|---|
| 1 | Parallel Priority Interrupt circuit |
| 2 | Wired communication using RS-232 by Termite software |
| 3 | Study of ALU (74181). |
| 4 | Read write action of RAM |
| 5 | Diode matrix ROM |
| 6 | EPROM |
| 7 | Study of Motherboard |
| 8 | Temperature Sensor using LM-35 |
| 9 | Instrumentation amplifier |
| 10 | Filters |
| 11 | Flash ADC |
| 12 | R-2R Ladder |
| 13 | Study of DC power supply |

Course Code: CSC1201

Subject Name: Advance Programming using C

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Identify appropriate sorting and searching techniques for the given problems using arrays. | Chalk board explanation |
| Implement the dynamic memory management techniques using the concept of Pointers. | Traditional lecture method along with ICT |
| Ability to work with characters and strings | Live demonstration of concepts using DLP |
| Competence to design simple application using structures and files. | Live demonstration of concepts using DLP and implementation |
| Proficiency to use various techniques for representation of the data in the real world. | Live demonstration of concepts using DLP and implementation |

| Unit No. | Title of Unit and Contents |
|---|---|
| I | **Application of array**<br>1.1 Sorting techniques (bubble, insertion, selection)<br>1.2 Searching techniques (linear search, binary search) |
| II | **Pointers**<br>2.1 Pointer declaration, initialization<br>2.2 Dereferencing pointers<br>2.3 Pointer arithmetic<br>2.4 Pointer to pointer<br>2.5 Arrays and pointers<br>2.6 Functions and pointers – passing pointers to functions, function returning pointers<br>2.7 Dynamic memory allocation |
| III | **Strings**<br>3.1 Declaration and initialization, string input/output, format specifiers<br>3.2 Standard library functions<br>3.3 Strings and pointers<br>3.4 Array of strings<br>3.5 Command Line Arguments |

| | |
|---|---|
| IV | **Structures and Unions**<br>4.1 Creating structures<br>4.2 Accessing structure members (dot Operator)<br>4.3 Structure initialization<br>4.4 Array of structures<br>4.5 Passing structures to functions<br>4.6 Nested structures<br>4.7 Pointers and structures<br>4.8 Self-referential structure<br>4.9 Unions<br>4.10 Difference between structures and unions<br>4.11 typedef<br>4.12 Bit-Fields |
| V | **C Preprocessor**<br>5.1 Introduction of Preprocessor directive<br>5.2 File Inclusion directive<br>5.3 Macro substitution, nested macro, argumented macro |
| VI | **File Handling**<br>6.1 Introduction<br>6.2 Modes of file opening<br>6.3 Operations on files |

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. Yashavant Kanetkar : Let Us C, Seventh Edition, PBP Publications
4. E Balagurusamy : Programming in ANSI C, Fourth Edition, TMH

Course Code: CSC1202

Subject Name: Relational Database Management System: (PL / SQL)

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Learning how code can be executed within a DBMS | Question answer method |
| Be able to design stored functions in general | Interactive procedure |
| Be able to construct and execute stored functions, triggers and cursors on PostgreSQL | Presentation and Hands-on session |
| Use the Relational model and how it is supported by SQL and PL/SQL | Demonstration method |
| Use the PL/SQL code constructs of IF-THEN-ELSE and LOOP types as well as syntax and command functions. | Problem solving |

| Unit No. | Title of Unit and Contents |
|---|---|
| I | **Relational Database Design**<br>1.1 PL/PgSQL: Datatypes, Language structure<br>1.2 Controlling the program flow, conditional statements, loops<br>1.3 Views<br>1.4 Stored Functions, Stored Procedures<br>1.5 Handling errors and exceptions<br>1.6 Cursors<br>1.7 Concepts of Triggers |
| II | **Transaction Concepts and concurrency control**<br>2.1 Describe a transaction, properties of transaction, state of the transaction.<br>2.2 Executing transactions concurrently associated problem in concurrent execution. Schedules, types of schedules, concept of Serializability, precedence graph for Serializability.<br>2.3 Ensuring Serializability by locks, different lock modes, 2PL and its variations.<br>2.4 Basic timestamp method for concurrency, Thomas Write Rule.<br>2.5 Locks with multiple granularity, dynamic database concurrency (Phantom Problem)<br>2.6 Timestamps versus locking<br>2.7 Deadlock handling methods<br>2.8 Detection and Recovery (Wait for graph)<br>2.9 Prevention algorithms (Wound-wait, Wait-die) |

| | |
|---|---|
| III | **Crash Recovery**<br>3.1 Failure classification<br>3.2 Recovery concepts<br>3.3 Log base recovery techniques (Deferred and Immediate update)<br>3.4 Checkpoints<br>3.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)<br>3.6 Database backup and recovery from catastrophic failure |

Learning Resources:


1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, Tata McGraw-Hill Education
2. Korry Douglas, PostgreSQL, ISBN:9780672327568
3. John Worsley, Joshua Drake Practical PostgreSQL (B/CD), Shroff/O'reilly
4. Joshua D. Drake, John C Worsley Practical Postgresql , O'Reilly
5. Richard Stones, Neil Matthew, Beginning Databases with PostgreSQL, From Novice to Professional, 2nd Edition Apress
6. Elmasri and Navathe Fundamentals of Database Systems 4th Edition
7. S.K Singh, Database Management System: Concepts, design & applications Pearson publication

Course Code: CSC1203

Subject Name: Computer Science Practical - III

Credits: 2

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Introduces the more advanced features of the C language. | Hands-on on programming assignments |
| Develop code that utilizes pointers which helps in proper management of memory. | Hands-on on programming assignments |
| Gain skills to handle strings. | Hands-on on programming assignments |
| Illustrate operations on text and binary files. | Hands-on on programming assignments |
| Develop interest and lay foundation to learn data structures and Java | Hands-on on programming assignments |

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Application of array |
| 2 | Use of pointers |
| 3 | Concept of strings, array of strings |
| 4 | String operations using pointers. |
| 5 | Structures using array, pointer and functions. |
| 6 | Nested structures and concept of union |
| 7 | Command line arguments and pre-processor directives. |
| 8 | File handling |
| 9 | Programs based on concepts of Sorting and File Handling |
| 10 | Programs based on concepts of Data Handling using Structure and Files |

Course Code: CSC1204

Subject Name: Computer Science Practical - IV

Credits: Grade

| Learning Outcomes | Suggested Pedagogical Processes |
|---|---|
| Learn, analyse and apply common SQL statements including DDL, DML and DCL statements to perform different operations. | Hands-on on programming assignments |
| Design different views of tables for different users and to apply embedded and nested queries | Hands-on on programming assignments |
| Design and implement a database for a given problem according to well-known design principles that balance data retrieval performance with data consistency | Hands-on on programming assignments |
| Acquiring the needs of database processing and learn techniques for controlling the consequences of concurrent data access | Hands-on on programming assignments |
| Implementing the concept of Transaction and Query processing | Hands-on on programming assignments |

| | **Title of Experiment / Practical** |
|---|---|
| 1 | Queries using Aggregate Functions |
| 2 | Nested queries |
| 3 | Control Structures |
| 4 | Stored Functions |
| 5 | Views |
| 6 | Exception handling |
| 7 | Cursors |
| 8 | Triggers |
| 9 | Queries using loops and conditional Statements |
| 10 | Queries using cursors and views |

Course Code: MTC1201

Subject Name: Graph theory

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| Demonstrate knowledge of the syllabus material. | Blackboard teaching |
| Write precise and accurate mathematical definitions of objects in graph theory. | Provide classroom assignments |
| Use a combination of theoretical knowledge and independent mathematical thinking in making relevance of real life problems to graph theory. | |

| Unit No. | Title and Contents |
|---|---|
| I | **Connected Graphs**<br>1.1 Walk, Trail, Path, Cycle: Definitions and elementary properties. Connected Graphs: definition and properties.<br>1.2 Distance between two vertices, eccentricity, centre, radius and diameter of a graph. Isthmus, Cut vertex: Definition and properties. Cutset, edge connectivity, vertex connectivity. Weighted Graph and Dijkstra's Algorithm. |
| II | **Eulerian and Hamiltonian Graphs**<br>2.1 Eulerian graph: Definition and examples, necessary and sufficient conditions, Fleury's Algorithm. Hamiltonian Graphs: Definition and examples, necessary condition .Introduction to Chinese Postman Problem and Travelling Salesman Problem. |
| III | **Trees**<br>3.1 Definition, Properties of trees. Centre of a tree. Binary Tree: Definition and properties. Tree Traversal. Spanning Tree: Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm. |
| IV | **Directed Graphs**<br>4.1 Definition, Examples, Elementary Terminologies and properties. Special Types of Digraphs. Connectedness of digraphs. Network and Flows: definition and examples.<br>4.2 Topological Sorting. |
| V | **Coloring of Graphs**<br>5.1 Chromatic Number. Chromatic Partitioning. Chromatic Polynomial. Matching. |

Learning Resources:


1. Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill) ,7th edition,2007.
2. John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers), 2013.
3. Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice), 1974.

Course Code: MTC1202

Subject Name: Calculus

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| Apply the techniques for solving linear systems of ordinary differential equations. | Blackboard teaching. |
| Understanding of continuous and derivable functions and mean value theorems. | Provide classroom assignments. |
| Using Taylor's theorem, student will able to find series expansion of several functions. | |

| Unit | Title and Contents |
|---|---|
| I | Continuity and Differentiability<br>1.1 Continuity and Properties of continuous functions defined on [a, b] (Without proof) and examples.<br>1.2 Differentiability.<br>1.3 Theorem – Differentiability implies continuity but not conversely.<br>1.4 Intermediate value theorem (without proof).<br>1.5 Rolle's theorem (Geometric interpretation).<br>1.6 Lagrange's Mean Value Theorem (with proof and geometric interpretation)<br>1.7 Cauchy's Mean Value Theorem (with proof),<br>1.8 Verification and applications.<br>1.9 L'Hospital's Rule (without proof). |
| II | Successive Differentiation<br>2.1 The nth derivatives of standard functions.<br>2.2 Leibnitz's Theorem (with proof), Examples. |
| III | Taylor's and Maclaurin's Theorems<br>3.1 Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders (without proof)<br>3.2 Taylor's and Maclaurin's Series. |
| IV | Ordinary differential equations [Lectures 11]<br>4.1 Basic Concepts: Introduction, Definition, Direction Fields.<br>4.2 First Order Differential Equations:<br>4.2.1 Linear Differential Equations,<br>4.2.2 Separable Differential Equations,<br>4.2.3 Exact differential Equations, |

| | |
|---|---|
| | 4.3 Bernoulli Differential Equations, Substitutions,<br>4.4 Euler's method.<br>4.5 Second Order Differential Equations: Basic concepts, Real, distinct roots, complex roots, repeated roots, Reduction of order. |

Learning Resources:


1. George F.Simmons, Differential equations with application and historical notes, McGraw Hill Education, 2nd edition, 2009.

2. Serge Lang, A First Course in Calculus, Springer publication, 5th edition, 2011.

Course Code: MTC1203

Subject Name: Mathematics Practical - II

Credits: 2

| Learning outcomes | Suggested Pedagogical Processes |
|---|---|
| The computational exercises develop basic techniques and tests understanding of concepts. | Black board teaching. |
| To enhance mathematical ability. | Provide classroom assignments. |
| Able to use softwares like Scilab and geogebra to implement different mathematical concepts. | Taking Practice of questions related to theoretical topics as well. |

| | **Title of Experiment/ Practical** |
|---|---|
| 1 | Geogebra: Introduction, Graphs of basic functions. |
| 2 | Numerical Integration Technique by using Scilab: Trapeziodal rule. |
| 3 | Numerical Integration Techniques by using Scilab: Simpson's $(1/3)^{rd}$ and Simpson's $(3/8)^{th}$ rule. |
| 4 | Continuity and Mean value Theorem. |
| 5 | Connected Graphs. |
| 6 | Successive Differentiation. |
| 7 | Trees. |
| 8 | Taylor's and Maclaurin's Theorems. |
| 9 | Directed Graphs. |
| 10 | Solution to ODE by Euler's Method (By Scilab).<br>Runge-kutta of $2^{nd}$ and $4^{th}$ order (By Scilab). |