# PANIMALAR
## ENGINEERING COLLEGE

An Autonomous Institution

*Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai*

# CURRICULUM & SYLLABUS
# REGULATION 2023

FOR THE STUDENTS ADMITTED DURING 2023-24

## B.TECH - COMPUTER SCIENCE AND BUSINESS SYSTEMS

www.panimalar.ac.in

# PANIMALAR ENGINEERING COLLEGE

***(An Autonomous Institution, Affiliated to Anna University, Chennai)***
***Bangalore Trunk Road, Varadharajapuram,***

**Poonamallee, Chennai – 600 123.**

## DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS
## B.TECH- COMPUTER SCIENCE AND BUSINESS SYSTEMS

# CURRICULUM AND SYLLABUS

**REGULATION-2023**

(For the Students admitted during 2023-24)

## PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. To acquire technical knowledge and proficiency required for the employment and lifelong learning and recognized as a valued professional and effective communicator in industries related to computer science and computing technologies.
2. To engage in lifelong learning and Practice their profession in a cooperative, team- oriented manner that holds the multidisciplinary and multicultural environment of suits the current business world.
3. To Function as a responsible member of society and an understanding of the ethics and responsibility of their work in a global context

# PROGRAM OUTCOMES (PO)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design ofexperiments, analysis and interpretation of data, and synthesis of the information.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological

# PROGRAMME SPECIFIC OUTCOMES (PSO)

**PSO 1:** Ability to apply the analytical and business skills to provide sustainable solutions as an engineer/researcher for the real-world problems using core topics in Computer Science with equal appreciation to IT Management.

**PSO 2:** Ability to understand the evolutionary changes in computing, apply innovative ideas by adapting to a rapidly changing environment by applying their knowledge in technology abstraction and common business principles to solve the real world problems and meet the challenges of the future.

**PSO 3:** Ability to practice high ethical, human values and professional standards with soft-skills qualities in computer science and business disciplines and to emerge as an entrepreneur for the growth and development of the society.

**PANIMALAR ENGINEERING COLLEGE**
(An Autonomous Institution)
**B.TECH COMPUTER SCIENCE AND BUSINESS SYSTEMS**
**REGULATIONS – 2023**
**CHOICE BASED CREDIT SYSTEM**
**I - VIII SEMESTERS CURRICULUM AND SYLLABI (REGUALTION 2023)**

| **Semester I** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23MA1103 | Introductory Topics in Statistics, Probability and Calculus | BS | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23ES1104 | Fundamentals of Computer Science | ES | 3/0/0 | 3 | 3 | 60/40 |
| 3 | 23HS1102 | Business Communication and Value Science I | HS | 2/0/2 | 4 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 4 | 23PH1102 | Physics for Computing Science | BS | 2/0/2 | 4 | 3 | 50/50 |
| 5 | 23ES1105 | Principles of Electrical Engineering | BS | 2/0/2 | 4 | 3 | 50/50 |
| 6 | 23MA1102 | Discrete Mathematics for Computer Science | BS | 3/0/2 | 5 | 4 | 50/50 |
| **Laboratory Course** | | | | | | | |
| 7 | 23ES1112 | Fundamentals of Computer Science Laboratory | ES | 0/0/4 | 4 | 2 | 40/60 |
| **Mandatory Course** | | | | | | | |
| 8 | 23TA1101 | தமிழர் மரபு / Heritage of Tamils | HS | 1/0/0 | 1 | 1 | 60/40 |
| | | | **TOTAL** | | **28** | **22** | |

| Semester II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1201 | Data Structures and Algorithms | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1202 | Fundamentals of Economics | PC | 3/0/0 | 3 | 3 | 60/40 |
| 3 | 23HS1202 | Business Communication and Value Science II | HS | 2/0/2 | 4 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 4 | 23EE1204 | Principles of Electronics Engineering | ES | 2/0/2 | 4 | 3 | 50/50 |
| 5 | 23MA1204 | Linear Algebra | BS | 3/0/2 | 5 | 4 | 50/50 |
| 6 | 23MA1205 | Statistical Methods and Modelling | BS | 3/0/2 | 5 | 4 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 7 | 23CB1211 | Data Structures and Algorithms Laboratory | PC | 0/0/4 | 4 | 2 | 40/60 |
| 8 | 23ES1212 | Technical Skill Practices I | EEC | 0/0/2 | 2 | 1 | 40/60 |
| **Mandatory Courses** | | | | | | | |
| 9 | 23TA1201 | தமிழரும் தொழில்நுட்பமும்<br>Tamils and Technology | HS | 1/0/0 | 1 | 1 | 60/40 |
| 10 | | Mandatory course | MC | 2/0/0 | 2 | 0 | 0/100 |
| | | | **TOTAL** | | **33** | **24** | |

| Semester III | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1301 | Object Oriented Programming | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1302 | Formal Language and Automata Theory | PC | 3/0/0 | 3 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 3 | 23MA1305 | Computational Statistics | BS | 3/0/2 | 5 | 4 | 50/50 |
| 4 | 23CB1303 | Software Engineering | PC | 2/0/2 | 4 | 3 | 50/50 |
| 5 | 23CB1304 | Computer Organization and Architecture | PC | 3/0/2 | 5 | 4 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 6 | 23CB1311 | Object Oriented Programming Laboratory | PC | 0/0/4 | 4 | 2 | 40/60 |
| 7 | 23ES1311 | Technical Skill Practices II | EEC | 0/0/2 | 2 | 1 | 40/60 |
| **Mandatory Courses** | | | | | | | |
| 8 | | Mandatory course | MC | 2/0/0 | 2 | 0 | 0/100 |
| | | | **TOTAL** | | **28** | **20** | |

| Semester IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1401 | Database Management Systems | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1402 | Introduction to Innovation and Entrepreneurship | EEC | 3/0/0 | 3 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 3 | 23MA1407 | Operations Research | BS | 3/0/2 | 5 | 4 | 50/50 |
| 4 | 23CB1403 | Operating Systems | PC | 3/0/2 | 5 | 4 | 50/50 |
| 5 | 23CB1404 | Software Design with UML | PC | 3/0/2 | 5 | 4 | 50/50 |
| 6 | 23CB1405 | Design Thinking | EEC | 2/0/2 | 4 | 3 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 7 | 23CB1411 | Database Management Systems Laboratory | PC | 0/0/4 | 4 | 2 | 40/60 |
| 8 | 23ES1411 | Technical Skill Practices III | EEC | 0/0/2 | 2 | 1 | 40/60 |
| | | | **TOTAL** | | **31** | **24** | |

| Semester V | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1501 | Machine Learning | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1502 | Fundamentals of Management | PC | 2/0/0 | 2 | 2 | 60/40 |
| 3 | | Professional Elective I | PE | 3/0/0 | 3 | 3 | 60/40 |
| 4 | | Open Elective I | OE | 3/0/0 | 3 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 5 | 23CB1503 | Design and Analysis of Algorithms | PC | 3/0/2 | 5 | 4 | 50/50 |
| 6 | 23CB1504 | Cloud Computing | PC | 2/0/2 | 4 | 3 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 7 | 23CB1511 | Machine Learning Laboratory | PC | 0/0/4 | 4 | 2 | 40/60 |
| 8 | 23CB1512 | Business Communication and Value Science III | PC | 0/0/2 | 2 | 1 | 40/60 |
| 9 | 23CB1513 | Socially Relevant Mini Project | EEC | 0/0/4 | 4 | 2 | 40/60 |
| 10 | 23ES1511 | Technical Skill Practices IV | EEC | 0/0/2 | 2 | 1 | 40/60 |
| | | | **TOTAL** | | **32** | **24** | |

| Semester VI | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **COURSE CODE** | **COURSE TITLE** | **Category** | **L/T/P** | **Contact Hours** | **Credit** | **Ext / Int Weightage** |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1601 | Computer Networks | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1602 | Financial and Cost Accounting | PC | 2/0/0 | 2 | 2 | 60/40 |
| 3 | | Professional Elective II | PE | 3/0/0 | 3 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 4 | 23CB1603 | Information Security | PC | 3/0/2 | 5 | 4 | 50/50 |
| 5 | 23CB1604 | Artificial Intelligence | PC | 3/0/2 | 5 | 4 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 6 | 23CB1611 | Computer Networks Laboratory | PC | 0/0/4 | 4 | 2 | 40/60 |
| 7 | 23HS1611 | Business Communication and Value Science IV | PC | 0/0/2 | 2 | 1 | 40/60 |
| 8 | 23ES16 11 | Technical Skill Practices V | EEC | 0/0/2 | 2 | 1 | 40/60 |
| | | | **TOTAL** | | **26** | **20** | |

| Semester VII | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No | COURSE CODE | COURSE TITLE | Category | L/T/P | Contact Hours | Credit | Ext / Int Weightage |
| **Theory Courses** | | | | | | | |
| 1 | 23CB1701 | Financial Management | PC | 3/0/0 | 3 | 3 | 60/40 |
| 2 | 23CB1702 | Human Resource Management | PC | 2/0/0 | 2 | 2 | 60/40 |
| 3 | | Professional Elective III | PE | 3/0/0 | 3 | 3 | 60/40 |
| 4 | | Professional Elective IV | PE | 3/0/0 | 3 | 3 | 60/40 |
| 5 | | Open Elective I | OE | 3/0/0 | 3 | 3 | 60/40 |
| **Theory Cum Practical Courses** | | | | | | | |
| 6 | 23CB1703 | Usability Design of Software Applications | PC | 2/0/2 | 4 | 3 | 50/50 |
| **Laboratory Courses** | | | | | | | |
| 7 | 23CB1711 | IT Workshop Laboratory Using Scilab | PC | 0/0/4 | 4 | 2 | 40/60 |
| | | | **TOTAL** | | **22** | **19** | |

| Semester VIII | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No | COURSE CODE | COURSE TITLE | Category | L/T/P | Contact Hours | Credit | Ext / Int Weightage |
| **Theory Courses** | | | | | | | |
| 1 | | Professional Elective V | PE | 3/0/0 | 3 | 3 | 60/40 |
| 2 | | Professional Elective VI | PE | 3/0/0 | 3 | 3 | 60/40 |
| **Laboratory Courses** | | | | | | | |
| 3 | 23CB1811 | Project Work | EEC | 0/0/20 | 20 | 10 | 40/60 |
| | | | **TOTAL** | | **26** | **16** | |

**TOTAL NO. OF CREDITS: 169**

## CREDIT DISTRIBUTION

| Sl. No | Subject Area | Credits Per Semester | | | | | | | | Credits Total | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Semester | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | Humanities and Social Studies (HS) | 4 | 4 | | | | | | | 8 | 4.73 |
| 2. | Basic Sciences (BS) | 13 | 8 | 4 | 4 | | | | | 29 | 17.15 |
| 3. | Engineering Sciences(ES) | 5 | 3 | | | | | | | 8 | 4.73 |
| 4. | Professional Core (PC) | | 8 | 15 | 13 | 15 | 16 | 10 | | 77 | 45.56 |
| 5. | Professional Electives (PE) | | | | | 3 | 3 | 6 | 6 | 18 | 10.65 |
| 6. | Open Electives (OE) | | | | | 3 | | 3 | | 6 | 3.55 |
| 7. | Project Work (PR/EEC) | | 1 | 1 | 7 | 3 | 1 | | 10 | 23 | 13.63 |
| 8. | Non-Credit/ (Mandatory) | | | | | | | | | | |
| | Total | 22 | 24 | 20 | 24 | 24 | 20 | 19 | 16 | 169 | 100% |

## VERTICALS - PROFESSIONAL ELECTIVES

| Vertical I<br><br>Full Stack Development | Vertical II Cloud Computing and Data Center Technologies | Vertical III Emerging Technologies | Vertical IV Artificial Intelligence Techniques | Vertical V<br><br>Computer Science Essentials | Vertical VI Management | Vertical VII Marketing |
|---|---|---|---|---|---|---|
| Open Source Technologies | Cloud Tools and Techniques | Augmented Reality/Virtual Reality | Knowledge Engineering | Java Programming | Customer Relation Management | Advance Finance |
| App Development | Virtualization | Robotic Process Automation | Soft Computing | Compiler Design | Business Analytics | Recommender Systems |
| Cloud Services Management | Cloud Services Management | Neural Networks and Deep Learning | Neural Networks and Deep Learning | Data Mining and Analytics | Computational Finance & Modeling | Digital Marketing |
| UI and UX Design | Storage Technologies | Cyber Security | Text and Speech Analysis | Robotics and Embedded Systems | Psychology | Conversational Systems |
| Software Testing and Automation | Site Reliability Engineering | Quantum Computing | Optimization Techniques in Machine Learning | Gen AI | IT Project Management | Advanced Social Text and Media Analytics |
| Web Application Security | Stream Processing | Cryptocurrency and Blockchain Technologies | Game Theory | Information Retrival | Entrepreneurship Development | Marketing Research and Management |
| DevOps | DevOps | Game Development | Cognitive Science | Modern Web Applications | Business Strategy | Risk Analytics |
| Principles of Programming Languages | Security and Privacy in Cloud | 3D Printing and Design | Ethics And AI | Introduction to IoT | Behavioral Economics | Enterprise Systems |

| 23MA1103 | INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- Analyse the various data by different statistical sampling techniques.
- Understand the basic concepts of probability and the distributions with characteristics of one and two-dimensional random variables.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

**UNIT I STATISTICS 9**

Definition of Statistics. Basic course objectives, Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample

**UNIT II DESCRIPTIVES STATISTICS 9**

Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution

**UNIT III PROBABILIY AND MOMENTS 9**

Probability: Concept of experiments, sample space, event. Definition of Combinatorial Probability, Conditional Probability, Bayes Theorem. Expected values: moments, and their properties, Moment generating function

**UNIT IV PROBABILITY DISTRIBUTIONS 9**

Discrete Probability distributions: Binomial, Poisson and Geometric distributions. Continuous Probability distributions: Uniform, Exponential, Normal distributions

**UNIT V CALCULUS 9**

Basic concepts of Differential and integral calculus, application of double and triple integral

**TOTAL :45 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Demonstrate and apply the basic probability axioms and concepts in their core areas of random phenomena

**CO2** Execute the concepts of probability distributions in an appropriate place of science and Engineering

**CO3** Exemplify the basics concepts of statistics through various representations of data

**CO4** Analyze the various collections of data in science / engineering problems using statistical inference techniques

**TEXT BOOKS**

1. Introduction of Probability Models, S. M. Ross, Academic Press, N.Y, 1997.

2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press

**REFERENCE BOOKS**

1. A first course in Probability, S. M. Ross, Prentice Hall, 2010.
2. Probability and Statistics for Engineers, (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI, 2023.
3. Introduction to the Theory of Statistics, A. M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education, 1974.
4. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning, 7th edition, 2012.
5. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, , Pearson Education.2nd edition,1998.
6. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar, Vidyarthi Prakashan. 2014.

**ONLINE COURSES / RESOURCES:**

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc23_ma86/preview

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO2 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO3 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO4 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO5 | 3 | 3 | 3 | | | | | | | | | 1 |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Written Examinations |
| 40 | 60 | 40 | 60 | 100 |
| 40% | | | | 60 % |

| 23ES1104 | FUNDAMENTALS OF COMPUTER SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To develop simple algorithms for arithmetic and logical problems.
- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions, pointers and structures.
- To do input/output and file handling in C.
- To learn some basic Unix system interface.

**UNIT - I GENERAL PROBLEM-SOLVING CONCEPTS AND IMPERATIVE LANGUAGE 9**

Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C). Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations.

**UNIT - II TYPES OF OPERATOR, EXPRESSIONS AND CONTROL FLOW 9**

Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment and Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation proper variable naming and Hungarian Notation. If-Else-If, Switch, Loops – while, do, for, break and continue, goto Labels-structured and unstructured programming.

**UNIT - III FUNCTIONS, ARRAYS AND POINTERS 9**

Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types.

Pointers and Arrays: Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

**UNIT -IV STRUCTURES, INPUT AND OUTPUT 9**

Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields

Input and Output: Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions.

**UNIT -V INTRODUCTION TO UNIX 9**

Unix system Interface: File Descriptor, Low level I/O – read and write, open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Ability to implement the algorithms and flow chart for solving Mathematical and Engineering problems

**CO2** Develop C programs for real world/technical application using basic constructs

**CO3** Explore the usage of arrays, pointers and functions in C.

**CO4** Implement Programs with structures and union in C.

**CO5** Design applications using sequential and random access file processing.

**CO6** Identify and use UNIX utilities to create and manage simple file processing operations, organize directory structures.

**TEXT BOOKS**


1. Herbert Schildt, C: The Complete Reference, Fourth Edition, , McGraw Hill, 2017
2. Paul Love, Joe Merlino, Craig Zimmerman, Jeremy C. Reed, and Paul Weinstein, Beginning Unix, Wiley Publishing, In, 2005
3. Reema Thareja, ¯Programming in C, Oxford University Press, Second Edition, 2016.


**REFERENCE BOOKS**


1. B. Gottfried, Programming in C, Third Edition, Schaum Outline Series, 2017
2. Kernighan, B.W and Ritchie,D.M, ¯The C Programming language, Second Edition, Pearson Education, 2006
3. W.Richard Stevens, Stephen A.Rago, Advanced Programming in the UNIX Environment, Addison-Wesley , 2013

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | | | | | | 2 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | 1 | | | | | | 2 | 2 |
| **CO3** | 1 | 1 | 2 | 2 | 2 | | | | | | 1 | 1 |
| **CO4** | 1 | 1 | 2 | 2 | 2 | | | | | | 1 | 1 |
| **CO5** | 2 | 2 | 3 | 2 | 1 | | | | | | 2 | 1 |
| **CO6** | 1 | 1 | 2 | 1 | 1 | | | | | | 1 | 1 |

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23HS1102 | BUSINESS COMMUNICATION AND VALUE SCIENCE - I | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE:**

- Understand what life skills are and their importance in leading a happy and well-adjusted life.
- Motivate students to look within and create a better version of self.
- Understand and apply the key concepts of values of life skills and business communication.
- Improve the language proficiency of students in English with an emphasis on Vocabulary and Grammar.
- Improve the relevant technical writing skills necessary for Business Communication.

**UNIT - I HUMAN VALUES 6+6**

Values – Self exploration – Values of individuals: Presentation on favourite personality and the skills and values they demonstrate – interviewing a maid, watchman, sweeper, cab driver,beggar and narrate what you think are the values that drive them
**Writing**: newspaper report on an IPL match – record conversation between a celebrity and an interviewer

**UNIT - II GRAMMAR AND LANGUAGE DEVELOPMENT 6+6**

Parts of Speech - Applications of tenses - Sentence formation, sentence structure, show sequence - Voices – Questioning –Vocabulary
**Word formation**: - Synonyms, antonyms, abbreviations - compound words -single word substitution.

**UNIT -III ESSENTIALS OF TECHNICAL COMMUNICATION 6+6**

**Email** -: Formal and informal emails - words from General Service List (GSL) by West, Academic word list (AWL) - technical specific terms related to the field of technology - phrases, idioms, significant abbreviations - formal business vocabulary.

**UNIT -IV BASIC WRITING SKILLS 6+6**

Reading articles – Summary writing, story writing - **writing your comprehensive CV** -Create a podcast on a topic.

**UNIT -V APPLICATION OF LIFE SKILLS 6+6**

Life Skills: Movie based learning – identifying skills and values - critical life skills - appreciation of diversity - **Community service** – work with an NGO and makes a presentation.

**TOTAL : 60 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Recognize the need for life skills and values

**CO2** Recognize own strengths and opportunities

**CO3** Apply the life skills to different situations

**CO4** Understand the basic tenets of communication

**CO5** To gain understanding of basic grammatical structures and use them in right context.

**CO6** Apply the basic communication practices in different types of communication

**TEXT BOOKS**


1. Alan Mccarthy and O'dell, “English vocabulary in use”, Cambridge.
2. Ashraf Rizvi. M, “Effective Technical Communication”, Second Edition, McGraw Hill, New Delhi, 2018.
3. Dhanavel, S.P., “English and Communication Skills for Students of Science and Engineering”, Orient Blackswan, Chennai, 2011
4. Dr. Alex K, Soft Skills, S. Chand Publications, New Delhi, 1997.
5. Dr.Saroj Hiremath, “Business Communication”


**WEB REFERENCES**


1. Train your mind to perform under pressure- Simon sinek
2. Brilliant way one CEO rallied his team in the middle of layoffs
3. Will Smith's Top Ten rules for success
4. APAART: Speak Well 1 (English language and communication)
5. APAART: Speak Well 2 (Soft Skills)


**ONLINE RESOURCES**


1. https://www.coursera.org/learn/learning-how-to-learn
2. https://www.coursera.org/specializations/effective-business-communication


**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 2 | 3 | 3 | | 3 |
| CO2 | | | | | | | | 2 | 3 | 3 | | 3 |
| CO3 | | | | | | | | 2 | 2 | 3 | | 3 |
| CO4 | | | | | | | | | 3 | 3 | | 2 |
| CO5 | | | | | | | | | 2 | 3 | | 3 |
| CO6 | | | | | | | | | 3 | 3 | | 2 |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Written Examinations |
| 40 | 60 | 40 | 60 | 100 |
| 40% | | | | 60 % |

| 23PH1102 | PHYSICS FOR COMPUTING SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE:**

- Understand the characteristics of simple and damped harmonic motion andillustrate the interference, diffraction and polarization of light.
- Exemplify the dual nature of matter and apply the Schrodinger wave equation to determine the wave function of particle in one dimensional box and assess the crystallographic parameters of seven crystal systems
- Compare the different types of lasers based on pumping method, active medium and energy levels and analyze the laws of thermodynamics and different thermodynamic processes

**UNIT - I OSCILLATIONS 6**

Periodic motion-simple harmonic motion-characteristics of simple harmonic motion- vibration of simple spring mass system. Resonance-definition. damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators – analogy with LCR circuits and mechanical oscillation.

**UNIT - II INTERFERENCE-PRINCIPLE OF SUPERPOSITION -YOUNG'S EXPERIMENT 6**

Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence. Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

**UNIT - III BASIC IDEA OF ELECTROMAGNETISMS AND SEMICONDUCTOR PHYSICS 6**

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

Semiconductor Physics: Conductor, Semiconductor and Insulator; Basic concept of Band theory.

**UNIT -IV LASER AND FIBER OPTICS 6**

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, $CO_2$ and Neodymium lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.

**UNIT -V THERMODYNAMICS 6**

Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes, third law of thermodynamics.

**TOTAL: 30 PERIODS**

## LIST OF EXPERIEMENTS

1. Magnetic field along the axis of current carrying coil – Stewart and Gee
2. Determination of Hall coefficient of semi-conductor
3. Determination of Plank constant
4. Determination of wave length of light by Laser diffraction method
5. Determination of wave length of light by Newton's Ring method
6. Determination of laser and optical fiber parameters
7. Determination of Stefan's Constant.
8. Determination of thermal conductivity of a bad conductor – Lee's Disc method

**TOTAL: 30 PERIODS**

## TEXT BOOKS


1. Ajoy Ghatak, Optics, 5th Ed., Tata McGraw Hill, 2012
2. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
3. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017
4. Halliday and Resnick, Fundamentals of Physics, 11 th edition, John Wiley and Sons, Inc, 2018
5. Basics of laser physics: for students of science and engineering http://www.springer.com/978-3- 319- 50650-0


## COURSE OUTCOME

Upon successful completion of the course, the student will be able to:

**CO1** Explain the different types of harmonic oscillations and compare electrical oscillator with mechanical oscillator

**CO2** Illustrate the interference, diffraction and polarization of light in Newton's rings, diffraction grating and double refraction respectively

**CO3** Gain knowledge on the basics of electromagnetic waves and its properties.

**CO4** Outline the different types of lasers and compare the different types of optical fibers based on mode and refractive index profile for data communication system

**CO5** Acquire the fundamental knowledge of laws of thermodynamics.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 1 | 1 | | | | | | |
| **CO2** | 3 | 3 | 2 | 1 | 2 | 1 | | | | | | |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 1 | | | | | | |
| **CO4** | 3 | 3 | 1 | 1 | 2 | 1 | | | | | | |
| **CO5** | 3 | 3 | 1 | 1 | 2 | 1 | | | | | | |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23ES1105 | PRINCIPLES OF ELECTRICAL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE:**

- To understand the basic concepts of electric circuits.
- To understand the basic concepts of magnetic circuits
- To identify the types of sensors and measure quantities in AC and DC systems

**UNIT - I INTRODUCTION 6**

Fundamental linear passive and active elements to their functional current-voltage relation, voltage source and current sources, ideal and practical sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis. Concept of work, power, energy and conversion of energy.

**UNIT - II BASIC NETWORK 6**

Current voltage relations of electric network by mathematical equations to analyse the network (Thevenins theorem, Nortons Theorem, Maximum Power Transfer theorem), Simplifications of networks using series- parallel, Star/Delta transformation. Superposition theorem.

**UNIT - III CONCEPT OF AC 6**

AC waveform definitions, form factor, peak factor, phasor representation in polar and rectangular form, concept of impedance, admittance, complex power, power factor, single phase and 3 phase concept.

**UNIT -IV ELECTROSTATICS AND ELECTRO-MECHANICS 6**

Electrostatic field, electric field strength, concept of permittivity in dielectrics, energy stored in capacitors, charging and discharging of capacitors, Electro Magnetism magnetic field and Faraday's law. Magnetic materials and B-H curve. self and mutual inductance, Ampere's law, Study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, Electromechanical energy conversion.

**UNIT -V MEASUREMENTS AND SENSORS 6**

Measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Basic concept of indicating and integrating instruments

Practical considerations: Electrical Wiring types and accessories, Illumination system: Basic layout of the distribution system, Types of earthing, Safety devices & system. Battery principles and types.

**TOTAL: 30 PERIODS**

**LIST OF EXPERIEMENTS**

1. Familiarization of electrical circuits, sources, measuring devices and transducers.
2. Determination of resistance temperature coefficient
3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem)
4. Simulation of R-L-C series circuits for XL>XC , XL< XC

5. Simulation of Time response of RC circuit
6. Demonstration of measurement of electrical quantities in DC and AC systems.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**


1. Electric Machinery, (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill, 2003
2. A Textbook of Electrical Technology, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi 2014.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd 2016.


**REFERENCE BOOKS**


1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press 2012.
3. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc Eight Edition 2020.
4. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd, Second Edition, 2007.


**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Understand the basic concepts and terminology of electrical quantities

**CO2** Analyze the DC circuit using various network theorems

**CO3** Analyze the electrical parameters of AC circuits with R-L-C elements

**CO4** Analyze the Static and dynamic characteristics of Electro-static and Electromagnetic fields

**CO5** Apply the concept of sensors in measurement of various electrical quantities

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | | | 1 | | | | | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | | 1 | | | | | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | | 1 | | | | | 1 |
| **CO4** | 3 | 3 | 2 | 2 | | | 1 | | | | | 1 |
| **CO5** | 3 | 2 | 2 | 2 | 2 | | 1 | | | | | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23MA1102 | DISCRETE MATHEMATICS FOR COMPUTER SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- Understand the basic concepts of propositions by various discrete structure techniques
- Analyze the combinatorics techniques in solving the system by various methodology
- Apply the concepts of graph theory and logic in solving the real time engineering problem

**UNIT I BOOLEAN ALGEBRA 9**

Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

**UNIT II ABSTRACT ALGEBRA 9**

Set, relation, group, ring, field.

**UNIT III COMBINATORICS 9**

Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

**UNIT IV GRAPH THEORY 9**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

**UNIT V LOGIC 9**

Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

**TOTAL:45 PERIODS**

**LIST OF EXPERIEMENTS**

1. Write a program in C to Display the Boolean Truth Table for AND, OR , NOT
2. Write a C Program to find Cartesian Product of two sets
3. Practice of various set operations
4. Recursion and Induction
5. Implementation of a recursive counting technique
6. Write a program in C for minimum cost spanning tree.
7. Write a program in C for finding shortest path in a GraphNote.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons second edition, 1975.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson 2016.
3. Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi, 2012.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London 1976.
5. Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore, 1989.

**REFERENCE BOOKS**

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4thEdition, Pearson Education Asia, Delhi,2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rdEdition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Understand the concepts and significance of lattices and boolean algebra.
**CO2** Familiarize the applications of algebraic structures
**CO3** Interpret the concepts of Permutations, Combinations and Mathematical induction
**CO4** Understand the basic concepts of combinatorics and graph theory
**CO5** Acquire the knowledge in check the validity of the argument and Normal forms

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO2 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO3 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO4 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO5 | 3 | 3 | 3 | | | | | | | | | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23ES1112 | FUNDAMENTALS OF COMPUTER SCIENCE LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVE:**

- To develop programs in C using basic constructs.
- To develop applications in C using arrays
- To develop applications in C using strings, pointers
- To develop applications in C using functions, structures
- To develop applications in C using file processing
- To build solutions for real world problems

**LIST OF EXPERIMENTS**

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
   a) Small but tricky codes
   b) Proper parameter passing
   c) Command line Arguments
   d) Variable parameter
   e) Pointer to functions
   f) User defined header
   g) Make file utility
   h) Multi file program and user defined libraries
   i) Interesting substring matching / searching programs
   j) Parsing related assignments
3. Mini Project

**TOTAL: 60 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Develop the use of the C programming language to implement various algorithms.
**CO2** Acquire decision making and looping concepts in C.
**CO3** Develop C programs using Array and Pointers.
**CO4** Ability to define structures, functions in solving real world problem
**CO5** Design applications using sequential and random access file processing
**CO6** Able to interpret real world problems into software solutions in C.

**WEB REFERENCES**

1. https://www.programiz.com/C-programming/examples
2. https://www.geeksforgeeks.org/C-programming-examples/
3. https://beginnersbook.com/2018/02/C-programs/

4. https://www.javatpoint.com/C-programs
5. https://www.w3schools.com/C/C-examples.asp
6. https://www.includehelp.com/c-programs/c-programs-pointers-solvedexamples.asp

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | | | | | | 2 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | 1 | | | | | | 2 | 2 |
| **CO3** | 1 | 1 | 2 | 2 | 2 | | | | | | 1 | 1 |
| **CO4** | 1 | 1 | 2 | 2 | 2 | | | | | | 1 | 1 |
| **CO5** | 2 | 2 | 3 | 2 | 1 | | | | | | 2 | 1 |
| **CO6** | 1 | 1 | 2 | 1 | 1 | | | | | | 1 | 1 |

| **Internal Assessment** | | **End Semester Examination** |
|---|---|---|
| **Evaluation of Laboratory Observation, Record** | **Test** | **Practical** |
| **75** | **25** | **100** |
| **60 %** | | **40%** |

| 23TA1101 | HERITAGE OF TAMIL | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**UNIT – I LANGUAGE AND LITERATURE 3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modernliterature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT – II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT – III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT –IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT –V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India — Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

**Total : 15 PERIODS**

**TEXT-CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு: மக்களும் பண்பாடும் - கே. கே பிள்ளை உலகத் தமிழாராய்ச்சி நிறுவனம், 2004 (வெளியீடு: தமிழ் நாடு பாடநூல் மற் றும் கல்வியியல் பணிகள்கழகம்).
2. கணினித்தமிழ், முனைவர் இல.சுந்தரம் (வெளியீடு: விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (வெளியீடு: தொல்லியல் துறை)
4. 'பொருநை - ஆற்றங்கரை நாகரிகம் (வெளியீடு:தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23TA1101 | தமிழர் மரபு | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**UNIT – I** **மொழியும் இலக்கியமும்** **3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி - தமிழில் செம்மொழி இலக்கியயங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் அறம் பகிர்வு - திருக்குறளில் மேலாண்மைக் கோட்பாடுகள் - தமிழ் இதிகாசங்களும் தமிழ் மண்ணில் பௌத்த, சமணத்தின் தாக்கமும் பக்தி இலக்கியம் ஆழ்வார்களும் நாயன்மார்களும் - சிற்றிலக்கியங்கள் - சிறுகவிதையின் வடிவங்கள் - தமிழில் நவீன இலக்கிய வளர்ச்சி – பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**UNIT – II** **பாரம்பரியம் - பாறை ஓவியங்கள் முதல் நவீன கலை சிற்பம் வரை** **3**

நடுகல் முதல் நவீன சிற்பம் வரை – பஞ்சலோக சிலைகள் - பழங்குடியினரும் அவர்களின் கைவினைப் பொருட்களும் - கோயில் திருத்தக் கலை - பிரம்மாண்டமான சுடுமண் சிற்பங்கள், கிராம தெய்வங்கள், கன்னியாகுமரியில் திருவள்ளுவர் சிலை, இசைக்கருவிகள் செய்தல் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோயில்களின் பங்கு.

**UNIT – III** **நாட்டுப்புற மற்றும் தற்காப்புக் கலைகள்** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியன் கூத்து, ஒயிலாட்டம், தோல் பொம்மலாட்டம், சிலம்பாட்டம், வளரி, புலியாட்டம் - தமிழர்களின் விளையாட்டுகள்.

**UNIT -IV** **தமிழர் திணைக் கோட்பாடு** **3**

தமிழர் தாவரங்களும் விலங்கினங்களும்- தொல்காப்பியம் மற்றும் சங்க இலக்கியக் கருத்து - தமிழர் பற்றிய அறக்கருத்து - சங்க காலத்தில் கல்வியும் எழுத்தறிவும் - சங்க கால பண்டைய நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதியும் இறக்குமதியும் - சோழர்களின் கடல் கடந்த வெற்றி.

**UNIT –V** **இந்திய தேசிய இயக்கம் மற்றும் இந்தியப் பண்பாட்டில் தமிழர்களின் பங்களிப்பு** **3**

இந்திய விடுதலைப் போராட்டத்தில் தமிழர்களின் பங்களிப்பு - இந்தியாவின் பிற பகுதிகளில் தமிழர்களின் பண்பாட்டுத் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவ முறைகளில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகளும் சுவடிகளும் - அச்சுத் தமிழ் நூல்களின் வரலாறு

**Total: 15 PERIODS**

**TEXT AND REFERENCE BOOKS:**


1. தமிழக வரலாறு: மக்களும் பண்பாடும் - கே. கே பிள்ளை உலகத் தமிழாராய்ச்சி நிறுவனம், 2004 (வெளியீடு: தமிழ் நாடு பாடநூல் மற் றும் கல்வியியல் பணிகள்கழகம்).

2. கணினித்தமிழ், முனைவர் இல.சுந்தரம் (வெளியீடு: விகடன் பிரசுரம்)

3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (வெளியீடு: தொல்லியல் துறை)

4. 'பொருநை - ஆற்றங்கரை நாகரிகம் (வெளியீடு:தொல்லியல் துறை)

12. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

13. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies

14. Historical by: International Institute of Tamil Studies).

15. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

16. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

17. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

18. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

**19.** Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23CB1201 | DATA STRUCTURES AND ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- Understand the basics of abstract data types
- Impart knowledge about the principles of linear and nonlinear data structures
- Build an application using sorting and searching

**UNIT - I BASIC TERMINOLOGIES AND INTRODUCTION TO ALGORITHM & DATA ORGANISATION 9**

Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction.

**UNIT - II LINEAR DATA STRUCTURE 9**

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures.

**UNIT - III NON-LINEAR DATA STRUCTURE 9**

Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures.

**UNIT -IV SEARCHING AND SORTING ON VARIOUS DATA STRUCTURES 9**

Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing

**UNIT -V FILE AND GRAPH 9**

Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes. Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Explore the basics of data structures and algorithm analysis.

**CO2** Demonstrate the concept of linear data structures

**CO3** Demonstrate the concept of non- linear data structures.

**CO4** Design algorithms for various searching and sorting techniques.

**CO5** Exemplify the concept of files and its operations

**CO6** Explain the concept of graph and its operations

**TEXT BOOKS**

1. Fundamentals of Data Structures in C, E. Horowitz, S. Sahni,S. A-Freed, Universities Press, 2012.

2. Data Structures and Algorithms, A. V.Aho, J. E.Hopperoft, J. D.Ullman, Pearson, 1985
3. Data Structure and Algorithm through C, Brijesh Bakariya, BPB Publication, 2018

**REFERENCE BOOKS**

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth, 1997.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press, Fourth Edition 2022..
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning), (Thirty First Edition), Pat Morin, UBC Press, 2013.

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | | | | | | 2 | 1 |
| **CO2** | 2 | 3 | 1 | 2 | 2 | | | | | | 1 | 1 |
| **CO3** | 1 | 2 | 1 | 2 | 2 | | | | | | 1 | 1 |
| **CO4** | 1 | 3 | 1 | 2 | 2 | | | | | | 1 | 1 |
| **CO5** | 3 | 1 | | 3 | 2 | | | | | | 1 | 1 |
| **CO6** | 2 | 2 | 1 | 1 | 1 | | | | | | 1 | 1 |

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23CB1202 | FUNDAMENTALS OF ECONOMICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To explain the fundamental principles of micro economics relevant to managing an organization.
- To understand the efficiency and equity implications of market interference, including government policy.
- To describe the fundamental principles of macroeconomics to have the understanding of economic environment of business.
- To understand the various aspects of India's economy

**UNIT I INTRODUCTION 9**

Principles of Demand and Supply- Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve)

**UNIT II CONSUMER ANALYSIS 9**

Welfare Analysis- Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behavior - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium- Effects of a Price Change, Income and Substitution Effects - Derivation of a Demand Curve

**UNIT III PRODUCTION AND COSTING 9**

Applications- Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect; Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves- Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

**UNIT IV MACROECONOMIC REFORMS 9**

National Income and its Components- GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector- Taxes and Subsidies; External Sector- Exports and Imports; Money- Definitions; Demand for Money-Transactionary and Speculative Demand; Supply of Money- Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets- IS, LM Model

**UNIT V POLICY GOVERNANCE 9**

Business Cycles and Stabilization- Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm- Price and Wage Rigidities - Voluntary and Involuntary Unemployment.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Understand the links between household behavior and the economic models of demand.

**CO2** Understand government policies and programs.

**CO3** Understand about approaches to consumer behaviour and relation between production and cost function

**CO4** Describe and discuss on interaction of product and factor market

**CO5** Get awareness about importance and development of Indian economy and economic reforms

**CO6** Have thorough knowledge in the areas of inflation, unemployment, monetary policy, fiscal policy and international trade

**TEXT BOOKS**


1. Pindyck, Robert S., and Daniel L. Rubinfeld, "Microeconomics", 7th edition Pearson 2009
2. Dornbusch, Fischer and Startz," Macroeconomics", 12th edition McGraw Hill,2018
3. Paul Anthony Samuelson, William D. Nordhaus, "Economics",19th edition, McGraw Hill,2009


**REFERENCE BOOKS**


1. Hal R, Varian, "Intermediate Microeconomics: A Modern Approach", 8th edition,2009
2. N. Gregory Mankiw, "Principles of Macroeconomics", 6th edition, Cengage India, 2008


**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | | | 2 | | 3 | 3 | 3 | 1 | 1 |
| CO2 | 2 | 2 | 1 | | | 1 | | 3 | | | | |
| CO3 | 2 | 2 | 1 | | | 1 | | 2 | 3 | | | |
| CO4 | 2 | 2 | 2 | | | 1 | | 2 | 2 | | | |
| CO5 | 2 | 3 | 1 | | | 2 | | | | | | |
| CO6 | 2 | 3 | 1 | | | | | 2 | 3 | | 1 | 1 |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23HS1202 | BUSINESS COMMUNICATION AND VALUE SCIENCE II | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE:**

- Develop effective writing, reading, presentation and group discussion skills.
- Help students identify personality traits and evolve as a better team player.
- Introduce them to key concepts of a) Morality b) Behavior and beliefs c) Diversity & Inclusion
- Facilitate students to broaden the writing skills in business communication
- Impart essentials life skills for professional and personal development

**UNIT - I MECHANICS OF WRITING 6+6**

**Listening**: social issues, causes and findings
**Speaking**: Icebreaker - Participating in „Join Hands Movement‟ - Individual identification of social issues – addressing social issues.
**Reading**: Research Reports based on social issues
**Writing**: Good and bad writing - Common errors, punctuation rules, use of words - writing techniques of Catherine Morris and Joanie McMahon‟s .
**Group Activity**: contribute articles to the magazine – Quiz Time

**UNIT - II LAUNCHING E MAGAZINE 6+6**

**Listening**: Listen to interactive e-magazines and presentations
**Speaking**: Introduction to basic presentation skills & ORAI app - Groups to present their ideas about e-magazine and share their findings
**Reading**: Introduction to skimming and scanning, speed reading techniques.
**Writing**: create vision, mission, value statement, and tagline and design a logo- individual write up for E- magazine and evaluation - preparation and publication of E-Magazine.
**Group Activity**: Plan & Design an e- magazine as a group - SATORI- Join the dots - Quiz Time

**UNIT - III TEAM PLAY 6+6**

**Listening**: Ad campaign - Brain storming session
**Speaking**: discussing and exploring the means of articulating and amplifying social issues
**Reading**: Articles on Team Building – secrets of team work
**Writing**: Berbin‟s 8 Team roles and Lindgren‟s big 5 personality traits
**Group Activity**: Designing skits: write the script - Promote the play through social media and gather audience - Enact the play- SATORI joining dots - Quiz Time

**UNIT -IV DIVERSITY AND INCLUSION 6+6**

**Listening**: Video recorded interviews of people from diverse groups -Touch the target, film: "The Fish and I‟ by Babak Habibifar - Learn from movies - film on diversity – discussion on key take away of the film - Theory to connect and concept of empathy.
**Speaking**: narration of story in first person - Feedbacks by other groups- Debate on diversity with an angle of ethics, morality and respect for individual. Prepared speech
**Reading**: Comprehension passages on diversity and human values
**Writing**: Write a review in a blog about their research on a book, incident or film - Diversity & Inclusion - Different forms of Diversity in our society.
**Group Activity**: Create story – a person's life affected by the social issue -Discussion on TCS values, Respect for Individual and Integrity. SATORI and Quiz Time.

**UNIT -V ORGANIZING AWARENESS CAMPAIGN 6+6**

**Listening:** Listening to various activities by NGOs
**Speaking:** Creating awareness on social welfare programs
**Reading:** Articles and reports about activities of different NGOs
**Writing:** Draft your resume - Include your recent achievements in your resume.
**Group Activity:**
**Project-**

a) Each team to look for an NGO/ social group in the city, which is working on the issue their college group, is supporting.
b) Spend a day with the NGO/ social group to understand exactly how they work and the challenges they face.
c) Render voluntary service to the group for one day
d) Invite the NGO/ social group to address their university students for couple of hours. Plan the entire event, decide a suitable venue in the university, gather audience, invite faculty members etc. (they need to get their plan ratified their professor). COURSE OUTCOME-- Host an interactive session with the NGO spokesperson
e) The groups to present their experience of a day with the NGO and inspire students to work for the cause.

**TOTAL: 60 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Understand and use tools of structured written communication
**CO2** Develop materials to create an identity for an organization dedicated to a social cause
**CO3** Identify individual personality types and role in a team.
**CO4** Understand the basic concepts of Morality and Diversity
**CO5** Gain confidence to communicate effectively in various situations to acquire employability skills.
**CO6** Organize an event to generate awareness and get support for a cause

**TEXT BOOKS**


1. Dr. A.P.J Abdul Kalam, ArunTiwari, "Guiding Souls : Dialogues on the purpose of life",2005.
2. Dr. A.P.J Abdul Kalam, AcharyaMahapragya , "The Family and the Nation", 2015.
3. Dr. A.P.J Abdul Kalam, Y.S.Rajan, " The Scientific India: A twenty First Century Guide to the World around Us",2011.


**REFERENCE BOOKS**


1. Dr. A.P.J Abdul Kalam , "Forge Your Future: Candid, Forthright, Inspiring" ,2014
2. Peter H. Diamandis and Steven Kotler, "Abundance: The Future is Better Than You Think", 2012.
3. Simon Sinek , "Start With Why: How Great Leaders Inspire Everyone to Take Action", Penguin,2011.
4. Sandra Moriarty, Nancy D. Mitchell, William D. Wells," Advertising & IMC: Principles and Practice", Pearson Education India,2016.

**WEB REFERENCES**

1. Ethics Fundamentals and approaches to ethics, https://www.eolss.net/Sample-Cchapters/C14/E1- 37-01-00.pdf
2. A Framework for Making Ethical decisions https://www.brown.edu/academics/science-and- technologystudies/framework- makingethical-decisions.
3. Five Basic Approaches to Ethical Decision http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

**ONLINE RESOURCES**

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 3 | 3 | | 3 |
| CO2 | | | | | | | | 2 | 2 | 2 | | 2 |
| CO3 | | | | | | | | | 3 | 3 | | 3 |
| CO4 | | | | | | | | 2 | 2 | 2 | | 2 |
| CO5 | | | | | | | | | 3 | 3 | | 3 |
| CO6 | | | | | | | | 2 | 2 | 3 | | 2 |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Written Examinations |
| 40 | 60 | 40 | 60 | 100 |
| 40% | | | | 60 % |

| 23EE1204 | PRINCIPLES OF ELECTRONICS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OURSE OBJECTIVE:**

- Understand about current, voltage and power, basic laws in circuits.
- Understand about semiconductor materials and its application
- Understand working principal of BJT and FET
- Understand about Integrated circuit and its application
- Understand about the fundamentals of Electronics and its applications.

**UNIT - I INTRODUCTORY IDEA OF SEMICONDUCTORS 6**

Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone. Formation of PNP / NPN junctions, energy band diagram. Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers.

**UNIT - II DIODES AND DIODE CIRCUITS 6**

V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

**UNIT - III TRANSISTORS AND TRANSISTOR CIRCUITS 6**

Transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode. Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles

transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

**UNIT -IV OPERATIONAL AMPLIFIER BASICS 6**

Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Proportional, Integral, Derivative circuits.

**UNIT -V BASIC IDEAS OF DIGITAL ELECTRONICS 6**

Basic idea of switching circuit, Realization of Logic gates, multiplexers and demultiplexers, Flip flop, Registers and Counters.

**TOTAL: 30 PERIODS**

**LIST OF EXPERIMENTS**

1. To plot V-I characteristics of PN junction diode.
2. To plot regulation characteristics of half wave rectifier
3. To plot regulation characteristics of Full wave rectifier
4. To plot input-output characteristics of CE configuration of BJT.

5. To study Biasing techniques of BJT- to find stability factor of self-bias, collector to base bias, fixed bias circuits.
6. To plot frequency response of single stage FET amplifier (CS/CD configuration) and find its bandwidth.
7. To study Colpitts Oscillator.
8. Study of OP-AMP circuits: Inverting and Non-inverting Amplifier
9. Study of basic logic gates and De-Morgan's Theorem
10. Study of half adder and full adder.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**


1. William Hayt,JVJack,EKemmerly and Steven M Durbin, Engineering Circuits Analysis, Tata Graw-Hill, 2013
2. L Robert Boylestead, Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Education,2012.
3. J Millman, C. Halkias&SatyabrataJIT "Electronic Devices and Circuits", Tata McGraw- Hill,2010
4. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press, 2019.


**REFERENCE BOOKS**


1. Ramakant A. Gayakwad, OP-AMP and Linear IC"s , Prentice Hall of India, 2002.
2. Thomas L. Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015.
3. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education, 2001.
4. Digital Logic & Computer Design, M. Morris Mano, Pearson, second edition, 2012.


**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Apply Voltage-Current laws and transformation techniques to solve linear electric circuits.

**CO2** Apply the diodes in rectifier and regulator applications and also analyze its characteristics.

**CO3** Explain the working of Bipolar Junction and Field Effect Transistors with different configurations and also analyze their characteristics.

**CO4** Illustrate the working of analog IC with different configurations and its applications

**CO5** Simplification of Boolean expressions using K-map and implementation of combinational &sequential circuits

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | | | | 1 | | | | 1 |
| **CO2** | 3 | 3 | 2 | 2 | | | | 1 | | | | 1 |
| **CO3** | 3 | 3 | 2 | 2 | | | | 1 | | | | 1 |
| **CO4** | 3 | 3 | 2 | 2 | | | | 1 | | | | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | | | 1 | | | | 1 |

.

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23MA1204 | LINEAR ALGEBRA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- To gain knowledge in using matrix algebra techniques to solve system of linear equations.
- To understand the concept of vector spaces to use in the principal component analysis

**UNIT I MATRICES AND DETERMINANTS 9**

Introduction to Matrices and Determinants; Solution of Linear Equations; Cramer's rule; Inverse of a Matrix.

**UNIT II APPLICATION OF MATRICES 9**

Vectors and linear combinations; Rank of a matrix; Gaussian elimination; LU Decomposition; Solving Systems of Linear Equations using the tools of Matrices**.**

**UNIT III VECTOR SPACE 9**

Dimension; Basis; Orthogonality; Projections; Gram-Schmidt orthogonalization and QR decomposition.

**UNIT IV EIGEN VALUES AND EIGEN VECTORS 9**

Positive definite matrices; Linear transformations; Hermitian and Unitary matrices.

**UNIT V PRINCIPAL COMPONENT ANALYSIS 9**

Singular value decomposition and Principal component analysis (Non-credit and optional); Introduction to their applications in Image Processing and Machine Learning (one or two classes).

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS**

1. Write a program which demonstrate the following
   i. Addition of two complex numbers.
   ii. Displaying the conjugate of a complex number.
   iii. Plotting a set of complex numbers.
   iv. Creating a new plot by rotating the given number by a degree 90, 180, 270 degrees and also by scaling b a number a=1/2, a=1/3, a=2 etc.
2. Write a program to do the following
   i. Enter a vector u as a n-list.
   ii. Enter another vector v as a n-list.
   iii. Find the vector au +bv for different values of a and b.
   iv. Find the dot product of u and v
3. Write a program to do the following
   i. Enter an r by c matrix M(r and c being positive integers).
   ii. Display M in matrix format.
   iii. Display the row and columns of the matrix M.
   iv. Find the scalar multiplication of M for a given scalar.
   v. Find the transpose of the matrix M

4. Write a program to do the following
   i. Find the vector-matrix multiplication of a r by c matrix M with an c- vector u.
   ii. Find the matrix- matrix product of M with a c by p matrix N.
5. Write a program to do the following
   i. Enter a vector b and find the projection of b orthogonal to a given vector u.
   ii. Find the projection of b orthogonal to a set of given vectors.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.

2. Introduction to linear algebra, (Fifth Edition), Gilbert Strang, Wellesley-Cambridge Press, 6th edition 2023.

**REFERENCE BOOKS**

1. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Cengage Learning, 7th edition, 2012
2. Advanced Engineering mathematics, (Second Edition), Michael. D. Greenberg, Pearson, 2nd edition, 1998.
3. Applied Mathematics (Vol. I & II), P. N. Wartikar& J. N. Wartikar, PuneVidyarthi Griha Prakashan, 2014.
4. Digital Image Processing, R C Gonzalez and R E Woods, Pearson, 2010.

**ONLINE COUSES / RESOURCES:**

1. https://machinelearningmastery.com/introduction-matrices-machine-learning/

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Use matrix algebra techniques to solve system of linear equations.
**CO2** Solve system of equations using the concept of matrix decomposition.
**CO3** Use the concept of vector spaces in generating ortho-normal bases.
**CO4** Solve problems of linear transformation using eigen values and eigen vectors.
**CO5** Use principal component analysis for applications in image processing and machine learning.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO2 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO3 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO4 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO5 | 3 | 3 | 3 | | | | | | | | | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23MA1205 | STATISTICAL METHODS AND MODELLING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- To gain knowledge of sampling techniques and use testing of hypothesis for parameter estimation.
- To understand the use of statistical models for forecasting
- To gain the knowledge of using R programming in simulation and modelling

**UNIT-I SAMPLING AND ESTIMATION THEORY 9**

Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling - Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. Concept & examples, complete sufficiency, their application in estimation

**UNIT-II LINEAR STATISTICAL MODELS 9**

Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Multiple regression& multiple correlation, Analysis of variance (one way, two way with as well as without interaction).

**UNIT-III TEST OF HYPOTHESIS 9**

Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing .Non-parametric Inference: Comparison with parametric inference, Use of order statistics.

**UNIT-IV NON-PARAMETRIC INFERENCE 9**

Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Tolerance region.

**UNIT-V BASICS OF TIME SERIES ANALYSIS & FORECASTING 9**

Stationary, ARIMA Models: Identification, Estimation and Forecasting.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS**

1. Introduction to R, Functions, Control flow and Loops
2. Working with Vectors and Matrices
3. Reading in and Writing Data
4. Working with Data
5. Manipulating Data
6. Simulation
7. Linear model
8. Data Frame
9. Graphics in R

**TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Probability and Statistics for Engineers (9th Edition), I.R. Miller, J.E. Freund and R. Johnson, 2023.
2. Fundamentals of Statistics (Vol. I & Vol. II), A. Goon, M. Gupta and B.Dasgupta, 8th edition 2002.
3. The Analysis of Time Series: An Introduction, Chris Chatfield, 7th edition 2019.

**REFERENCE BOOKS**

1. Introduction to Linear Regression Analysis, D.C. Montgomery &E.Peck, 2006
2. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill & D.C. Boes,2017
3. Applied Regression Analysis, N. Draper & H. Smith, Third edition,1998.
4. Hands-on Programming with R,- Garrett Grolemund, 2014.
5. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, 2013.

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Apply the concept of sampling distribution and estimation theory in forecasting.

**CO2** Apply the concept of correlation, regression using R programming and design experiments

**CO3** Use the concepts of Testing of Hypothesis for industrial problems.

**CO4** Use the concepts of Non Parametric Testing for Non-Normal Populations

**CO5** Apply the concept of time series analysis in real life situation.

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO2 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO3 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO4 | 3 | 3 | 3 | | | | | | | | | 1 |
| CO5 | 3 | 3 | 3 | | | | | | | | | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23CB1211 | DATA STRUCTURES AND ALGORITHMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVE:**

- To provide the knowledge of basic data structures and their implementations.
- To understand the Linear data structures
- To be aware of the Non Linear data structures
- To solve problems using data structures binary search trees, and graphs and writing programs for these solutions.
- To efficiently implement the different data structures and solutions for specific problems.

**LIST OF EXPERIMENTS**

1. Stack using array
2. Queue using array
3. Towers of Hanoi using user defined stacks.
4. Singly Linked List
5. Stack using Linked List
6. Queue using Linked List
7. Reading, writing, and addition of polynomials.
8. Line editors with line count, word count showing on the screen.
9. Trees with all operations.
10. Binary Search Tree
11. Breadth First Search
12. Depth First Search
13. Reading the data from file using file operation
14. Writing the data into file using file operation
15. Mini Project

**TOTAL: 60 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Implement linear data structure such as stacks, queues and linked lists

**CO2** Apply linear data structure applications.

**CO3** Execute Non-linear data structure applications.

**CO4** Realize basic operations on binary trees

**CO5** Demonstrate the representation and traversal techniques of graphs and their applications

**CO6** Demonstrate the file concepts using file operations

**WEB REFERENCES:**

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial
3. https://www.programiz.com/dsa/data-structure-types

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 2 | | | | | | 2 | 1 |
| CO2 | 2 | 3 | 1 | 2 | 2 | | | | | | 1 | 1 |
| CO3 | 1 | 2 | 1 | 2 | 2 | | | | | | 1 | 1 |
| CO4 | 1 | 3 | 1 | 2 | 2 | | | | | | 1 | 1 |
| CO5 | 3 | 1 | | 3 | 2 | | | | | | 1 | 1 |
| CO6 | 2 | 2 | 1 | 1 | 1 | | | | | | 1 | 1 |

| Internal Assessment | | End Semester Examination |
|---|---|---|
| Evaluation of Laboratory Observation, Record | Test | Practical |
| 75 | 25 | 100 |
| 60 % | | 40% |

| 23ES1212 | TECHNICAL SKILL PRACTICES I | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVE:**

- To impart essential problem solving skills through general problem solving concepts.
- To provide basic knowledge on programming essentials using C as implementation tool.
- To introduce various programming methods using C.

**LIST OF EXPERIMENTS**

1. Data Types, Variables, Operators
2. Expressions, Precedence , Operators
3. Conditional Statements , Switch Statements
4. Looping, Nested Loops
5. Problems on Bit Manipulation
6. Patterns
7. Number Problems
8. Array Basics , Static vs Dynamic Array, Two Dimensional Matrix
9. Structure , Union ,Storage Classes
10. Function , Parameters passing
11. Recursion
12. Strings
13. Pointers
14. Command Line Arguments, Pre-processors
15. File Handling & Exception Handling.

**TOTAL: 30 PERIODS**

**COURSE OUTCOME**

On successful completion of the course student will be able to:

**CO1** Propose solutions for a given problem.

**CO2** Infer the fundamental programming elements in C language and learn to apply basic control structures in C.

**CO3** Demonstrate the applications of structures and unions.

**CO4** Visualize the capabilities of modular programming approach in C.

**CO5** Understand the basic principles of pointers and their association during implementations.

**CO6** Apply various input, output and error handling functions in C.

**TEXT BOOKS**


1. Reema Thareja, ``Programming in C"", 2nd edition, OXFORD University Press, New Delhi, 2019.
2. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication,2016.

**REFERENCE BOOKS**


1. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education, 2014.
2. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill, 2000.


**ONLINE COURSES / RESOURCES:**

1. https://www.javatpoint.com/c-programming-language-tutorial
2. https://www.tutorialspoint.com/cprogramming/
3. https://nptel.ac.in/Courses/

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 3 | | | | | | | 3 |

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23TA1201 | TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**UNIT – I WEAVING AND CERAMIC TECHNOLOGY 3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT – II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT – III MANUFACTURING TECHNOLOGY 3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins — Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT –IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT –V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**Total : 15 PERIODS**

**TEXT-CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு: மக்களும் பண்பாடும் - கே. கே பிள்ளை உலகத் தமிழாராய்ச்சி நிறுவனம், 2004 (வெளியீடு: தமிழ் நாடு பாடநூல் மற் றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ், முனைவர் இல.சுந்தரம் (வெளியீடு: விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (வெளியீடு: தொல்லியல் துறை)
4. 'பொருநை - ஆற்றங்கரை நாகரிகம் (வெளியீடு:தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:

InternationalInstitute of Tamil Studies

7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu(Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & TamilNadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23TA1201 | தமிழரும் தொழில்நுட்பமும் | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**UNIT – I நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் 3**

சங்க காலத்தில் நெசவுத் தொழில் - பீங்கான் தொழில்நுட்பம் - கருப்பு சிவப்பு மட்கலன் மட்பாண்டங்கள் - மட்பாண்டங்களில் பெருங்கற்காலக் குறியீடுகள்.

**UNIT – II வடிவமைப்பு மற்றும் நிர்மாண தொழில்நுட்பம் 3**

சங்க காலத்தில் வீடு மற்றும் வீட்டு உபயோகப் பொருட்களின் வடிவமைப்பு மற்றும் கட்டுமானம் - சங்க கால கட்டுமானப் பொருட்கள் மற்றும் வீரக்கற்கள் - சிலப்பதிகாரத்தில் மேடை கட்டுமானங்களின் விவரங்கள் - மாமல்லபுரத்தின் சிற்பங்கள் மற்றும் கோயில்கள் - சோழர்களின் பெரிய கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் கால கோயில்கள் - வகை ஆய்வு (மதுரை மீனாட்சி அம்மன் கோயில்) - திருமலை நாயக்கர் மகால் - செட்டி நாடு வீடுகள், ஆங்கிலேயர் காலத்தில் சென்னையில் இந்தோ - சரசனிக் கட்டிடக்கலை.

UNIT - III **உற்பத்தி தொழில்நுட்பம்** 3

கப்பல் கட்டும் கலை - உலோகவியல் ஆய்வுகள் - இரும்புத் தொழில் - இரும்பு உருக்குதல், எஃகு - செம்பு மற்றும் தங்கம் - வரலாற்றின் ஆதாரமாக நாணயங்கள் - நாணயங்கள் அச்சிடுதல் - மணிகள் தயாரிக்கும் தொழில்கள் கல் மணிகள் - கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் / எலும்புத் துடிப்புகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் விவரிக்கப்பட்டுள்ள இரத்தினக்கல் வகைகள்.

**UNIT –IV விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பங்கள் 3**

அணை, ஏரி, குளம், மதகு, சோழர் கால குமிழி பூமியின் முக்கியத்துவம், கால்நடை வளர்ப்பு - கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள் - விவசாயம் மற்றும் வேளாண் பதப்படுத்துதல் - கடல் அறிவு - மீன்பிடி - சங்கு மற்றும் முத்து குளித்தல்- பண்டைய கடல் அறிவு - அறிவுசார் சமூகம்.

**UNIT –V அறிவியல் தமிழ் & தமிழ் கணினியியல் 3**

அறிவியல் தமிழ் - தமிழ்க் கணிமை வளர்ச்சி - தமிழ் நூல்களை மின்னுருவாக்கம் செய்தல் - தமிழ் மென்பொருள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத் தமிழ் அகராதி - சொற்குவை திட்டம்.

**Total : 15 PERIODS**

**TEXT-CUM REFERENCE BOOKS:**

1. தமிழக வரலாறு: மக்களும் பண்பாடும் - கே. கே பிள்ளை உலகத் தமிழாராய்ச்சி நிறுவனம், 2004 (வெளியீடு: தமிழ் நாடு பாடநூல் மற் றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ், முனைவர் இல.சுந்தரம் (வெளியீடு: விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (வெளியீடு: தொல்லியல் துறை)
4. 'பொருநை - ஆற்றங்கரை நாகரிகம் (வெளியீடு:தொல்லியல் துறை)
5. Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies
7. Historical by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu(Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & TamilNadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

**SEMESTER - III**

| 23CB1301 | OBJECT ORIENTED PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:** :

- To understand Object Oriented Programming concepts and basic characteristics of C and C++.
- To build C++ classes using appropriate encapsulation and design principles
- To introduce advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling etc
- To apply object oriented concepts to solve bigger computing problems.

**UNIT I INTRODUCTION TO C 8**

Introduction to C, Data Types, Operators and Expressions, Scope and Lifetime of variables, Constants, Pointers, Arrays, and Strings, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (*C*-way), Library Functions (*string*, *math*, *stdlib*), Command line arguments, Pre-processor directive.

**UNIT II FUNCTIONS IN C PROGRAMMING 9**

Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments.

**UNIT III OBJECT ORIENTED PROGRAMMING CONCEPTS 10**

Necessity for OOP, OOP in C++, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object. Extensions to C in C++ - Scope of Class and Scope Resolution Operator, Member Function of a Class, Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception).

**UNIT IV INHERITANCE AND POLYMORPHISM 9**

Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling

**UNIT V GENERIC PROGRAMMING AND I/O STREAMS 9**

Generic Programming - Template concept, class template, function template, template specialization. Input and Output -Streams, Files, Library functions, formatted output.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Understand the concepts of C and relative merits of C++.

**CO2** Gain the basic knowledge on Object Oriented concepts.

**CO3** Able to reuse the code with extensible Class types, User-defined operators and function Overloading.

**CO4** Able to use proper class protection mechanism to provide security.

**CO5** Achieve code reusability and extensibility by means of inheritance and how C++ supports Object Oriented principles such as abstraction, polymorphism.

**CO6** Understand and implement the features of templates, exceptions and file handling for providing programmed solutions to complex problems.

**TEXT BOOKS:**


1. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 3rd Edition, 2009.
2. Debasish Jana, "C++ and Object-Oriented Programming Paradigm", PHI Learning, 2nd Edition, 2005.
3. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.


**REFERENCE BOOKS**


1. Bjarne Stroustrup, "Programming: Principles and Practice Using C++", Addison Wesley, 2009
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020


**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | 1 | - | 1 | | - | - | - | - |
| **CO2** | 3 | 2 | 2 | - | | 1 | 1 | 2 | - | - | - | - |
| **CO3** | | 2 | 3 | 1 | 1 | 2 | 2 | 2 | - | - | - | - |
| **CO4** | 1 | 1 | 3 | 1 | | 2 | 2 | 2 | - | - | - | - |
| **CO5** | 1 | 1 | 3 | 1 | | 1 | 2 | 2 | - | - | - | - |
| **CO6** | 3 | 2 | 2 | - | | | 2 | | - | - | - | - |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Written Examinations |
| 40 | 60 | 40 | 60 | 100 |
| 40% | | | | 60 % |

| 23CB1302 | FORMAL LANGUAGE AND AUTOMATA THEORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To understand foundations of computation including automata theory
- To construct models of regular expressions and languages.
- To design context free grammar and push down automata
- To understand Turing machines and their capability
- To understand Undecidability and NP class problems

**UNIT I INTRODUCTION AND FINITE AUTOMATA 9**

**Introduction** : Alphabet- languages and grammars- productions and derivation - Chomsky hierarchy of languages.
**Finite automata:** Regular expressions - Deterministic Finite Automata (DFA) and equivalence with regular expressions - Nondeterministic Finite Automata (NFA) and equivalence with DFA, Myhill-Nerode theorem and its uses - Minimization of finite automata.

**UNIT II REGULAR LANGUAGES AND CONTEXT-FREE LANGUAGES 9**

**Regular Languages** : Introduction - Regular grammars and equivalence with finite automata - properties of regular languages- Kleene's theorem - pumping lemma for regular languages.
**CONTEXT-FREE LANGUAGES** : Context-free grammars (CFG) and languages (CFL) - Chomsky and Greibach normal forms.

**UNIT III PUSHDOWN AUTOMATA 9**

**Pushdown Automata:** Nondeterministic pushdown automata (PDA) and equivalence with CFG -parse trees- ambiguity in CFG - pumping lemma for context-free languages - deterministic pushdown automata, closure properties of CFLs .
Context-sensitive grammars (CSG) and languages- linear bounded automata and equivalence with CSG.

**UNIT IV TURING MACHINES 9**

The basic model for Turing machines (TM) - Turing recognizable(recursively enumerable) and Turing - decidable (recursive) languages and their closure properties - variants of Turing machines - nondeterministic TMs and equivalence with deterministic TMs - unrestricted grammars and equivalence with Turing machines – TMs as enumerators.

**UNIT V UNDECIDABILITY AND COMPLEXITY 9**

**Undecidability** :Church-Turing thesis - universal Turing machine - the universal and diagonalization languages - reduction between languages and Rice's theorem - undecidable problems about languages

**Basic Introduction to Complexity** : Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP, NP – completeness - Cook's Theory - other NP - Complete problems.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Apply the computational models to solve problems in diverse areas such as pattern matching and language design

**CO2** Identify deterministic and non-deterministic machines

**CO3** Analyze machines by their power to recognize languages

**CO4** Apply pumping lemma to Regular Languages and Context Free Languages

**CO5** Construct a Turing Machine for a recursive language

**CO6** Understand the differences between decidability and undecidability

**TEXTBOOKS**


1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman. 3rd Edition, Pearson Education, 2014.
2. John C Martin , "Introduction to Languages and the Theory of Computation".3rd Edition, Tata McGraw Hill, 2007.


**REFERENCE BOOKS**


1. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.
2. Lewis, H. and Papadimitriou, C.H "Elements of the Theory of Computation", 2nd Edition, Pearson. Education/PHI, 2003.
3. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, Cengage Learning, 2013.
4. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishers, New Delhi,2011
5. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP Completeness", 1979.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 1 |
| **CO2** | 2 | 2 | 2 | 2 | 1 | - | - | - | - | 2 | 2 | 1 |
| **CO3** | 1 | 2 | 2 | 3 | 1 | - | - | - | - | 2 | 2 | 1 |
| **CO4** | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 | 2 |
| **CO5** | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 1 | 2 |
| **CO6** | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 2 |

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23MA1305 | COMPUTATIONAL STATISTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- To study the concepts of linear regression models.
- To develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
- To apply principles of data science to analyse the business problems.
- To effectively visualize the data.
- To analyse data using various statistical tools like clustering and correlation.

**UNIT I MULTIVARIATE NORMAL DISTRIBUTION 9**

Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

**UNIT II DISCRIMINANT ANALYSIS 9**

Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

**UNIT III PRINCIPAL COMPONENT ANALYSIS 9**

Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

**UNIT IV FACTOR ANALYSIS 9**

Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

**UNIT V . CLUSTERING 9**

Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

**TOTAL :45 PERIODS**

**LIST OF EXPERIMENTS**

1. Basic Python Programs.
2. Program using String Operations.
3. Program on python Data structures.
4. Working with data in python using pandas.
5. Perform various numpy operations and special functions.
6. Draw statistical graphics using seaborn.

7. Implement k-means, logistic and time series algorithm using Scikit-learn.
8. Visualization in python using matplotlib.

**TOTAL: 30 PERIODS**

**COURSE OUTCOME(S):**

On Successful completion of the course, students will be able to:

**CO1** Interpret the usage of multivariate Normal distribution.
**CO2** Compute and interpret the results of multivariate regression.
**CO3** To find discriminants, rules to optimally assign new objects to the labelled classes.
**CO4** Apply the principal component techniques to reduce data and to interpret.
**CO5** To reduce the number of variables in regression models using Factor analysis.
**CO6** Apply the techniques of clustering methods for massive amounts of data.

**TEXT BOOKS:**


1. Probability and Statistics for Engineers (9th Edition), I.R. Miller, J.E. Freund and R. Johnson, 2023.
2. Fundamentals of Statistics (Vol. I & Vol. II), A. Goon, M. Gupta and B.Dasgupta, 8th edition 2002.
3. The Analysis of Time Series: An Introduction, Chris Chatfield, 7th edition 2019.


**REFERENCE BOOKS:**


1. Introduction to Linear Regression Analysis, D.C. Montgomery &E.Peck, 2006.
2. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill& D.C. Boes,2017.
3. Applied Regression Analysis, N. Draper & H. Smith, Third edition,1998.
4. Hands-on Programming with R,- Garrett Grolemund, 2014.
5. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, 2013.


**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO2** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO3** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO4** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO5** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO6** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23CB1303 | SOFTWARE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE:**

- To gain knowledge of basic Software Engineering methods and practices, and their appropriate application.
- To describe software engineering layered technology and Process frame work
- To identify software measurement and software risks.
- To describe the approaches to verification and validation using static and dynamic testing.
- To examine the good qualities of a software.
- To gain knowledge of basic Software Engineering methods and practices, and their appropriate application.

**UNIT-I INTRODUCTION 6**

**Introduction:** Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development. **Agile Software Engineering:** Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories.

**UNIT-II SOFTWARE PROJECT MANAGEMENT 6**

Basic concepts of life cycle models – different models and milestones; software project planning -identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

**UNIT-III SOFTWARE QUALITY MANAGEMENT AND RELIABILITY 6**

Software Quality and Reliability: Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation**.**

**Software Requirements Analysis, Design and Construction:** Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modelling – Decision tables, Event tables, State transition tables, Petri nets; requirements documentation through use cases; Introduction to UML, Introduction to software metrics and metrics-based control methods; Measures of code and design quality.

**UNIT-IV OBJECT ORIENTED ANALYSIS, DESIGN AND CONSTRUCTION 6**

Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; Quality of design; Design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.

**UNIT-V SOFTWARE TESTING 6**

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.

**TOTAL: 30 PERIODS**

**LIST OF EXPERIMENTS**

1. Development of requirements specification
2. Function-oriented design using Structured Analysis(SA) / Structured Design (SD)
3. Object-Oriented design using UML
4. Test case design
5. Implementation using C++ and testing
6. Use of appropriate CASE tools and other tools such as configuration management tools
7. Program analysis tools in the software life cycle.

   Prepare the following documents for any one of the above experiments and develop the software using software engineering methodology.

   - Course Registration System
   - Quiz System
   - Online ticket reservation system
   - Remote computer monitoring
   - Student marks analysing system
   - Expert system to prescribe the medicines for the given symptoms
   - ATM system
   - Platform assignment system for the trains in a railway station
   - Stock maintenance.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**


1. Software Engineering, Ian Somerville, Addison-Wesley, 8th Edition, 2021.
2. Software Engineering A Practitioner's Approach, Roggers S. Pressman and Bruce R. Maxim. 8th edition,2024

3. Roger S. Pressman, Bruce R.Maxim¯Software Engineering – A Practitioner's Approach, Seventh Edition, McGraw-Hill International Edition, 2024.

**REFERENCE BOOKS**

1. Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino, "Fundamentals of Software Engineering", 2nd Edition, Pearson,2002.
2. Ivar Jacobson, Grady Booch, James Rum Baugh, "The Unified Development Process", Addison Wesley, 2004.
3. A Lexicon of Practice, Principles and Prejudices, Michael Jackson, "Software Requirements and Specification", 1 Edition, 1995.
4. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of
Object-Oriented Reusable Software", 1st Edition, Addison Wesley, 1994.
5. Norman E. Fenton, Shari Lawrence Pledger, "Software Metrics: A Rigorous and Practical Approach", 2nd Edition, International Thomson Computer Press, 1997.

**COURSE OUTCOME(S):**

On successful completion of the course, the student will be able to:

**CO1** Apply the system development life cycle for any Business system.
**CO2** Establish software project management activities such as planning, scheduling and Estimation for the business system.
**CO3** Specify the business requirements through appropriate system analysis and design.
**CO4** Adapt good programming and documentation standards
**CO5** Implement and demonstrate any business system software from specification to validation
and verification.
**CO6** Analyze the Software Requirements Specifications and modelling

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | - |
| **CO2** | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | - |
| **CO4** | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | - |
| **CO5** | 2 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | - |
| **CO6** | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | - |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23CB1304 | COMPUTER ORGANIZATION AND ARCHITECHTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- Discuss the functionalities of various blocks of a digital computer and express the data representation.
- llustrate the logic design of Arithmetic and control Unit.
- Infer the concepts of memory system, concurrence access in parallel processors and classify the approaches for I/O communication.
- Distinguish hazards in pipelining and outline its impact in the performance of the processors

**UNIT I COMPUTER ORGANISATION AND INSTRUCTIONS 9**

Basics in Boolean logic and Combinational/Sequential Circuits.
**Functional blocks of a computer**: CPU, memory, input-output subsystems, control unit; **Instruction set architecture of a CPU**: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set; Outlining instruction sets of some common CPUs. **Data representation**: Signed number representation, fixed and floating point representations, character representation

**UNIT II COMPUTER ARITHMETIC 9**

**Computer arithmetic:** Integer addition and subtraction- ripple carry adder- carry look-ahead adder, etc.; multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. - Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

**UNIT III X86 ARCHITECTURE 9**

**x86 architecture**: Introduction.
**CPU control unit design**: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.
**Memory system design**: Semiconductor memory technologies, memory organization.

**UNIT IV PERIPHERAL DEVICE 9**

**Peripheral devices and their characteristics**: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions; Programs and processes – role of interrupts in process state transitions, I/O device interfaces – Small Computer System Interface (SCSI), Universal Serial Bus (USB).

**UNIT V PIPELINING AND MEMORY ORGANIZATION 9**

**Pipelining**: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
**Parallel Processors**: Introduction to parallel processors, Concurrent access to memory and cache coherency.
**Memory organization**: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

**TOTAL: 45 PERIODS**

## LIST OF EXPERIMENTS

1. Circuits on breadboard or simulators

   a) Implementation of Combinational Digital/Boolean Circuits: Adder, Subtractor, Multiplication Module, Division Module, Multiplexer, Demultiplexer, Encoder, Decoder

   b) Implementation of Sequential Circuits: Counters, Linear Feedback Shift Registers (LFSR)

2. C/C++ programming to understand the formats of char, int, float, double, long etc.

3. Machine language programming on x86 or higher version kits or simulators:

   a) Add/subtract/multiplication/division/GCD/LCM

   b) Accessing some specific memory locations/ports

   c) Counting odd and even integers from a series of memory locations

   d) Printing values of selected registers

   e) Handing interrupts

**TOTAL: 30 PERIODS**

**COURSE OUTCOME(S):**
On successful completion of the course student will be able to:

**CO1** Understand the basic structure of computers, operations and instructions.

**CO2** Discuss the functionalities of various blocks of a digital computer and express the data representation.

**CO3** Illustrate the logic design of Arithmetic and control Unit.

**CO4** Understand parallel processing architectures.

**CO5** Infer the concepts of memory system, concurrence access in parallel processors and classify the approaches for I/O communication.

**CO6** Distinguish hazards in pipelining and outline its impact in the performance of the

processors.

**TEXT BOOKS**

1. Morris Mano, “Computer System Architecture” 3rdEdition, Prentice Hall of India, New Delhi, 2014.
2. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, Elsevier, 5th Edition 2013.
3. Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, “Computer Organization and Embedded Systems” McGraw-Hill, 6th Edition 2014.

**REFERENCE BOOKS**

1. John P. Hayes, Computer Architecture and Organization, McGraw-Hill ,3rd Edition, 2013.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 10thEdition, Pearson Education, 2015.
3. Vincent P. Heuring and Harry F. Jordan,”Computer System Design and Architecture”, Prentice Hall, 2ndEdition, 2004

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | | | | |
| **CO2** | 2 | 2 | 2 | 1 | | | | 1 | | 1 | | |
| **CO3** | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | | | |
| **CO4** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| **CO5** | 2 | 1 | 2 | | | | | 2 | | | 1 | |
| **CO6** | 1 | 1 | 1 | 1 | | | 1 | 1 | | | 1 | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23CB1311 | OBJECT ORIENTED PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVE:**

- Understand the basics of C and C++.
- To develop applications using files in C++
- Apply object oriented programming concepts to solve real time problems
- To familiarize with constructors, inheritance, polymorphism, templates and exception handling

**LIST OF EXPERIMENTS**

1. Write a Program to pass parameter by value vs by reference, passing array as constant pointer.

2. Write a program for function overloading in String ,operations like strcat and strncat, strcpy and strncpy as overloaded functions.

3. Dynamically allocating space for a pointer depending on input and doing this repeatedly, depending on different inputs and finally de-allocating the pointer.

4. Write a class complex with all possible operations: constructor, destructor, copy constructor, assignment operator with the data members stored as pointer to integers.

5. Write a class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators.

6. Write a class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators.

7. Write a class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators.

8. Develop class stack, queue, linked-list, array, set using some data-type (int) with data members kept as private and functions kept in both protected and public sections.

9. Write a class complex with all possible operators: constructor, destructor, copy constructor, assignment operator and operators >, <, >=, <=, ==, ++ (pre and post), +, +=, ( ), with the data members stored as pointer to integers.

10. Write a class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).

11. Write a program to create class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).

12. Write a program to perform stack and queue inherited from array class, with standard functions and operators.

13. Design a class called ‘array’ with data type passed as template type with constructor, destructor, copy constructor and assignment operators and index operator.

14. Write a template functions to compare and use it in the algorithms like bubble sort, insertion sort, merge sort

15. Write a program for Formatted input-output examples.

16. Write a program to implement Input manipulators.

17. Write a Program to Override the operators <<, >>.

18. Design a class model for complex number, student class, book class and show it using UML diagram as well as concrete class.

19. Implement behavioural modelling through sequence diagram and activity diagram for workflow in a typical log-in, log-out situation.

**TOTAL: 60 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** To develop the skills in programming using C++.
**CO2** Apply object oriented programming concepts to solve real time problems.
**CO3** Employ the concepts of constructors, inheritance and polymorphism.
**CO4** Implement function and operator overloading using C++.
**CO5** Develop software applications using templates, exception handling and files in C++.
**CO6** Implement the concepts of data structures and UML diagrams.

**WEB REFERENCES:**

1. https://www.studytonight.com/cpp/cpp-and-oops-concepts.php
2. https://www.tutorialspoint.com/What-are-basic-Object-oriented-programming-concepts
3. https://www.geeksforgeeks.org/basic-concepts-of-object-oriented-programming-using-c/
4. http://www.iitk.ac.in/esc101/05Aug/tutorial/java/concepts/index.html

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 |
| CO2 | 2 | 3 | - | 2 | 1 | - | - | - | - | - | 2 | - |
| CO3 | 2 | 2 | - | 1 | 1 | - | - | - | - | - | 1 | - |
| CO4 | 1 | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 1 |
| CO5 | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | 1 | 2 |
| CO6 | 1 | 3 | 2 | 3 | 2 | - | - | - | - | - | 2 | 2 |

| Internal Assessment | | End Semester Examination |
|---|---|---|
| Evaluation of Laboratory Observation, Record | Test | Practical |
| 75 | 25 | 100 |
| 60 % | | 40% |

| 23ES1311 | TECHNICAL SKILL PRACTICES II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVE:**

- To understand the concepts of Arrays, ListADT.
- To learn linear data structures-stacks and queues ADTs.
- To understand and apply Tree data structures.
- To analyze sorting and searching algorithms.
- To understand and apply Graph structures and hashing techniques.

**LIST OF TOPICS**

1. Arrays
2. List ADT
3. Queue ADT
4. Stack ADT
5. Problems on Postfix and Infix expressions
6. Binary Tree Traversal
7. Binary Search Tree
8. B-Tree
9. Binary Heaps
10. Linear search algorithm & Binary search algorithm
11. Sorting algorithms
    i. Bubble Sort
    ii. Selection Sort
    iii. Insertion Sort
    iv. Merge Sort
    v. Quick sort
    vi. Radix Sort
    vii. Bucket Sort
    viii. Heap Sort
    ix. Shell Sort
12. Graph Traversal algorithms
    i. BFS
    ii. DFS
    iii. Topological Sorting
13. Shortest Path algorithm
    i. Dijkstra Algorithm
    ii. Bellman-Ford Algorithm
14. Minimum Spanning tree
    i. Kruskal Algorithm
    ii. Prim's Algorithm

15. All pairs shortest paths using Floyd's Algorithm
16. Hashing using open addressing technique

**TOTAL: 30 PERIODS**

**COURSE OUTCOME(S):**

Upon successful completion of the course, students will be able to:

**CO1** Implement arrays and abstract data types for list.
**CO2** Solve real world problems using appropriate linear data structures.
**CO3** Apply appropriate tree data structures in problem solving.
**CO4** Implement various searching and sorting algorithms.
**CO5** Implement appropriate Graph representations and solve real-world applications.
**CO6** Apply various hashing operations.

**SOFTWARE REQUIREMENTS**

Anaconda Python Distribution/ TURBO C.

**TEXT BOOKS:**


1. G. A. Vijayalakshmi Pai," A Textbook of Data Structures and Algorithms, Volume 1", Wiley-ISTE,January 2023.
2. G. A. Vijayalakshmi Pai,"A Textbook of Data Structures and Algorithms, Volume 2: Mastering Nonlinear Data Structures", Wiley-ISTE,February2023.
3. Dr.Harsh Bhasin,"Data Structures with Python", BPB Publications,Delhi,March2023.
4. John Canning ,Alan Broder,Robert Lafore,``Data Structures & Algorithms in Python", Addison-Wesley Professional, October 2022.
5. Y Daniel Liang, "Introduction To Python Programming And Data Structures", Global Edition 3rd Edition ,Pearson Publications ,November 2022.


**REFERENCE BOOKS:**


1. Dr.Basant Agarwal,"Hands-On Data Structures and Algorithms with Python",3rd Edition, Packt Publishing, July 2022.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, August 2016.
3. MichaelH.Gold wasser, Michae IT.Good rich, and Roberto Tamassia," Data Structures and Algorithms in Python", Wiley Publications 2013.


**ONLINE COURSES/RESOURCES:**

1. https://www.codechef.com/practice.
2. https://www.javatpoint.com/data-structure-tutorial.
3. https://www.simplilearn.com/tutorials/python-tutorial/data-structures.
4. https://nptel.ac.in/Courses/.

## SEMESTER IV

| 23CB1401 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To understand the basic concepts and the applications of database systems.
- To know the basics of SQL and construct queries using SQL.
- To learn the relational database design principles.
- To learn about the normalization concepts and storage strategies.
- To understand the basic issues of transaction processing and concurrency control.
- To familiar with advances in data security

**UNIT I DATABASE FUNDAMENTALS 9**

Introduction to Database - Hierarchical, Network and Relational Models, Database system architecture - Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML), Data models - Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

**UNIT II RELATIONAL DATABASE 9**

Relational query languages - Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL,ORACLE, DB2, SQL server.

**UNIT III RELATIONAL DATABASE DESIGN, QUERY PROCESSING AND STORAGE 9**

Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design, Storage strategies - Indices, B-trees, Hashing, Query processing and optimization - Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms, .

**UNIT IV TRANSACTION PROCESSING 9**

Transaction processing-Concurrency control, ACID property (Atomicity, Consistency, Isolation, Durability), Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

**UNIT V DATABASE SECURITY AND ADVANCED DATABASE 9**

Authentication, Authorization and access control, DAC ( Discretionary Access Control), MAC(Mandatory Access Control) and RBAC(Role-based access control) models, Intrusion detection, SQL injection, Advanced topics - Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME(S):**

On Completion of the course, the students will be able to

**CO1** Understand the basic concepts of database systems.

**CO2** Apply SQL and MySQL Queries using open source and commercial database and relational database design

**CO3** Apply the query processing techniques for the optimization.

**CO4** Utilize various indexing and hashing techniques of database and security mechanisms for authentication and recovery.

**CO5** Understand the basic issues of transaction processing and concurrency control.

**CO6** Interpret various advanced database to compare with traditional databases.

**TEXTBOOKS**


1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 7th Edition, Tata McGraw Hill, March 2019.
2. Gupta G K, “Database Management Systems”, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
3. Peter rob, Carlos Coronel, “Database Systems – Design, Implementation and Management”, 9 th Edition, Thomson Learning, 2009.


**REFERENCE BOOKS**


1. J. D. Ullman, “Principles of Database and Knowledge – Base Systems”, Vol 1, Computer Science Press, Inc. New York, 1998.
2. R. Elmasri and S. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson, 2016.
3. Serge Abiteboul, Richard Hull, Victor Vianu, “Foundations of Databases”, Addison-Wesley Publishing Company, 1995.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | 3 | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | - |
| CO3 | 3 | 1 | 1 | 1 | 3 | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | 0 | 2 | - | - | - | - | - | - | - | - |
| CO5 | 3 | 3 | 0 | 2 | - | - | - | - | - | - | - | - |
| CO6 | 1 | 2 | 0 | 2 | - | - | - | - | - | - | - | - |

| Internal Assessment | | | | End Semester Examinations |
|---|---|---|---|---|
| Assessment I (100 Marks) | | Assessment II (100 Marks) | | |
| Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Individual Assignment / Case Study / Seminar / Mini Project | Written Test | Written Examinations |
| 40 | 60 | 40 | 60 | 100 |
| 40% | | | | 60 % |

| 23CB1402 | INTRODUCTION TO INNOVATION AND ENTREPRENEURSHIP | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- Learn to be familiar with creative and innovative thinking styles.
- Learn to investigate, understand and internalize the process of founding a start-up.
- Learn to protect the innovations and intangible assets from exploitation.
- Learn to manage various types of IPR to protect competitive advantage.

**UNIT I INTRODUCTION TO INNOVATION 9**

**Innovation:** What and Why?, Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.
Discussion Topic - Is innovation manageable or just a random gambling activity?.

**UNIT II INNOVATIVE ORGANIZATION BUILDING 9**

**Building an Innovative Organization** : Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture
Discussion Topic - Innovation: Co-operating across networks vs. 'go-it-alone' approach.

**UNIT III ENTREPRENEURSHIP AND FINANCIAL PLANNING 9**

**Entrepreneurship**: Opportunity recognition and entry strategies , Entrepreneurship as a Style of Management, Maintaining Competitive Advantage- Use of IPR to protect Innovation.
**Financial Planning** -Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing.

**UNIT IV INTELLECTUAL PROPERTY RIGHTS (IPR) 9**

**Intellectual Property Rights (IPR):** Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context.

**UNIT V INTELLECTUAL PROPERTY TYPES 9**

**Types of Intellectual Property :**
Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name , Geographical Indications- What is GI, Why protect them?, Copyright- What is copyright, Industrial Designs- What is design? How to protect?
**Discussion Topic -** Major Court battles regarding violation of patents between corporate companies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Create a learning system to enhance the innovation.

**CO2** Develop creative thinking skills.

**CO3** Acquaint themselves with the special challenges of starting new ventures

**CO4** Use IPR as an effective tool to protect their innovations and intangible assets from exploitation

**CO5** Identify criteria's to fit one's own intellectual work in particular form of IPRs

**CO6** Apply statutory provisions to protect particular form of IPRs.

**TEXT BOOKS**

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change, 7th Edition, 2020

**REFERENCE BOOKS**

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
3. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers:
5. Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.
6. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
7. Mathew J Manimala, “Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | - | 1 | 1 | - | 1 | 2 | 1 | 1 | 2 | 2 |
| **CO2** | 1 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 |
| **CO3** | - | - | - | 1 | 1 | 1 | - | 2 | 1 | 1 | 1 | - |
| **CO4** | 1 | - | - | - | - | - | 2 | 2 | 1 | 1 | 2 | 1 |
| **CO5** | 2 | 2 | - | - | - | - | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO6** | 2 | 2 | - | - | - | - | 2 | 1 | 1 | 1 | 1 | 1 |

| **Internal Assessment** | | | | **End Semester Examinations** |
|---|---|---|---|---|
| **Assessment I (100 Marks)** | | **Assessment II (100 Marks)** | | |
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Written Examinations** |
| 40 | 60 | 40 | 60 | 100 |
| **40%** | | | | **60 %** |

| 23MA1407 | OPERATIONS RESEARCH | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- To formulate linear programming problem and solve using graphical, simplex method.
- To solve transportation and assignment problem.
- To optimize inventory levels considering costs, demand, and lead time.
- To apply and extend queueing models to analyze real world systems.
- To provide knowledge and training in using optimization techniques under limited resources for engineering and business problems.

**UNIT I** **LINEAR PROGRAMMING** **9**

**Introduction**: Origin of OR and its definition. Types of OR problems, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution - System of linear equations.
**Linear programming** – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP – Hyper plane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions - Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy &degeneracy, Sensitivity analysis - Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method - identification and resolution of special cases through simplex iterations - Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

**UNIT II** **TRANSPORTATION AND ASSIGNMENT MODELS** **9**

**Transportation Problem** - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality(MODI method), degeneracy and its resolution.

**Assignment Problem** - Examples, Definitions – decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

**UNIT III** **NETWORK MODELS** **9**

**PERT – CPM** - Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off - for safety stock with known/unknown stock out situations, models under 75 prescribed policy, Probabilistic situations.

**UNIT IV** **INVENTORY MODELS** **9**

Inventory Control -Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ &Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models.

**UNIT V** **QUEUEING MODELS** **9**

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase) - Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.
**Simulation -** Methodology- Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

**TOTAL :45 PERIODS**

## LIST OF EXPERIMENTS

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
   a) Multiple constraints
   b) Unbounded solution
   c) Infeasible solution
   d) Alternative or multiple solution.
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two-phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method
16. ABC analysis
17. Inventory model.

**SOFTWARE REQUIRED: R-PROGRAMMING/ PYTHON**

**TOTAL :30 PERIODS**

**COURSE OUTCOME(s):**

On successful completion of the course, students will be able to:

**CO1** Formulate and find optimal solution in the real life optimizing.

**CO2** Apply transportation and assignment models optimization techniques to solve problems.

**CO3** Apply operations research techniques and algorithms to solve Network problems.

**CO4** Recognize and solve inventory problems.

**CO5** Acquire skills in analyzing queuing models.

**CO6** Simulate appropriate application/distribution problems.

**TEXT BOOKS:**

1. Taha H.A, “Operation Research”, 10th Edition, Pearson Education, 2017.

2. A. Ravi Ravindran, “Operations Research and Management Science, Hand Book”, CRC Press, 2008.

**REFERENCE BOOKS:**

1. K.G. Murthy, Linear Programming, Wiley, New York, 1983.

2. H.M. Wagner, “Principles of OR with Application to Managerial Decisions”, Prentice Hall,1975.

3. F.S. Hiller and G.J. Lieberman, “Introduction to Operations Research”, McGraw Hill, 2001.

4. Thomas L. Saaty, “Elements of Queuing Theory”, McGraw Hill, 1961.

5. Jerome D. Wiest, Ferdin, and K. Levy Management Guide to PERT/CPM, Englewood Cliffs, N.J. : Prentice-Hall, 1969.

6. J.W. Prichard and R.H. Eagle, “Modern Inventory Management”, Wiley, 1965.

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | 1 | 1 | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO3** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO4** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO5** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO6** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23CB1403 | OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- To understand the basic concepts and functions of operating systems.
- To understand concepts of Processes and analyse Scheduling algorithms.
- To analyse various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Unix system.

**UNIT I INTRODUCTION 8**

**Introduction:** Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.
**Processes**: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
**Thread**: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

**UNIT II PROCESS MANAGEMENT 11**

**Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
**Scheduling algorithms:** Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.
**Inter-process Communication:** Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.
**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.
**Concurrent Programming:** Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

**UNIT III STORAGE MANAGEMENT 9**

**Memory Management:** Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition-Internal and External fragmentation and Compaction.

**Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).
**I/O Hardware:** I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

**UNIT IV FILE SYSTEMS 9**

**File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed),Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.
**Disk Management:** Disk structure, Disk scheduling – First come-First Serve (FCFS), Shortest Seek Time First (SSTF), SCAN, Circular-Scan (C-SCAN), Disk reliability, Disk formatting, Boot-block, Bad blocks.

**UNIT V CASE STUDY 8**

**Case study:** UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS**

1. Unix commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C program implementation of the following:
    a) Scheduling Algorithms
    b) Shared memory
    c) Thread and Multi Thread
    d) Inter Process Communication
    e) Deadlock Avoidance and Deadlock Detection
    f) Semaphore
    g) Memory Management
    h) Indexing and Hashing

**TOTAL: 30 PERIODS**

**COURSE OUTCOME(S):**
On successful completion of the course student will be able to:

**CO1** Study and Understand the basics of Operating System.

**CO2** Analyse and design the applications of Process, Process scheduling, Process Synchronization, Deadlock.

**CO3** Analyse the various memory management schemes.

**CO4** Learn the various concepts of File systems.

**CO5** Understand various concepts of Disk management techniques.

**CO6** Understand the functionality of UNIX Operating System.

**TEXT BOOKS**


1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley, 2018.

2. William Stallings, “Operating Systems -Internals and Design Principles”, 8thEdition, Pearson Publications, 2014.


**REFERENCE BOOKS**


1. N. Gregory Mankiw, “Principles of Macroeconomics”, 6th edition, Cengage India, 2008
2. Charles Patrick Crowley, “Operating System: A Design-oriented Approach”,2001.
3. Gary Nutt, ¯Operating Systems, Third Edition, Pearson Education, 2004.
4. Maurice J. Bach, “Design of the Unix Operating Systems”, Prentice/Hall International., Inc,2016.
5. Daniel Pierre Bovet, Marco Cesati, “Understanding the Linux Kernel”,2000.


**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| **CO2** | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| **CO3** | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| **CO4** | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| **CO5** | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |
| **CO6** | 1 | 1 | - | - | - | - | - | - | - | - | - | 2 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23CB1404 | SOFTWARE DESIGN WITH UML | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVE:**

- Obtain knowledge of software engineering discipline
- Learn various modelling techniques for different perspectives of object oriented software design(UML)
- Apply business modeling and modeling languages to design software
- Develop correct and robust software deployment models

**UNIT-I INTRODUCTION TO ON OBJECT ORIENTED TECHNOLOGIES AND THE UML METHOD 9**

**Software development process:** The Waterfall Model vs. The Spiral Model. -The Software Crisis, description of the real world using the Objects Model. -Classes, inheritance and multiple configurations-Quality software characteristics. -Description of the Object-Oriented Analysis process vs. the Structure Analysis Model.

**Introduction to the UML Language:** Standards, Elements of the language. General description of various models, The process of Object Oriented software development, Description of Design Patterns, Technological Description of Distributed Systems.

**UNIT-II REQUIREMENTS ANALYSIS USING CASE MODELING AND INTERACTION DIAGRAMS 9**

**Using Case Modeling :** Analysis of system requirements -Actor Definitions-Writing a case goal. -Use Case Diagram -Use Case Relationships-Requirements Analysis Using Case Modeling

**Interaction Diagrams** : Description of goal-Defining UML Method, Operation, Object Interface, Class-Sequence Diagram -Finding objects from Flow of Events-Describing the process of finding objects using a Sequence Diagram-Describing the process of finding objects using a Collaboration Diagram.

**UNIT-III THE LOGICAL VIEW DESIGN STAGE 9**

**The Static Structure Diagrams:** The Class Diagram Model-Attributes descriptions-Operations descriptions- Connections descriptions in the Static Model -Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.

**UNIT-IV PACKAGE DIAGRAM MODEL AND DYNAMIC MODEL 9**

**Package Diagram Model :** Description of the model-White box, black box-Connections between packagers -Interfaces -Create Package Diagram -Drill Down.

**Dynamic Model:** State Diagram / Activity Diagram-Description of the State Diagram -Events Handling -Description of the Activity Diagram - Exercise in State Machines.

**UNIT-V COMPONENT DIAGRAM AND DEPLOYMENT DIAGRAM MODEL 9**

Component Diagram Model- Physical Aspect. -Logical Aspect. -Connections and Dependencies. -User face. -Initial DB design in a UML environment. Deployment Model- Processors -Connections -Components-Tasks-Threads -Signals and Events.

**TOTAL: 45 PERIODS**

## LIST OF EXPERIMENTS

Draw the UML diagrams for the suggested Mini Projects:

1. Class Diagram
2. Object Diagram
3. Use Case Diagram
4. Sequence Diagram
5. Collaboration Diagram
6. State Chart Diagram
7. Activity Diagram
8. Component Diagram
9. Deployment Diagram

Suggested Mini Projects Domain For the following Applications: (Not limited to)

a) Passport automation Systems
b) Stock Maintenance System
c) Online Reservation Systems
d) Student Information Systems
e) Software Personnel Management Systems
f) Credit Card Management Systems
g) Recruitment Systems
h) Library Management Systems

**TOTAL: 30 PERIODS**

**TEXT BOOKS:**


1. The Unified Modelling Language User Guide. Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, Publisher: Addison Wesley, First Edition, 1998.
2. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit. Third Edition, 2000 Pearson Education, Inc., publishing as Prentice Hall.


**REFERENCE BOOKS:**


1. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.


**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Understand the software development process models

**CO2** Interpret the contemporary issues and discuss about analysis and coding standards

**CO3** Analyze the design methods and modelling

**CO4** Provide a clear view of the hierarchical structure of the various UML elements within a given system.

**CO5** Show which software elements are deployed by which hardware elements.

**CO6** Employ UML diagrams for real time problems

**CO-PO MAPPING**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | 1 | - | - | - | 2 | 2 | - | 3 |
| **CO2** | 3 | 2 | 2 | - | 2 | - | - | - | 1 | 1 | - | 2 |
| **CO3** | 3 | 3 | 3 | - | 2 | - | - | - | 1 | 1 | - | 3 |
| **CO4** | 3 | 3 | 3 | - | 1 | - | - | - | 3 | 3 | - | 3 |
| **CO5** | 3 | 2 | 2 | - | 1 | - | - | - | 3 | 3 | - | 3 |
| **CO6** | 2 | 2 | 2 | - | 2 | 1 | - | 1 | 1 | 2 | 2 | 2 |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | |
| **100** | | | | **100** |
| **50 %** | | | | **50 %** |

| 23CB1405 | DESIGN THINKING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE**:

- Recognize the importance of Design Thinking.
- Explain the phases in the Design Thinking process.
- List the steps and apply the steps required to complete each phase in Design Thinking process.
- Use doodling and storytelling in presenting ideas and prototypes.
- Create value proposition statements as part of their presentations.
- Recognize how Design Thinking can help in functional work.and how Agile and Design Thinking

**UNIT I INTRODUCTION 6**

Why is Design Thinking important for business? - Linking Design Thinking Solution to Business Challenges. Why is Design Thinking important for you? – Recognize the importance of Design Thinking - What is Design Thinking? – Empathy- Recognize the steps in the empathize phase of Design Thinking - How to empathize? - Introduction to Immersion Activity - Immersion activity through flowcharts and handouts.

**UNIT II UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM 6**

Creating personas - Recognize the steps to create personas in the define phase of Design Thinking- Create personas in the define phase of Design thinking- Problem statements- Recognize the steps to create problem statements in the define phase of Design Thinking - Defining problem statements - Define the problem statements in the define phase of Design Thinking.

**UNIT III IDEATION 6**

How to Ideate? - Recognize the steps in the ideate phase of Design Thinking - Ideation games - Apply the steps in the ideate phase of Design Thinking - Six Thinking Hats - Million-dollar idea- Ideate to find solutions - Ideate solutions for the problem statements identified (as continuation of immersion activity) - Apply ideation methods- Let's doodle! - Presenting ideas during ideate and prototype phases - Storytelling in Design Thinking - Present their findings in forms of stories.

**UNIT IV PROTOTYPING 6**

Why is a Prototype important in Design Thinking? - Recognize the importance of the prototype phase in Design Thinking - Prototype your idea - Create a prototype - Value Proposition Statement – how to create a value proposition statement.

**UNIT V TESTING 6**

Testing in Design Thinking – The importance of Testing the prototype through stories – Test the Prototype - Conducts a group/open house discussion on : "How Design Thinking can help me to become a better coder.

**TOTAL: 30 PERIODS**

## LIST OF EXPERIMENTS

1. 2030 Schools Challenge: Concept: Design thinking is often presented without teaching content. This is very different. Learners get 30 minutes to choose a UN 2030 Goal (there are 17) that is relevant and meaningful to them, then they get into small groups. The group researches the goal quickly, by answering the questions: What does the world need to know about this goal and what can we do about it? The group then creates a short PSA (Public Service Announcement) and shares it widely with an authentic audience. It is fun, fast, and shows the power of design sprints to teach content and skills.

2. THE GIFT-GIVING PROJECT VIA STANFORD D-SCHOOL Concept: The Gift-Giving Project is 90-minute (plus debrief) fast-paced project through a full design cycle. Students pair up to interview each other, come to a point-of-view of how they might design for their partner, ideate, and prototype a new solution to "redesign the giftgiving experience" for their partner.

3. THE WALLET PROJECT VIA STANFORD D-SCHOOL Concept: Very similar to the GiftGiving Project, the Wallet Project is 90-minute (plus Tentative 48 debrief) fast-paced project through a full design cycle. Students pair up, show and tell each other about their wallets, ideate, and make a new solution that is "useful and meaningful" to their partner.

4. INVENT A SPORT (WITH JUST THESE ITEMS) Concept: We've all played sports at some point in our life. Who came up with the rules? Who created the game? Who made the constraints? And who decided the objects to play with? Now, with limited time and resources, your group will create and invent a new sport, and a set of directions for people to actually play the game.

5. "BOOK IN AN HOUR" ACTIVITY (VIA ALL WHO WONDER) Concept: Give a group a book (fiction or non-fiction). Then you break them up into smaller groups (or individuals) to read different parts of the book. Each group (or person) has to read and then create an overview/trailer of their part of the book to share chronologically with the rest of the class. Here the design really starts with the creative process driving how you share the information, plot, characters etc. Perfect use for professional development when you want to introduce a topic in a fun, engaging way.

6. CHILDREN'S STORY DESIGN ACTIVITIES Concept: The University of Arkansas created a series of STEM Challenges that work as great design activities with groups old and young! For example after reading "The Three Billy Goat's Gruff" they set up a challenge like this: You decide to help the billy goats reach the opposite side of the creek so they can eat. You must create a model structure to help the billy goats get from one side to the other while using the design loop and only the materials provided. Your teacher will also provide you with model billy goats, with specific weights, that your bridge must be able to withstand.

**TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Müller-Roterberg, Christian, “Handbook of Design Thinking”, Amazon Digital Services LLC - KDP Print US, 2018.
2. Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Collins Publisher, 2009.
3. Eli Woolery, Design Thinking Handbook, Invision, 2019.

**REFERENCE BOOKS**

1. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2. Nir Eyal , Hooked: How to build habit-forming, 2014.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Understand the importance of design thinking and its different phases.

**CO2** Empathize with user situations and be able to define clear problem statements.

**CO3** Use the different ideation methods and come with different feasible and viable ideas for solving the problem statements.

**CO4** Create prototypes for clear understanding of the problem statement.

**CO5** Test the created prototypes and be able to iterate if the design does not meet the customer requirement.

**CO6** Identify the phases of Design thinking to solve problem related to real world.

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | - |
| **CO2** | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | - |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | - |
| **CO4** | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | - |
| **CO5** | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | - |
| **CO6** | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 | 3 | 3 | - |

| **Assessment** (40% weightage) (Theory Component) | | **Assessment** (60% weightage) (Laboratory Component) | | **End Semester Examination** |
|---|---|---|---|---|
| **Individual Assignment / Case Study / Seminar / Mini Project** | **Written Test** | **Evaluation of Laboratory Observation, Record** | **Test** | **Written Examination** |
| **40** | **60** | **75** | **25** | **100** |
| **100** | | | | |
| **50 %** | | | | **50 %** |

| 23CB1411 | DATABASE MANAGEMENT SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVE:**

- Learn to create and use a database.
- Be familiarized with a query language.
- Have hands on experience on DDL Commands.
- Have a good understanding of DML Commands and DCL Commands.
- Familiarize advanced SQL queries
- Be exposed to different applications

**LIST OF EXPERIMENTS**

1. C implementation of a Database Editor
2. Creation of tables for Salesman and Customer Relation
3. Creating relationship between the databases and retrieve records using joins
4. Set various constraints like Not Null, Primary Key, Foreign Key and Check constraints.
5. Creation of Views, Synonyms, Sequence, Indexes, Save point
6. Implementation of SQL commands DDL, DML, DCL and TCL
7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
8. Write a PL/SQL block that handles all types of exceptions.
9. Creation of Procedures.
10. Creation of database triggers and functions
11. Database Connectivity with Front End Tools ( Java/Python).
12. Study of Cloud Storage i)IT Training Group Database ii) Blood Donation System iii)Salary Management System iv)Traffic Light Information System
13. Mini Project (Application Development using DB)

**TOTAL: 60 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course student will be able to:

**CO1** Understand the Syntax of SQL commands.

**CO2** Remember queries to retrieve records.

**CO3** Apply referential integrity constraints.

**CO4** Analyze the database design using constraints.

**CO5** Evaluate PL/SQL programs to implement triggers, functions, procedures and exceptions

**CO6** Create front end tools to manipulate information from backend.

**WEB REFERENCES:**

1. http://nptel.ac.in/video.php?subjectId=106106093

## CO-PO MAPPING

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - |
| CO5 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - |
| CO6 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - |

| Internal Assessment | | End Semester Examination |
|---|---|---|
| Evaluation of Laboratory Observation, Record | Test | Practical |
| 75 | 25 | 100 |
| 60 % | | 40% |

| 23ES1411 | TECHNICAL SKILL PRACTICES III | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVE:**

- To understanding Java Fundamentals..
- To develop proficiency in flow control statements and Understand the usage of arrays and var-arg types
- To exploring Object-Oriented Programming Concepts through Java Programming
- To develop programs on Exception handling through Java Programming
- To understand the usage of wrapper classes and Utilizing Standard Java Libraries.

**LIST OF TOPICS**

1. Java Tokens- Comments, Identifiers, Keywords, Separators, Data types
2. Scoping and Parameter passing (by value & by reference)
3. Flow Control Statements
4. Arrays and Var-arg types
5. Operators & their Precedence & Associativity
6. Conversions: Narrowing & Widening Conversions
7. Access Modifiers for Class & Class Members
8. Non Access Modifiers for Class & Class Members
9. Packages with Static imports
10. Creating Classes and Instances
11. Method and Types of methods
12. Inheritance
13. Polymorphism(Method Overloading & Overriding) Abstract classes and Interfaces
14. Constructors and Initialization
15. Static data and methods
16. Checked and Unchecked Exceptions - User defined Exceptions
17. Java Thread Model

**TOTAL: 30 PERIODS**

**COURSE OUTCOME(S):**

On successful completion of the course, students will be able to:

**CO1** Understanding the fundamental programming elements of Java and learn to apply basic control structures in Java.

**CO2** Apply scoping rules and demonstrate an understanding of parameter passing in Java

**CO3** Analyze and create effective flow control statements in Java

**CO4** Evaluate the usage of arrays, var-args, and enums in Java, based on program requirements and design considerations.

**CO5** Develop Java programs to implement object-oriented design principles.

**CO6** Apply exception handling techniques in Java, including the creation of user-defined exceptions.

**TEXT BOOKS:**


1. Herbert Schildt, “Java The complete reference”, 12th Edition, McGraw Hill Education, 2022.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 11th Edition, Prentice Hall, 2020.


**REFERENCE BOOKS:**


1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.


**WEB REFERENCES**

1. https://www.javatpoint.com/java-tutorial
2. https://www.tutorialspoint.com/java/index.htm