# MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102


## SCHOOL OF COMPUTING

# Master of Computer Applications (M.C.A) with Specialization in Full Stack Development

## CURRICULUM AND SYLLABUS

*(For 2022-23 Admitted Students)*

**FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)**

# MOHAN BABU UNIVERSITY

## Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

## Mission

- Develop industry-focused professionals with a global perspective.
- Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.
- Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.
- Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

## SCHOOL OF COMPUTING

## Vision

To lead the advancement of computer science research and education that has real-world impact and to push the frontiers of innovation in the field.

## Mission

- Instil within our students fundamental computing knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community.
- Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential.
- Impart continued education and research support to working professionals in the computing domain to enhance their expertise in the cutting-edge technologies.
- Inculcate among the computing engineers of tomorrow with a spirit to solve societal challenges.

## DEPARTMENT OF COMPUTER APPLICATIONS

# Vision

To become a center of excellence in the field of computer science and applications.

# Mission

- Imparting knowledge and skills through contemporary curriculum to the diverse group of students.
- Creating a talent pool of faculty in diverse domains of computer applications through continuous training.
- Domain and transferable skill development for the holistic personality of students to inculcate values and ethics for effective professional practice and as an entrepreneur.

# MASTER OF COMPUTER APPLICATIONS (MCA)

## PROGRAM EDUCATIONAL OBJECTIVES

*After few years of completion of the Program, the graduates of MCA with Specialization in Full Stack Development will be able to:*

**PEO1.** Pursue higher education in the core and allied areas of computer science by applying computing knowledge and domain-specific knowledge, demonstrating their innovative skills, and considering social and environmental concerns.

**PEO2.** Become professionals in industry and academia with ability to investigate, and solve complex computing problems using modern tools in evolving technologies in the core and allied areas of computer science.

**PEO3.** Become successful entrepreneurs to excel in diverse application skills in the core or allied area of computer science of societal importance.

**PEO4.** Exhibit professionalism, and uplifting health, safety, legal, environmental, ethical, and cultural diversity issues for serving the society and communicating with local, and national peers, bound within regulations and leading to lifelong learning.

## PROGRAM OUTCOMES

*On successful completion of the Program, the graduates of M.C.A Program with Specialization in Full Stack Development will be able to:*

**PO1.** **Computational Knowledge**: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

**PO2.** **Problem Analysis**: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

**PO3.** **Design / Development of Solutions**: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

**PO4.** **Conduct Investigations of Complex Computing Problems**: Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5.** **Modern Tool Usage**: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

**PO6.** **Professional Ethics**: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

**PO7.** **Life-long Learning**: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

**PO8.** **Project management and finance**: Demonstrate knowledge and understanding of the computing 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.

**PO9.** **Communication Efficacy**: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

**PO10.** **Societal and Environmental Concern**: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

**PO11.** **Individual and Team Work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

**PO12.** **Innovation and Entrepreneurship**: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

## PROGRAM SPECIFIC OUTCOMES

*On successful completion of the Program, the graduates of M.C.A Program with Specialization in Full Stack Development will be able to:*

**PSO1:** Design, implement and test applications for complex computing problems for desired specifications using programming skills.

**PSO2:** Analyze and adapt managerial and domain skills of Information Management to model an application's data requirements to extract information for interpreting the datasets for Decision Making.

**PSO3:** Apply suitable techniques and algorithms to integrate Operating System Services, Network devices, Security mechanisms and Infrastructure to meet the requirements for the deployment of an application and to communicate on networks.

**PSO4:** Design and develop websites and Platforms by applying skills of Full Stack Technologies

## MASTER OF COMPUTER APPLICATIONS (MCA) with Specialization in Full Stack Development

### Basket Wise - Credit Distribution

| S. No. | Basket | Credits (Min.- Max.) |
|---|---|---|
| 1 | SCHOOL CORE | 30-36 |
| 2 | PROGRAM CORE | 24-30 |
| 3 | PROGRAM ELECTIVE | 12-16 |
| 4 | SPECIALIZATION ELECTIVE | 18-24 |
| 5 | UNIVERSITY ELECTIVE | 6-9 |
| | **TOTAL CREDITS** | **Min. 90** |

# School Core (30-36 Credits)

| Course Code | Title of the Course | Lecture | Tutorial | Practical | Project Based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|
| | | L | T | P | S | C | |
| 22CA201001 | Computational Statistics | 3 | - | - | - | 3 | - |
| 22MM201404 | Mathematical Foundations for Computer Applications | 3 | - | - | - | 3 | - |
| 22CA201002 | Computer Organization and Architecture | 3 | - | - | - | 3 | - |
| 22CA202001 | Operating Systems | 2 | - | 2 | - | 3 | - |
| 22CA202002 | Python Programming | 3 | - | 2 | - | 4 | - |
| 22CA211001 | Internship | - | - | - | - | 2 | - |
| 22CA209001 | Project Work | - | - | - | - | 10 | - |
| **Language Basket (Min. 2 Credits to be earned)** | | | | | | | |
| 22LG205602 | Communicative English | - | 1 | 2 | - | 2 | - |
| 22LG101403 | German Language | 2 | - | - | - | 2 | - |
| 22LG101404 | French Language | 2 | - | - | - | 2 | - |
| **Management Basket (Min. 3 Credits to be earned)** | | | | | | | |
| 22CM201401 | Financial and Management Accounting | 3 | - | - | - | 3 | - |
| 22ME101703 | Management Science | 3 | - | - | - | 3 | - |
| 22CM201402 | Principles of Business Management | 3 | - | - | - | 3 | - |
| 22CM201403 | Personality and Career Management | 3 | - | - | - | 3 | - |
| **Mandatory Courses (Min. 4 Credits to be earned. Earned Credits will not be considered for CGPA)** | | | | | | | |
| 22CE107601 | Environmental Science* | 2 | - | - | - | 2 | - |
| 22LG207601 | Technical Report Writing | 2 | - | - | - | 2 | - |
| 22CM207601 | Essentials of Leadership | 2 | - | - | - | 2 | - |

# Program Core (24 – 30 Credits)

| Course Code | Title of the Course | Lecture | Tutorial | Practical | Project Based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|
| | | L | T | P | S | C | |
| 22CA202003 | Database Management Systems | 3 | - | 2 | - | 4 | - |
| 22CA202004 | Data Mining | 3 | - | 2 | - | 4 | Database Management Systems |
| 22CA202005 | Computer Networks | 3 | - | 2 | - | 4 | - |
| 22CA202006 | Data Structures and Algorithms | 3 | - | 2 | - | 4 | - |
| 22CA204001 | Object Oriented Programming through JAVA | 3 | - | 2 | 4 | 5 | Python Programming |
| 22CA204002 | Web Technologies | 3 | - | 2 | 4 | 5 | - |
| 22CA201003 | Software Engineering | 3 | - | - | - | 3 | - |
| 22CA202007 | Cloud Computing | 3 | - | 2 | - | 4 | - |

## Program Elective (12- 16 Credits)

| Course Code | Knowledge Area | Title of the Course | Lecture | Tutorial | Practical | Project based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | S | C | |
| 22CA202008 | Information Management | Data Analytics | 3 | - | 2 | - | 4 | Data Mining |
| 22CA201004 | | Information Retrieval Systems | 3 | - | - | - | 3 | Data Mining |
| 22CA201005 | | Data Science and Statistical Modeling | 3 | - | - | - | 3 | Data Mining |
| 22CA201010 | Networks | Internet of Things | 3 | - | - | - | 3 | - |
| 22CA201006 | | Mobile Computing | 3 | - | - | - | 3 | Computer Networks |
| 22CA202009 | Infrastructure Management Services | Database Management Administration | 3 | - | 2 | - | 4 | Computer Networks |
| 22CA202010 | Programming Languages | Programming in C# and .Net Framework | 3 | - | 2 | - | 4 | Object Oriented Programming through JAVA |
| 22CA202011 | | R Programming | 3 | - | 2 | - | 4 | Computational Statistics |
| 22CA202012 | | Programming with AngularJS | 3 | - | 2 | - | 4 | Object Oriented Programming through JAVA |
| 22CA202013 | | Programming in Ruby | 3 | - | 2 | - | 4 | Object Oriented Programming through JAVA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 22CA201007 | | Theory of Computation | 3 | - | - | - | 3 | - |
| 22CA202014 | | LINUX Programming | 3 | - | 2 | - | 4 | Operating Systems |
| 22CA202015 | | Natural Language Processing | 3 | - | 2 | - | 4 | Computational Statistics/ Python Programming |
| 22CA202016 | Graphics | Computer Graphics and Multimedia | 3 | - | 2 | - | 4 | - |
| 22CA202021 | Cloud Computing | Cloud Practitioner | 3 | - | 2 | - | 4 | Cloud Computing |
| 22CA202017 | | Cloud Architecture and Design | 3 | - | 2 | - | 4 | Cloud Computing |
| 22CA202018 | | Cloud Architect | 3 | - | 2 | - | 4 | Cloud Computing |
| 22CA201008 | Information Security | Cryptography and Network Security | 3 | - | | - | 3 | Computer Networks |
| 22CA201009 | | Cyber Security | 3 | - | | - | 3 | Computer Networks |
| 22CA201011 | | Ethical Hacking | 3 | - | | - | 3 | Computer Networks |
| 22CA201012 | Software Engineering | Software Project Management | 3 | - | | - | 3 | Software Engineering |
| 22CA201013 | | Software Architecture and Design Patterns | 3 | - | | - | 3 | Software Engineering |
| 22CA202019 | | Software Testing and Quality Assurance | 3 | - | 2 | - | 4 | Software Engineering |
| 22CA201014 | | Optimization Techniques | 3 | - | | - | 3 | Computational Statistics |
| 22CA203001 | | Object Oriented Modeling and Design | 3 | - | - | 4 | 4 | Software Engineering |
| 22CA202020 | Platform Based Development | Mobile Application Development | 3 | - | 2 | - | 4 | Object Oriented Programming through JAVA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 22CA201015 | | User Experience/Interface Design (UX/UI) | 3 | - | - | - | 3 | - |
| 22CA201016 | | Blockchain Technologies | 3 | - | | - | 3 | Computer Networks |
| 22CA202022 | | DevOps Application Development | 3 | - | 2 | - | 4 | Cloud Computing |
| 22CA201017 | | Realtime Operating System | 3 | - | - | - | 3 | Object Oriented Programming through JAVA |

# Specialization Elective (18 - 24 Credits)

## (i) Full Stack Development

| Course Code | Title of the Course | Lecture | Tutorial | Practical | Project based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|
| | | L | T | P | S | C | |
| 22CA201029 | Full Stack Web Development | 3 | - | - | - | 3 | - |
| 22CA202029 | MERN Stack Development | 3 | - | 2 | - | 4 | - |
| 22CA202023 | Go Java Full Stack with Spring Boot and React | 3 | - | 2 | - | 4 | Full Stack Web Development |
| 22CA202024 | Full Stack Cloud Developer | 3 | - | 2 | - | 4 | Full Stack Web Development |
| 22CA202025 | DevOps and Software Engineering | 3 | - | 2 | - | 4 | software engineering and cloud computing |
| 22CA202026 | Responsive Website Development and Design | 3 | - | 2 | - | 4 | Full Stack Web Development |
| 22CA204003 | Modern Application Development with Node.js on AWS | 2 | - | 2 | 4 | 4 | Cloud Computing |
| 22CA202027 | Extreme Web Development | 3 | - | 2 | - | 4 | Web Technologies |
| 22CA202028 | Enterprise App and API Development with AngularJS and Sails | 3 | - | 2 | - | 4 | Full Stack Web Development |

## (ii) Artificial Intelligence and Machine Learning

| Course Code | Title of the Course | Lecture | Tutorial | Practical | Project based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|
| | | L | T | P | S | C | |
| 22CA202030 | Machine Learning | 3 | - | 2 | - | 4 | Data mining /Python Programming |
| 22CA202031 | Data Handling and Visualization | 3 | - | 2 | - | 4 | Data Analytics |
| 22CA201018 | Deep Learning | 3 | - | - | - | 3 | Machine Learning |
| 22CA201019 | Reinforcement Learning | 3 | - | - | - | 3 | Machine Learning |
| 22CA201020 | Predictive Analytics | 3 | - | - | - | 3 | Data mining /Python Programming |
| 22CA201021 | Artificial Intelligence | 3 | - | - | - | 3 | Computational Statistics |
| 22CA202032 | AI for Health Care | 3 | - | 2 | - | 4 | Artificial Intelligence |
| 22CA201022 | Digital Image Processing | 3 | - | - | - | 3 | Machine Learning |

**Note:**

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under SPECIALIZATION ELECTIVE.

2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

# University Elective (6-9 Credits)

| Course Code | Title of the Course | Lecture | Tutorial | Practical | Project based Learning | Credits | Pre-requisite |
|---|---|---|---|---|---|---|---|
| | | L | T | P | S | C | |
| 22AI201701 | Business Analytics | 3 | - | - | - | 3 | - |
| 22EC101701 | AI in Healthcare | 3 | - | - | - | 3 | |
| 22CB101701 | Cyber Laws and Security | 3 | - | - | - | 3 | |
| 22MG101701 | Entrepreneurship for Micro, Small and Medium Enterprises | 3 | - | - | - | 3 | |
| 22CB101703 | Forensic Science | 3 | - | - | - | 3 | |
| 22SS101702 | Gender and Environment | 3 | - | - | - | 3 | |
| 22ME101704 | Managing Innovation and Entrepreneurship | 3 | - | - | - | 3 | |
| 22LG201701 | Personality Development | 3 | - | - | - | 3 | |
| 22SS101706 | Women Empowerment | 3 | - | - | - | 3 | |

**Note:**

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.
2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201001** | **COMPUTATIONAL STATISTICS** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course covers measures of Central Tendency, measures of Dispersion and basics of 'R' language. Fitting the Probability distributions of Discrete Probability Distributions, Continuous Probability Distributions and implementing the probability distributions in R. Correlation and Regression Analysis is done and able to calculate Correlation and Regression Coefficients along with fitting lines of Regression in R tool. Testing of hypothesis can be done for Large sample Tests and Small sample tests.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate the concepts of descriptive statistics, basics in R, Probability Distributions, Testing of Hypothesis, Correlation and Regression.

**CO2.** Apply testing of hypothesis on small and large sample testing using Z-test, t-test, F-test and chi-square test and to draw the valid inferences and solve the problems on probability distributions.

**CO3.** Use R programming tools to Simulate Binomial, Poisson and Normal distributions, and calculate Correlation and Regression Coefficients, Fitting lines of Regression.

**CO4.** Analyze the relationship between variables using Correlation and Regression.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | - | - |
| CO2 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **2.5** | **3** | **3** | **-** | **-** | **-** | - | **-** | **-** | **-** | **3** | **-** | **-** | **-** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

### COURSE CONTENT

**Module 1: INTRODUCTION TO DESCRIPTIVE STATISTICS (10 Periods)**

**Measures of Central Tendency:** The Arithmetic Mean, The Arithmetic Mean Computed from Grouped data, Median, Mode, Empirical Relation Between the Mean, Median, and Mode, Geometric Mean, Harmonic Mean.

**Measures of Dispersion:** The Range, The Mean Deviation, The Semi- Interquartile Range, The Standard Deviation, The Variance, coefficient of variation and Moments, measures of Skewness and Kurtosis.

**Module 2: BASICS IN R (09 Periods)**

Basic concepts of R, R Studio, run R, Variables, Data Types, Vectors, Data Frames, Lists, Matrices, Arrays, Classes, Functions, and diagrammatical presentations in R.

**Module 3: PROBABILITY DISTRIBUTIONS (09 Periods)**

**Discrete Probability Distributions:** Binomial Distribution- Mean and variance and fitting of Binomial distribution; Poisson distribution -Mean and variance and fitting of Poisson distribution.

**Continuous Probability Distributions:** Normal Distribution- Mean, variance and area properties of Normal distribution.

**Implementing in R: Simulate Binomial, Poisson and Normal distributions**

**Module 4: CORRELATION AND REGRESSION ANALYSIS (08 Periods)**

**Correlation Analysis:** Linear Correlation, scatter diagram, Karl Pearson's coefficient of Correlation and Spearman's Rank correlation coefficient (with and without tied ranks).

**Regression Analysis:** Regression Lines, Fitting of two lines of Regression, Regression coefficients and multiple regression.

**Implementing in R: Calculate Correlation and Regression Coefficients and Fitting lines of Regression**.

**Module 5: TESTING OF HYPOTHESIS (09 Periods)**

**Large sample Tests:** Null hypothesis and Alternative hypothesis, Type-I and Type-II errors, Level of significance, Critical Region, one tailed and two tailed tests; Test of Significance of single proportion, Difference of two Proportions, Single mean, Difference of two Means.

**Small sample tests:** t-test: Single mean, Difference of two Means; F-test; chi-square test**:** chi-square test for independence of attributes, chi-square test for goodness of fit.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

**I.** For **Covid 19 scenario,** do the following using R Programming tool:

Globally, the number of new weekly cases has continued to decline since the peak in January 2022. During the week of 30 May to 5 June 2022, over three million cases were reported, a 12% decrease as compared to the previous week. The number of new weekly deaths also continues to decline, with over 7,600 fatalities reported, representing a 22% decrease as compared to the previous week. As of 5 June 2022, over 529 million confirmed cases and over six million deaths have been reported globally.

**a. Requirement gathering**

i. Identify the variables and methods
ii. Draw Histogram for statistical analysis
iii. Write use cases for Patient information & Recovery percentage

**b. Analysis**

i. Fit the Linear Regression model for the system
ii. Draw Mathematical relationship to find the Patient information
iii. Identify the Patient current condition and to provide right Medication

**C. Design**

i. Design Data Visualization for "patient entry "and conditions
ii. Draw R-Chart based on the Statistical analysis.

**d. Evaluate quality of design**

Given R-Chart, diagrammatic Representation of Histogram, evaluation of mathematical relationships will provide the patient recovery percentage in Visualization

**II.** **Do a MOOC on** Computational Statistics: https://www.my-mooc.com/en/categorie/statistics-and-probability

## RESOURCES

**TEXT BOOKS:**


1. T. K. V. Iyengar, B. Krishna Gandhi etal., "*Probability and Statistics*," S. Chand and Company ltd: New Delhi, 3rd Edition, 2011.
2. Allerhand M. "*Tiny Handbook of R,*" Springer Briefs in Statistics, 2011.


**REFERENCE BOOKS:**


1. Shanaz Bhatul, "*Probability and Statistics"*, RIDGE Publications, 2nd Edition, 2006.
2. S.C. Gupta and V.K. Kapoor, "*Fundamentals of Applied Statistics,"* S.Chand and Sons, New Delhi, 2010.
3. Baayen R. "*Analyzing Linguistic Data - A Practical Introduction to Statistics using R,*" 2008.
4. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, "*Beginner's Guide to R,*" Springer, 2009.


**SOFTWARE/TOOLS:**

1. R Programming
2. R studio

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=GuTd8Yb2jUk
2. https://www.youtube.com/watch?v= V8eKsto3Ug

**WEB RESOURCES:**

1. http://www.nptelvideos.in/2012/11/probability-and-statistics.html.
2. https://www.classcentral.com/course/swayam-probability-and-statistics-5228.
3. https://www.coursera.org/browse/data-science/probability-and-statistics.

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22MM201404** | **MATHEMATICAL FOUNDATIONS FOR COMPUTER APPLICATIONS** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course addresses the challenges of the relevance of Boolean, Lattice and algebraic systems to computer science and their corresponding systems. To apply number theory, graph theory and their related concepts and algorithm to develop security levels and intelligent systems.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Apply mathematical logic and predicate calculus to validate precise statements

**CO2.** Analyze the basic structures of lattice and Boolean algebra.

**CO3.** Demonstrate the importance of algebraic properties with regard to working within various number systems.

**CO4.** Formulate recurring Problems and solve their recurrence relations.

**CO5.** Apply the concepts of graph theory and trees to implement computer algorithms.

### CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PS04 |
| **CO1** | 3 | 3 | | 1 | | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 2 | | 2 | | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | | 2 | | | | | | | | | | | | - |
| **Course Correlation Mapping** | **3** | **3** | | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: MATHEMATICAL REASONING** ***(07 Periods)***

Concepts of mathematical logic, Normal Forms, The Predicate Calculus, Rule of Inference, Consistency, Proof of Contradiction, quantifiers.

**Module 2: LATTICES AND BOOLEAN ALGEBRA** ***(09 Periods)***

**Lattices:** Partially Ordered Relations, Hasse Diagram, Lattices as Posets, Properties of Lattices

**Boolean Algebra:** Basic Definitions, Truth Tables, Boolean Functions, Representation and Minimization of Boolean Functions, Karnaugh Map.

**Module 3: ALGEBRAIC STRUCTURES AND NUMBER THEORY** ***(11 Periods)***

**Algebraic Structures:** Binary Operations and Algebraic Structures Groups, Subgroups, Lagrange's Theorem.

**Number Theory:** Division Algorithm, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Euler Totient Function, Modular Arithmetic (Fermat's Theorem and Euler's Theorem (without proof)

**Module 4: RECURRENCE RELATIONS** ***(09 Periods)***

Generating Functions of Sequences, Calculating coefficients of generating function, Homogeneous Recurrence relation, solving recurrence relations by substitution and Generating functions, Methods of Characteristic Roots.

**Module 5: GRAPH THEORY AND ITS APPLICATIONS** ***(09 Periods)***

**Graphs:** Representation of Graphs and Graph Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Planar Graphs, Euler's Formula and Graph Coloring.

**Trees:** Introduction to Trees, Properties of Trees, Applications of Trees, Spanning Trees, Counting trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

***Total Periods: 45***

## EXPERIENCE LEARNING:

**1.** To understand the application of Boolean algebra in designing and simplifying circuits. Students will be divided into groups and given a set of logic gate ICs (Integrated Circuits) including AND, OR, NOT, NAND, NOR, XOR, XNOR, along with breadboards, power supplies, LEDs, and connecting wires. Each group will be tasked with designing a circuit that performs a specific function provided to them, such as creating a particular light sequence or simulating a simple arithmetic operation (e.g., addition or subtraction).

2. To apply graph theory concepts to analyze and solve problems in network design and optimization. (Students will use a software tool (such as Gephi, NetworkX in Python, or any graph theory toolkit that is accessible) to model and analyze a network. This could be a social network (e.g., friendships, collaborations), a transportation network (e.g., roads, flights), or a data communication network (e.g., routing, data packets))

## RESOURCES

### TEXT BOOKS:


1. Kenneth H. Rosen, "*Discrete Mathematics and its Applications,"*Tata McGraw Hill, 8th Edition, 2019.
2. Jon Pierre Fortney, "*Discrete Mathematics for Computer Science*," CRC Press, Taylor &Francis Group, 1st Edition, 2021.


### REFERENCE BOOKS:


1. Richard Johsonbaugh, *"Discrete Mathematics,"* Prentice Hall,8th Edition, 2019.
2. NarasingDeo, "*Graph Theory with application to Engineering and Computer Science*," Prentice Hall India 2016.
3. J.P. Trembly and R. Manohar, "*Discrete Mathematical Structures with Applications to Computer Science,"* Tata McGraw Hill, 37th Edition, 2017


### VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/106106094

### WEB RESOURCES:

1. https://www.coursera.org/learn/discrete-mathematics
2. https://people.cs.pitt.edu/~milos/courses/cs441/
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201002** | **COMPUTER ORGANIZATION AND ARCHITECTURE** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on computer organization, architecture and interconnection structures of a digital computer.

**CO2.** Analyze Arithmetic Operations, Addressing Modes, Instruction Formats, Processor and Register organization.

**CO3.** Design digital circuits for the given functional description of microoperations and memory elements.

**CO4.** Investigate the performance of Input/Output Systems, Memory systems, parallel processors, Multicore architectures to evaluate the cost-performance trade-offs.

**CO5.** Demonstrate on Parallel Processing and Multicore Computers.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **Course Correlation Mapping** | **3** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | - | - | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION TO COMPUTER SYSTEM (08 Periods)**

Organization and architecture, Structure and function, IAS computer structure, Computer function, Interconnection structures, Bus interconnection.

**Module 2: CENTRAL PROCESSING UNIT (09 Periods)**

Arithmetic logic unit, Integer multiplication- Booth's algorithm; Floating point representation principles, Machine instruction characteristics, Addressing modes, Instruction formats – Instruction length, Allocation of bits; Processor organization, Register organization – User visible registers, Control and status registers; Instruction cycle.

**Module 3: CONTROL UNIT AND INPUT/OUTPUT (10 Periods)**

**Control Unit:** Micro operations, Control of the processor – Functional requirements, Control signals, Internal processor organization; Hardwired implementation, Microinstructions, Microprogrammed control unit, Micro instruction sequencing – Design considerations, sequencing techniques, Address generation; Micro instruction execution- A taxonomy of microinstructions, Microinstruction encoding.

**Input/Output:** External devices, I/O modules, Direct memory access function, I/O Channels and Processors, PCI Physical and Logical Architecture.

**Module 4: MEMORY SYSTEMS (09 Periods)**

**Semiconductor Memories:** Computer Memory System overview, Semiconductor Main Memory- Organization, DRAM and SRAM, Types of ROM, Chip logic, Chip packaging, Module organization, Interleaved memory; DDR DRAM, Flash Memory, Newer Nonvolatile Solid-State Memory Technologies.

**Cache Memory**: Cache Memory Principles, Elements of Cache Design-Cache Addresses, Mapping Functions.

**External Memory**: Solid State Drives.

**Module 5: PARALLEL ORGANIZATION (09 Periods)**

**Parallel Processing:** Multiple Processor Organizations, Instruction Pipelining, Symmetric Multiprocessors, Nonuniform Memory Access, Multicore Organization.

**Multicore Computers:** Hardware performance issues, Software performance issues, Multicore organization, Intel Core i7-990X.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Write a report on Product Specifications such as CPU, Memory, Processor Graphics and advanced technologies of Intel Core i9-12900K -New performance hybrid architecture. The World's Best Gaming Processor: Available with up to 16 cores and 24 threads, the new 12th Gen Intel Core processor family includes the world's best gaming processor, the Core i9-12900K, unleashing gaming experiences across top titles. (https://ark.intel.com/content/www/us/en/ark/products/134599/intel-core-i912900k-processor-30m-cache-up-to-5-20-ghz.html)

2. Write a report on OpenCL (Open Computing Language) framework used for writing programs that execute across heterogeneous platforms consisting of central processing units, graphics processing units, digital signal processors, field-programmable gate arrays and other processors or hardware accelerators.

   (https://www.khronos.org/api/opencl)

## RESOURCES

### TEXT BOOKS:


1. William Stallings, Computer Organization and Architecture: Design for performance, Pearson, 11th Edition, 2020.


### REFERENCE BOOKS:


1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw

   Hill Education, 2013.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design - A Hardware software interface, 5th Edition, Morgan Kaufmann, 2014.


### VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
4. https://freevideolectures.com/course/2277/computer-organization
5. https://www.youtube.com/watch?v=4TzMyXmzL8M

### WEB RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/last-minute-notes-computer-organization/
3. https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation-architecture
4. https://tutorialspoint.dev/computer-science/computer-organization-and-architecture/

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202001** | **OPERATING SYSTEMS** | 2 | - | 2 | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides theoretical and practical knowledge on process management, synchronization, handling deadlocks, memory management, storage, File system, I/O System. It also emphasizes the mechanisms for access control and security.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyze performance of CPU scheduling algorithms.

**CO2.** Design solutions for process synchronization problems by using semaphores and monitors.

**CO3.** Devise solutions for deadlocks using deadlock handling mechanism.

**CO4.** Solve memory management problems, file allocation using page replacement and disk scheduling algorithms.

**CO5.** Analyze services of I/O subsystems and mechanisms of security & protection

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | 3 | 3 | - | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| **Course Correlation Mapping** | **3** | **2.4** | **3** | **3** | **2** | - | - | - | - | **-** | - | - | - | - | 3 | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO OPERATING SYSTEM AND PROCESS MANAGEMENT (6 Periods)**

**Introduction:** Definition, Operating System Structure and Services, System Calls. **Process Management**: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

**Module 2: PROCESS SYNCHRONIZATION AND DEADLOCKS (6 Periods)**

**Process Synchronization**: Critical Section Problem, Peterson's Solution,

Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.

**Deadlocks**: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

**Module 3 MEMORY MANAGEMENT AND SECONDARY STORAGE (6 Periods)**

**Memory Management**: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging

**Virtual Memory:** Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.

**Secondary Storage Structure**: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management.

**Module 4 FILE AND I/O SYSTEMS (06 Periods)**

**File System**: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.

**I/O System**: I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

**Module 5 PROTECTION AND SECURITY (06 Periods)**

**Protection:** Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.

**Security:** Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

**Total Periods: 30**

## EXPERIENTIAL LEARNING

**LIST OF EXERCISES:**

1. a. Write a program to implement Process System Calls.

b. Write a program to implement I/O System Calls.

2. Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
   FCFS b) SJF c) Round Robin d) Priority
3. Write a program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue
4. Write a program to simulate producer-consumer problem using semaphores
5. Design Banker's Algorithm for Deadlock Avoidance. Find the safe sequence. If Maximum request of any one process is changed, detect whether a deadlock has occurred or not. Consider the number of resources are three and Jobs are five.
6. Write a program to simulate the MVT and MFT memory managementtechniques
7. Write a program to simulate the following contiguous memory allocation techniques
   Worst-fit b) Best-fit c) First-fit
8. Implement the following Page Replacement Algorithms
   a) FIFO b) LFU c) LRU d) Optimal
9. Write a program to simulate disk scheduling algorithms
   a) FCFS b) SSTF c) SCAN d) CSCAN
10. Write a program to simulate the following file allocation strategies.
    a) Sequential b) Indexed c) Linked

## RESOURCES

### TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley India Edition, 10th Edition, 2018.

### REFERENCE BOOKS:

1. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Edition, 2013.
2. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd Edition, 2009.

### SOFTWARE/TOOLS:

1. Software: Dev C++

### VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs44/preview
2. https://www.edx.org/learn/operating-systems
3. https://www.cse.iitb.ac.in/~mythili/virtcc/
4. https://www.youtube.com/channel/UCCsCO5D7PHqAqVLFM5aKAHA

**WEB RESOURCES:**

1. http://www.sncwgs.ac.in/wp-content/uploads/2015/11/operating_system_tutorial.pdf
2. https://www.tutorialspoint.com/operating_system/index.html

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202002** | **PYTHON PROGRAMMING** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Basics of Python programming, Control structures, Sequences, Sets, Dictionaries, Regular expressions, Functions, File handling, Object-oriented programming, Exception handling.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.

**CO2.** Apply the concepts of regular expressions for searching patterns in strings.

**CO3.** Develop and use Python modules to provide solutions to problems.

**CO4.** Apply the knowledge of file operations in Python for file processing.

**CO5.** Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PS04 |
| **CO1** | 3 | 2 | - | - | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 3 | 2 | - | - | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO4** | 3 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO5** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

### COURSE CONTENT

**Module 1: INTRODUCTION TO PYTHON PROGRAMMING (07 Periods)**

Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input and output in

Python.

**Module 2: CONTROL STRUCTURES (08 Periods)**

**Selection Statements:** if statement, if-else statement, if-elif-else statement, nested-if statement.

**Iterative Statements:** while loop, for loop, break statement, continue statement, pass and else statements used with loops.

**Module 3 SEQUENCES, SETS, DICTIONARIES AND REGULAR EXPRESSIOI (11 Periods)**

**Sequences:** Lists and operations – Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists; Tuples – Creating, Searching and sorting, Nested tuples; Strings – Initializing a string and string operations, String handling methods, String formatting.

**Sets**: Set creation, Set operations.

**Dictionaries:** Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

**Regular Expressions:** Regular expressions, Sequence characters in regular expressions, Quantifiers in regular expressions, Special characters in regular expressions.

**Module 4 FUNCTIONS AND FILE HANDLING (09 Periods)**

**Functions:** Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.

**File Handling:** Types of files, Opening and closing files, Reading and writing data.

**Module 5 OBJECT ORIENTED PROGRAMMING AND EXCEPTION HANDLING (10 Periods)**

**Object Oriented Programming:** Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.

**Exception Handling:** Errors in a python program, Exceptions, Exception handling, Types of exceptions, Except block, Assert statement, User defined exceptions.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

**LIST OF EXERCISES:**

1) Design a python script to the perform the various computations for the amount payable by the customer for Challenger Computers Store. A customer buying two numbers of SSD device, one SSD device cost is Rs. 3575/-. The stores offer 15% of the total cost. The customer has to pay 9% CGST, and 9% SGST. Prepare the Net Amount to be payable by the customer.

2) Design a python script to compute and generate the electricity bill as per the following slab rates. Collect the meter reading inputs, such as current unit and previous unit.

| Consumption Units | Rate (in Rupees/Unit) |
|---|---|
| 0-200 | 3.0 |
| 201-250 | 4.5 |
| 251-300 | 5.2 |
| 301-400 | 6.5 |
| Above 400 | 7.0 |

3) Design a python script to display the sum of numbers divisible by 4. The code must allow the user to accept a number and add it to the sum if it is divisible by 4. It should repeatedly accepting numbers as long as the user wants to provide an input using an appropriate iterative statement and should display the final sum.

4) Food Corner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo. Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:

| Distance in kms | Delivery charge in Rs per km |
|---|---|
| For first 3kms | 0 |
| For next 3kms | 3 |
| For the remaining | 6 |

Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer.

- Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.
- Distance in kms must be greater than 0.
- Quantity ordered should be minimum 1.
- If any of the input is invalid, bill amount should be considered as -1.

5) a) A list has the AP City Names [Tirupati, Kurnool, Kadapa]. Design a python script and perform the operations like, add 3 more AP City names Chittoor, Nellore, Guntur, insert Hyderabad in 3rd position, delete any two city names, update all city names as in Uppercase. Displays the list data, whenever an operation completes.

b) Design a python script for given an integer tuple, for each element in the tuple, check whether there exists a smaller element on the next immediate position of the tuple. If it exists print the smaller element. If there is no smaller element on the immediate next to the element then print -1.
Example: Input: 4 2 1 5 3 Output: 2 1 -1 3 -1

6) a) Sets n1 has the data {1, 3, 5, 7, 9}, n2 has the data {9, 5, 6, 8},
wd1=set(["Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"]),

wd2=set(["Mon", "Tue", "Wed"]).

Design a python script to perform intersection, difference, and symmetric

difference operations on the sets n1 and n2, and to perform superset, and subset operations on the sets wd1, and wd2.

b) The dictionary city_pin has the data {'Tirupati': 517101, 'Hyderabad': 500002, 'Chittoor': 517001,'Nellore': 524001}. Design a python script using lambda function to sort the dictionary on city name and produce the output and sort the dictionary on pincode and produce the output.

c) The string has the data, Wel_str = "Welcome to AI ML DS". Design a python script to search the pattern "AI" using regular expression search and display the three location numbers of the pattern. First shows the pattern starts location, second shows the pattern end location, and the last shows pattern span locations.

7) a) Design a python script for the mathematical puzzle, Towers of Hanoi. The puzzle has three rods and n disks. To move the entire stack to another rod, obeying the three rules (i) Only one disk can be moved at a time, (ii) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e., a disk can only be moved if it is the uppermost disk on a stack, (iii) No disk may be placed on top of a smaller disk.

b) Design a python script to display the numbers that do not appear in the Fibonacci series of n numbers where n is given by the user. (If n is 8 then up to 8 Fibonacci numbers has to be printed Ex: 1 1 2 3 5 8 13 21 and in this series missing numbers should be traced and printed, Ex: missing numbers are: 4 6 7 9 10 11 12 14 15 16 17 18 19.

8) a) Design a function Learner_Age_Days with two formal parameters name, age and it computes Learner's age in days, then displays learners name and age in days.

(i) Design a driver code to call the function using positional arguments, keyword arguments

(ii) Apply the necessary changes in Learner_Age_Days function, and design a driver code to call the function using default arguments.

b) Design a python script using lambda and filter functions to construct an odd numbers list from numbers 1 to 10, and construct a negative numbers list from range of numbers -7 to 7 and to find the biggest number from a numbers list.

9) a) Design a python script to create a new file Collect_Literals_Phython.txt, collect the data from the keyboard about the contents of collection literals list, tuple, sets, dictionaries details, then write all the data into that file, and then close that file. Afterwards Open the Collect_Literals_Phython.txt file in read mode, read the entire contents of the file Collect_Literals_Phython.txt, then display all the contents of that file in monitor.

b) The file feat_python1.txt has the contents of features of the Python programming language. Design a python script to open that file feat_python1.txt in read mode, open the new file in feat_python2.txt in write mode, then read entire contents of the file feat_python1.txt, then copy all the contents of that file into the new file feat_python2.txt

10) a) Construct a Python script to implement the below requirements. Create a base class Basic_Info with data members name, rollno, gender and two member functions getdata() and display(). Derive a class Physical_Fit from Basic_Info which has data members height and weight and member functions getdata() and display(). Display all the information using object of derived class.

b) Design a Python script to implement the below specifications, compute, and produce required output. Define a class REPORT with the following specification

**Private members**

| | | |
|---|---|---|
| Admno | : | 4-digit admission number |
| Name | : | 20 characters |
| Marks | : | A list of 5 floating point values |
| Average | : | average marks obtained |

GETAVG() a function to compute the average obtained in five subjects.

**Public members**

READINFO() function to accept values for Adno, Name, Marks. Invoke the function GETAVG ().

DISPLAYINFO() function to display all data members of report on the screen. You should give function definitions. Write driver code to demonstrate all the functions.

11) a) The below scenarios will create Logical Error/Exception, and it will forcibly stop the execution in middle of the program. Design a Python Script the to handle these operations exceptions effectively, and avoid to stop the script execution in the middle.
   i. The variable num has the data 100, the value of num dividing by the value 0.
   ii. To importing a library file matheqn, this library file not available in Python.
   iii. A num_List has the values[10,20,30].To print the fifth value of num_List[5]
   iv. A dictionary has the data, Dict_Univ = {'1':"MBU", '2':"Tirupathi", '3':"CSE"}. to print the fifth key value Dict_Univ[5]

b) Design a python script to collect the 10 students Python course mark. Check that entered mark is negative, then throw a user defined exception called Negative, otherwise store into the mark in the List Python_mark[].

## RESOURCES

### TEXT BOOKS:


1. R. Nageswara Rao, *"Core Python Programming,"* 3rd Edition, Dreamtech Press, 2021.
2. Paul J. Deitel, Harvey Deitel, *"Python for Programmers with Big Data and Artificial Intelligence Case Studies,"* Pearson, 2019.


### REFERENCE BOOKS:


1. Charles Dierbach, *"Introduction to Computer Science using Python: A Computational Problem Solving Focus,"* Wiley India, 2016.
2. Christian Hil,*"Learning Scientific Programming with Python,"* 2nd Edition, Cambridge University Press, 2020.


### SOFTWARE/TOOLS:

1. Python 3.10
2. Jupyter Notebook/JupyterLab/IDLE/Google CoLab

**VIDEO LECTURES:**

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. https://www.coursera.org/specializations/python
3. https://www.coursera.org/learn/python-for-applied-data-science-ai
4. https://www.youtube.com/watch?v=WGJJIrtnfpk
5. https://www.youtube.com/watch?v=_uQrJ0TkZlc
6. https://www.udemy.com/topic/python/
7. https://freevideolectures.com/course/2512/python-programming

**WEB RESOURCES:**

1. https://www.w3schools.com/python/
2. https://www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.javatpoint.com/python-lists
5. https://www.learnpython.org/

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA211001** | **INTERNSHIP** | - | - | - | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1**. Analyze latest equipment, materials and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.

**CO2.** Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solving complex engineering problems.

**CO3.** Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

**CO-PO-PSO Mapping Table:**

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | - | 3 | 3 | - | - | 3 | - | - | - | 3 | - | - | - | - |
| **CO2** | - | 3 | - | - | - | 3 | 3 | - | - | - | 3 | - | - | - | - | - |
| **CO3** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **-** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **-** |

***Correlation Level: 3-High; 2-Medium; 1-Low***

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA209001 | CAPSTONE PROJECT | - | - | - | - | 8 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1**. Create/Design computer science engineering systems or processes to solve complex computer science engineering and allied problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

**CO2.** Consider society, health, safety, environment, sustainability, economics and project management in solving complex computer science engineering and allied problems.

**CO3.** Perform individually or in a team besides communicating effectively in written, oral and graphical forms on computer science engineering systems or processes.

**CO-PO-PSO Mapping Table:**

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | 3 | - | - | - | - |
| CO2 | - | - | - | - | - | 3 | 3 | - | - | - | 3 | - | - | - | - | - |
| CO3 | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **-** |

***Correlation Level: 3-High; 2-Medium; 1-Low***

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22LG205602** | **COMMUNICATIVE ENGLISH** | - | 1 | 2 | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** The course deals with gathering ideas and information to organize ideas relevantly and coherently, Engaging in debates, Participating in group discussions, Facing interviews, Writing technical reports, Making oral presentations, Writing formal letters, Transferring information from non-verbal to verbal texts and vice-versa, Taking part in social and professional communication.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Apply appropriate listening, speaking, reading, and writing skills by analyzing the context.

**CO2.** Demonstrate knowledge of Phonetics by applying sounds of English.

**CO3.** Analyze sentence structures by applying and demonstrating knowledge of Vocabulary and Grammar.

**CO4.** Function effectively as an individual and as a member of diverse teams applying speaking skills in Just A Minute, Role Plays, Presentations, and debates.

**CO5.** Apply appropriate writing skills in writing a letter, Email, and Resume by analyzing the context.

**CO-PO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | 2 | 2 | - | 2 | - | 2 | - | 3 | - | - | - |
| **CO2** | 3 | 2 | - | - | 2 | - | 2 | - | 3 | - | - | - |
| **CO3** | 2 | 3 | 2 | - | 2 | - | 2 | - | 3 | - | - | - |
| **CO4** | 2 | 2 | - | - | 2 | - | 2 | - | 3 | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | 2 | - | 2 | - | 3 | - | - | - |
| **Course Correlation Mapping** | **2** | **2** | **2** | **-** | **2** | **-** | **2** | **-** | **3** | **-** | **3** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

***Any ten modules are mandatory among the following:**

**Module 1 JUST A MINUTE, ELOCUTION/IMPROMPTU**

Steps to be followed, Useful tips Dos & Don'ts Preparation, Examples

**Module 2 PHONETICS**

Sounds of English, Consonants, Vowels, Speech Organs, Phonetic Transcription, Word Accent, Basics of Intonation

**Module 3 VOCABULARY BUILDING**

Prefixes & Suffixes, Synonyms & Antonyms, Phrasal verbs, Idioms,One-word substitutes, Words often confused

**Module 4 GRAMMAR**

Tenses, Nouns, Word order, and error correction

**Module 5 GIVING DIRECTIONS**

Useful phrases, Sample conversations, Exercises

**Module 6 ROLE PLAYS**

Useful tips, Dos & Don'ts, Exercises, Role Plays for practice

**Module 7 PUBLIC SPEAKING**

Stage presence, Voice control, Body Language, Rehearsals, Audience, Delivery - Dos & Don'ts, Project Submission

**Module 8 LETTER WRITING**

Introduction, Objective, Formats Types, Exercises

**Module 9 DESCRIBING OBJECTS**

Jargon Useful Phrases, Do's & Don'ts, Exercises

**Module 10 LISTENING COMPREHENSION**

Introduction, Types of listening, Practice, Benefits of listening, Exercises

**Module 11 INFORMATION TRANSFER**

Tables Pie Charts, Venn Diagrams, Graphs, Flow Charts, Steps to be followed, Exercises

**Module 12 READING COMPREHENSION**

Introduction, Types of reading, Inferring, Critical analysis, Exercises

## EXPERIENCE LEARNING:

**1. Activity:** Organize a "Just a Minute" session where students must speak on a given topic without hesitation, deviation, or repetition. Follow this with impromptu speeches where students draw random topics and speak for a short duration.

**2. Activity:** Phonetic Transcription Contest. Divide the class into small groups, and provide each group with a list of words to transcribe phonetically, then have them present their transcriptions for class review.

Reflection: Discuss the importance of accurate phonetic transcription in understanding pronunciation and the role of speech organs in producing different sounds.

**3. Activity**: Vocabulary Building Game Day. Utilize games like "Word Association," "Synonyms and Antonyms Relay," and "Phrasal Verb Match-up" to reinforce learning in a fun, interactive way.

## RESOURCES

### TEXT BOOKS:


1. D. Sudha Rani, *"A Manual for English Language Laboratories"*, Pearson, Noida, 2010.
2. Nira Kumar, "*English Language Laboratories*," PHI Learning Pvt. Ltd., New Delhi, 2011.


### REFERENCE BOOKS:


1. S.P. Dhanavel, "*English and Soft Skills"*, Orient Black Swan Private Limited, 2010.


### SOFTWARE/TOOLS:

1. K - VAN Solutions.
2. Learning to Speak English 8.1, The Learning Company – 4 CDs.
3. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
4. Language in Use 1, 2 & 3.
5. Cambridge Advanced Learner's Dictionary - 3rd Edition.
6. Let's Talk English, Regional Institute of English South India
7. Dorling Kindersley Series of Grammar.
8. Speech Solutions
9. Mastering English: Grammar, Punctuation, and Composition

### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=crzEJHrL4ZI
2. https://www.youtube.com/watch?v=vblbqhMkyaY

### WEB RESOURCES:

1. https://en.wikipedia.org/wiki/Practical_English_Usage.

## SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22LG101403** | **GERMAN LANGUAGE** | 2 | - | - | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Oral communication; Basic grammar; Basic writing; Berufsdeutcsch (Business German)

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate basic knowledge of the German language and verb conjugation.

**CO2.** Comprehend and apply the knowledge of vocabulary and phrases in day-to-day real-life conversation.

**CO3.** Apply the various sentence structures by examining the rules of grammar in speaking and writing.

**CO4.** Analyze the various verb structure of English and German languages effectively in professional writing

**CO5.** Apply the various verb structure of English and German languages effectively in professional writing

### CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO2** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO3** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO4** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO5** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **Course Correlation Mapping** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

### COURSE CONTENT

**Module 1: INTRODUCTION** ***(06 Periods)***

Introduction - German alphabet, numbers, days in a week, names of months, seasons. Grammar: Nouns –(i)Nominative case and (ii) Nominative personal pronouns, simple sentence, Verb Conjugation 1st and 2nd type, verb Conjugation 3rd type, 'Wh' questions (simple sentences) Nominative (definite and indefinite) Articles

**Module 2: CITY AND FOOD** ***(06 Periods)***

In the city: naming places and buildings, means of transport, basic directions. Food:

drink, groceries and meals. Apartments: rooms, furniture, colours.
Grammar: Nouns-articles negation–(kein and nicht); imperative and the accusative case; Nominative Possessive Pronouns.

**Module 3: DAY-TO-DAY CONVERSATIONS** ***(06 Periods)***

Everyday life, telling time, making appointments, leisure activities, and celebrations. Different types of professions, Health and the body, holidays and weather, Clothes and

**Module 4: BASIC GRAMMAR** ***(06 Periods)***

Grammar: Possessive articles, Prepositions (am, um, von. bis); Modal verbs, Separable verbs, accusative, past tense of 'to have' and 'to be', imperative sentences, dative case, perfect tense.

**Module 5: BASIC WRITING** ***(06 Periods)***

Translation from English to German and German to English, Contacts, Writing letters and Email Writing.

***Total Periods: 30***

## EXPERIENTIAL LEARNING

1. Prepare a report on the importance of the German language in India
2. Why is German taught in Indian schools?

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

**TEXTBOOKS:**

1. Stefanie Dengler, Paul Rusch, Helen Schmitz, Tana Sieber, *Netzwerk Deutsch als Fremdsprache, Arbeitsbuch A1*, Goyal Publishers and Distributors Pvt. Ltd. 2015.

**REFERENCE BOOKS:**

1. The Everything Learning German Book Speak, Write, and Understand Basic German in No Time By Edward Swick · 2011

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=o4GvYa-3BmY
2. https://www.youtube.com/watch?v=mrF9BizWmgk
3. https://www.youtube.com/watch?v=mojirClzQEs
4. https://www.youtube.com/watch?v=0osSyX0MmCM
5. https://www.youtube.com/watch?v=mMDOtG5ucHA

**WEB RESOURCES:**

1. https://learngerman.dw.com/en/beginners/c-36519789
2. https://storylearning.com/learn/german/german-tips/basic-german-phrases
3. https://study.com/academy/lesson/how-to-write-a-letter-in-german.html

# SCHOOL CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22LG101404** | **FRENCH LANGUAGE** | 2 | - | - | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Oral communication; Basic writing; Basic grammar

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate basic knowledge of the French language.

**CO2.** Comprehend and apply the knowledge of the alphabet in day-to-day real-life conversation.

**CO3.** Apply the various styles of greetings in speaking and writing.

**CO4.** Analyze the various conversations in French languages

**CO5.** Apply the French words for date and time.

## CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO2** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO3** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO4** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO5** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |
| **Course Correlation Mapping** | 3 | - | - | - | - | - | - | 2 | - | - | - | - |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION** ***(06Periods)***

Introduction – Introduction, History of the French Language, Extent of the French Language,
Reasons To Learn French, Book Organization, Learning French, Advice on Studying French

**Module 2: THE ALPHABET** ***(06 Periods)***

Letters, Punctuation, Acute Accent, Grave Accent, Tonic Accent, Stress

**Module 3: GREETINGS** ***(06 Periods)***

Greetings, Good-byes, Names, Vous vs. tu, Courtesy, Formal Speech Titles, Asking For One's Name

**Module 4: CONVERSATIONS & NUMBERS** ***(06 Periods)***

How are you?, Asking How One Is Doing,
Cardinal Numbers and Ordinal Numbers

**Module 5: THE DATE & TIME** ***(06 Periods)***

Numbers 01-31, Seasons, Days of the week, Months of the Year, Numbers 30-60, Times of Day, Asking for the time.

***Total Periods: 30***

## EXPERIENTIAL LEARNING

1. Prepare a report on the importance of the French language in India
2. Why is French taught in Indian schools?

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

**TEXTBOOKS:**

1. The current, editable version of this book is available in Wikibooks, the open-content textbooks collection, at http://en.wikibooks.org/wiki/French

**REFERENCE BOOKS:**

1. Practice Makes Perfect French Sentence Builder By Eliane Kurbegov · 2009.

**VIDEO LECTURES:**

1. https://www.bing.com/videos/riverview/relatedvideo?&q=video+lecture+on+THE+ALPHABET+in+french&qpvt=video+lecture+on+THE+ALPHABET+in+french&mid=D123409C16604E0FDE26D123409C16604E0FDE26&&FORM=VRDGAR
2. https://www.youtube.com/watch?v=hd0_GZHHWeE

**WEB RESOURCES:**

1. https://vdocument.in/french-lecture-notespdf.html?page=2

# SCHOOL CORE

**(Management Basket)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CM201401** | **FINANCIAL AND MANAGEMENT ACCOUNTING** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** The course is designed so that the students can understand the accounting process and preparation of accounting books with relevant interpretations. The course also provides students with knowledge of financial analysis and Capital Budgeting.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on concepts of financial accounting.

**CO2.** Analyze and prepare Financial Statements.

**CO3.** Demonstrate knowledge on financial analysis such as Ratio Analysis and Break-Even Analysis.

**CO4.** Apply Capital Budgeting techniques for decision making.

**CO-PO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Course Correlation Mapping** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: FINANCIAL ACCOUNTING** ***(08 Periods)***

Meaning and Definition - Objectives – Functions – Principles of accountancy: Concepts and Conventions - Double entry system of accounting - Types of accounts – Journal - Ledger and Trial Balance

**Module 2: PREPARATION OF FINANCIALSTATEMENTS** **(10 Periods)**

Trading account - Profit and Loss Account and Balance Sheet (with simple adjustments)– Computerized Accounting – Computerized accounting Vs. Manual Accounting - Advantages and Disadvantages –Tally ERP9.0.

**Module 3: RATIO ANALYSIS** **(09 Periods)**

Ratio Analysis – Advantages and disadvantages of Ratio Analysis –Types of Ratios – Profitability Ratios, Activity Ratios, Liquidity Ratios, Solvency Ratios (Simple Problems)

**Module 4: BREAK-EVEN-ANALYSIS** **(09 Periods)**

Break-Even-Analysis – Assumptions, Managerial significance of Break-Even-Analysis – Concept of Break Even Point (BEP) – Break-Even Chart –Determination of BEP – Profit/Volume (P/V) ratio – Margin of safety (Simple Problems).

**Module 5: CAPITAL BUDGETING** **(09 Periods)**

Features, Proposals, Methods of Capital Budgeting: Payback Period Method – Accounting Rate of Return (ARR) – Time value of money – Net Present Value Method (NPV) – Profitability Index (PI) – Internal Rate of Return (IRR) (Simple problems)

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. In rainy seasons a lot of snakes are found crawling around. Prepare a write-up on the reactions of people when they found snakes.
2. India is now for entrepreneurs and the government announced a lot of startup programmes for that. Prepare a presentation on recent entrepreneurs.
3. Small courtesies play a major role in creating an impression on other people. List out a few examples.
4. Prepare a PowerPoint presentation on the present scenario in higher education and jobs in India.
5. Being a shopkeeper and persuading a customer to buy a product which is introduced newly in the market. Prepare a conversation.
6. The English language has a rich vocabulary. List out the homophones and homonyms and write down the pronunciation and meaning of those words.
7. Describe a situation in your college where teamwork is needed and explain the strategies to manage the team effectively.

8. India is a country of unity in diversity. List out the existence of different racial and religious people and bring out reasons for the harmonious relationship among the people.
9. Forget and forgive are the most important quality of any human being. Prepare a write-up on any two experiences which come across in your life where you forgive or forget to maintain good relationships with friends or relatives.
10. Make a case study on the problems of second language learners of English and suggest solutions to overcome them.
11. How do you feel that the role of science and technology in nation-building?

## RESOURCES

### TEXTBOOKS:


1. Tyagi, C.L. and MadhuTyagi, "*Financial and Management Accounting*," Atlantic Publishers and Distributors, New Delhi,2016.
2. Madhuvij, "*Financial and Management Accounting*," Anmol Publishers New Delhi, 11th Edition,2018.


### REFERENCE BOOKS:


1. PaulineWeetman,"*FinancialandManagementAccounting–AnIntroduction*," Financial Times Prentice Hall, New Delhi, 4th edition,2014.
2. Jain, S.P. and Narang, K.L., "Financial Accounting," Kalyani Publishers, Ludhiana, 2th Edition,2016.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=lnPfqw-EVGs
2. https://www.youtube.com/watch?v=5h6nEBUrd3o

### WEB RESOURCES:

1. https://archive.mu.ac.in/myweb_test/MCA%20study%20material/M.C.A.%20(Sem%20-%20II)%20Accounting%20and%20Financial%20Management.pdf
2. http://uni.delf.pro/uploads/7/1/0/7/7107980/financial_and_management_accounting_an_introduction.pdf

# SCHOOL CORE

**(Management Basket)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22ME101703** | **MANAGEMENT SCIENCE** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Concepts of Management; Concepts Related to ethics and social responsibility; Human Resource Management; Operations Management; Statistical Process Control; Inventory Management; Marketing; Project Management; Project Crashing.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate the concepts of management, its functions and processes used in optimum resource utilization within the context of ethics and social responsibility.

**CO2.** Apply the concepts of HRM for selection and management of human resources.

**CO3.** Analyze different operations management problems using quality management tools to produce effective, efficient and adoptable products/services

**CO4.** Identify different marketing strategies to maximize enterprise profitability and customer satisfaction within the realistic constraints

**CO5.** Develop network models in time-cost trade-off for effective project management.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | 1 | - | 1 | - | 1 | 2 | - | - | - | 1 | - | 3 | - | - |
| **CO2** | 3 | 2 | 1 | - | 1 | - | - | - | - | - | - | 1 | - | 3 | - | - |
| **CO3** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | - | 3 | - | - |
| **CO4** | 3 | 2 | 1 | - | 1 | - | - | - | - | - | - | 1 | - | 3 | - | - |
| **CO5** | 3 | 3 | 3 | 1 | 1 | - | | - | - | - | - | 2 | - | 3 | - | - |
| **Course Correlation Mapping** | **3** | **2** | **1** | **1** | **1** | - | **1** | **2** | - | - | - | **1** | - | **3** | - | - |

**Correlation Levels:** **3: High;** **2: Medium;** **1: Low**

**COURSE CONTENT**

**Module 1: MANAGERIAL FUNCTION AND PROCESS (10 Periods)**

Concept and foundations of management, Evolution of management thought; Managerial functions – Planning, Organizing, Directing and Controlling; Decision-making; Role of manager, managerial skills; Managing in a global environment, Flexible systems management; Social responsibility and managerial ethics; Process and customer orientation; Managerial processes on direct and indirect value chain.

**Module 2: HUMAN RESOURCE MANAGEMENT (08 Periods)**

Human Resource challenges; Human Resource Management functions; Human Resource Planning; Job analysis; Job evaluation, Recruitment and selection; Training and Development; Promotion and transfer; Performance management; Compensation management and benefits; Employee morale and productivity; Human Resource Information System.

**Module 3 OPERATIONS MANAGEMENT (10 Periods)**

Fundamentals of Operations Management, Services as a part of operations management; Facilities location and layout; Line balancing; Quality management – Statistical Process Control, Total Quality Management, Six sigma; Role and importance of materials management, Value analysis, Make or Buy decision, Inventory control, Materials Requirement Planning, Enterprise Resource Planning, Supply Chain Management.

**Module 4 MARKETING MANAGEMENT (08 Periods)**

Concept, evolution and scope; Marketing strategy formulation and components of marketing plan; Segmenting and targeting the market; Positioning and differentiating the market offering, Analyzing competition; Product strategy; Pricing strategies; Designing and managing marketing channels; Integrated marketing communications.

**Module 5 PROJECT MANAGEMENT (09 Periods)**

Project management concepts; Project planning – Work Breakdown Structure, Gantt chart; Project scheduling – Critical Path Method, Program Evaluation and Review Technique, Crashing the project for time-cost trade off; Resource Levelling.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Find the social responsibilities in the context of management theoretically and practically in an organization.
2. Identify and apply different marketing strategies to maximize enterprise profitability and customer satisfaction.
3. Apply the network models practically in an industry for effectiveness

*(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)*

**CASE STUDIES/ ARTICELS:**

Contemporary relevant case studies/Articles will be provided by the course instructor at the beginning.

## RESOURCES

**TEXT BOOKS:**


1. MartandT.Telsang, *Industrial Engineering and Production Management,* S. Chand, 2nd Edition, 2006.
2. Koontz and Weihrich, *Essentials of Management*,TMH, 6th Edition, New Delhi, 2007.


**REFERENCE BOOKS:**


1. O.P. Khanna, *Industrial Engineering and Management,*Dhanpat Rai and Sons,2010.
2. N.D. Vohra, *Quantitative Techniques in Management,* TMH, 2nd Edition, New Delhi.
3. L.M. Prasad, *Principles and practice of Management,* S. Chand and Sons, 2006.


**VIDEO LECTURES:**

1. https://archive.nptel.ac.in/courses/122/106/122106032/
2. https://www.digimat.in/nptel/courses/video/122102007/L01.html

**WEB RESOURCES:**

1. https://mitsloan.mit.edu/teaching-resources-library/management-simulations
2. https://ocw.mit.edu/

# SCHOOL CORE

**(Management Basket)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CM201402** | **PRINCIPLES OF BUSINESS MANAGMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

The course is aimed to offer the basic concepts of business and different forms business to the students. Further, management concepts such as Change management and Strategic management.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate Knowledge on fundamental of Business.

**CO2.** Analyze different forms of business organisations.

**CO3.** Demonstrate knowledge on theories of management, business ethics and corporate social responsibility.

**CO4.** Demonstrate knowledge on concepts of Change management and Strategic management.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO3** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **Course Correlation Mapping** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

**COURSE CONTENT**

**Module 1: INTRODUCTION TO BUSINESS** ***(09 periods)***

Meaning - Nature of business - Scope of business - Characteristic and objective of business - Classification of business activities - Social responsibility of business towards different groups.

**Module 2: FORMS OF BUSINESS UNIT** **(10 Periods)**

Introduction to Sole trade – Advantages and disadvantages of Sole trade – Introduction to Partnership – Partnership Deep – types of partnerships – Introduction to Joint stock company – Introduction to Co-operative society.

**Module 3: INTRODUCTION TO MANAGEMENT** **(09 Periods)**

Meaning - Definition - Scope of management - Characteristics of management - Importance of management – Functions of Management – Principles of Management - Management and administration - Management - a science or art - Levels of management.

**Module 4: EVOLUTION OF MANAGEMENT THOUGHT** **(09 Periods)**

Management process – Principles of Management - Development of management thought - Theories of management: F.W.Taylor, Henri Fayol, Elton Mayo and Chester Barhard & Peter Drucker to the management thought **Business Ethics and Corporate Social Responsibility. Introduction to Business Ethics – Concepts – Shift to Ethics – Tools of Ethics – Introduction to Corporate Social Responsibility – Importance of CSR – Characteristics of CSR**

**Module 5: MANAGEMENT OF CHANGE AND STRATEGIC MANAGEMENT** **(09 Periods)**

Management of change and conflict - Management in changing environment: Models for Change, Force for Change - Need for Change - Alternative Change Techniques - New Trends in Organisation Change

**Strategic Management:** Definition – Classes of Decisions – Levels of Decision – Strategy – Role of different Strategist – Relevance of Strategic Management and its Benefits – Strategic management in India

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Observation of different forms of business organizations in the business environment.
2. Visiting a Business and knowing real time management process of business activities.

## RESOURCES

### TEXT BOOKS:


1. Dr. L. M. Prasad, "*Principles and practice of management*" Sultan Chand & Sons – New Delhi, 2018.
2. Tripathi Reddy, "*Principles of Management*," Tata McGraw Hill, New Delhi, 2012.


### REFERENCE BOOKS:


1. Murugan and Shaktivel, "Management Principles and Practices," New Age, New Delhi, 2021.
2. Talloo, "*Business organization and Management*," Tata McGraw Hill, 2018.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=kTWyt6KC9Jw
2. https://www.youtube.com/watch?v=lj7ZnyskZuA

### WEB RESOURCES:

1. https://www.in.gov/doe/files/cf-bmite-principles-of-business-management-01-2016.pdf
2. https://dkdailyblogs.blogspot.com/2018/12/principal-of-management-notes-for-1st.html

# SCHOOL CORE

**(Management Basket)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CM201403** | **PERSONALITY AND CAREER MANAGEMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on Self-Development Skills, Interpersonal Skills, Career Self Concept, Job Search, Labour Markets and Employment.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate self development skills and interpersonal skills.

**CO2.** Build a good career and development.

**CO3.** Understand the job and select the appropriate job.

**CO4.** Analyse the labour markets and job opportunities.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 2 | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| **CO3** | 2 | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| **CO4** | 2 | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - |
| **Course Correlation Mapping** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: SELF-DEVELOPMENT SKILLS** ***(09 Periods)***

**Module 2: INTERPERSONAL SKILLS** ***(09Periods)***

Hard Skills, Soft Skills, Effective Communication, Skills for successful interview, Leadership, Social Empathy.

**Module 3 CAREER SELF CONCEPT** ***(09 Periods)***

Introduction of career self concept, Resume review Career Fair Preparation, Job Interviews, References, Salary Negotiation, Interviewing techniques, types of interviews, Mock Interviews.

**Module 4 JOB SEARCH** ***(09 Periods)***

Job Search Strategies, Recruiting Firms, Networking Job Search Strategies, Job Boards and Advertisements Recruiting Firms, Video job interview using Interview Stream, Career Goals.

**Module 5 LABOUR MARKETS AND EMPLOYMENT** ***(09 Periods)***

Labour Markets, New Employment Reality, Labour Market Trends Other Resources, Developing Skills and Abilities, Global world, Global opportunities, Global Mobility, Transition from, Academics to work Strategies.

***Total Periods: 45***

## EXPERIENCE LEARNING:

**Activity:** Personal SWOT Analysis Workshop

Description: Organize a workshop where students conduct a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) on themselves. Guide them to identify their personal strengths and weaknesses, as well as opportunities for growth and potential external threats to their success.

**Activity:** Goal Setting and Action Planning

Description: Have students set specific, measurable, achievable, relevant, and time-bound (SMART) goals for their self-development. They should create action plans outlining steps to achieve these goals, with milestones to monitor progress.

## RESOURCES

**TEXT BOOKS:**


1. Onkar R.M., "*Personality Development and Career Management*", S Chand & Company, 1st Edition, 2014.
2. Boyes Carolyn, "*Career Management*", HarperCollins Publishers, 2nd Edition, 2019.


**REFERENCE BOOKS:**


1. Ronald A. Warren. "*Personality at Work: The Drivers & Derailers of Leadership*", 1st Edition, McGraw Hill Education, 2017.
2. **Elizabeth Hurlock,** "*Personality Development*", **McGraw Hill Education,** 2nd Edition**, 1976.**

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=SmYCplM0nfs

2. https://www.youtube.com/watch?v=HPZiL8-Ly38

**WEB RESOURCES:**

1. https://gmdconsulting.eu/nykerk/wp-content/uploads/2020/02/role-of-personality-in-career-dev.pdf
2. https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BSS201%20-%20PERSONALITY.pdf

# SCHOOL CORE

**(MANDATORY COURSE)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CE107601** | **ENVIRONMENTAL SCIENCE** | 2 | - | - | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on natural resources, ecosystems, biodiversity, environment pollution and control, social issues and environment, human population and environment.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.

**CO2.** Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.

**CO3.** Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.

**CO4.** Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.

**CO5.** Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

**CO-PO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| **CO1** | 3 | 3 | - | 2 | - | 1 | 1 | - | - | - | 1 | - |
| **CO2** | 3 | 3 | - | 2 | - | 1 | 1 | 1 | - | 1 | - | - |
| **CO3** | 3 | 3 | - | 2 | 1 | 1 | 1 | 1 | - | - | - | 1 |
| **CO4** | 3 | 3 | - | 3 | - | 1 | 1 | 1 | - | 1 | - | - |
| **CO5** | 3 | 3 | - | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **-** | **3** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **1** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

### Module 1: NATURAL RESOURCES *(07 Periods)*

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

### Module 2: ECOSYSTEMS AND BIODIVERSITY *(07 Periods)*

***Ecosystems:*** Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

***Biodiversity:*** Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

### Module 3: ENVIRONMENTAL POLLUTION AND CONTROL *(06 Periods)*

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management – Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

### Module 4: SOCIAL ISSUES AND THE ENVIRONMENT *(06 Periods)*

Sustainable development, Urban problems related to energy, Environmental ethics – Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

### Module 5: HUMAN POPULATION AND THE ENVIRONMENT *(04 Periods)*

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets – Water bodies/Forest/Grassland/Hill/Mountain.

***Total Periods: 30***

## EXPERIENTIAL LEARNING

1. Visit a nearby villages and know the status of availability of local resources that can be improved through proper education.
2. Make an awareness program in the villages for the development of natural resources, ecosystems and biodiversity.
3. Prepare a document by visiting a local urban waste dumping yard near to the Tirupati city.
4. Visit a local village and find a barren land and make the land into a useful land by planting plants or providing the soil and fertilizers required to improve the soil.

5. Visit a local zoological park and identify the species variety and variability.

*(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)*

## RESOURCES

### TEXT BOOKS:


1. Anubha Kaushik and Kaushik, C.P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies,* Orient Blackswan, 3rd Edition, 2021.


### REFERENCE BOOKS:


1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.


### VIDEO LECTURES:

1. http:// nptel.ac.in/courses/109/104/109104047
2. https://www.youtube.com/watch?v=mIPBPG-5dUw

### WEB RESOURCES:

1. https://nptel.ac.in/courses/122102006
2. https://www.flame.edu.in/academics/ug/program-structure/major-minor courses/environmental-studies
3. https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

# SCHOOL CORE

**(MANDATORY COURSE)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22LG207601** | **TECHNICAL REPORT WRITING** | 2 | - | - | - | 2 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course deals with preparing effective technical documents for both written and digital media, with particular emphasis on technical memos, problem-solving and decision-making reports, and organizational, product-support, and technical-information webs.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge of Technical Report Writing and structures with a scientific attitude.
**CO2.** Analyze the process of writing in preparing effective reports.
**CO3.** Demonstrate styles of writing for Publication in a Scientific Journal.
**CO4.** Apply the process of referencing and editing techniques for effective communication in written documents.
**CO5.** Analyze the strategies in the technical report presentation.

### CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | - | - | - | - | - | 2 | - | 3 | - | - | - | - | - | - |
| **CO2** | 2 | 3 | 2 | - | - | - | 2 | - | 3 | - | - | - | - | - | - |
| **CO3** | 3 | - | - | - | - | - | 2 | - | 3 | - | - | - | - | - | - |
| **CO4** | 2 | - | - | - | 3 | - | 2 | - | 3 | - | - | - | - | - | - |
| **CO5** | 2 | 3 | 2 | - | 2 | - | 2 | - | 3 | - | - | - | | | |
| **Course Correlation Mapping** | **2** | **3** | **-** | **-** | **3** | **-** | **2** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION TO TECHNICAL REPORT WRITING** ***(06 Periods)***

Concepts of Technical Report, Types of Reports, Planning Technical Report Writing, Components of a Technical Report, Report Writing in Science and Technology, Selecting and Preparing a Title, Language Use in Report Writing.

**Module 2: PROCESSOF WRITING** ***(06 Periods)***

Writing the 'Introduction', Writing the 'Materials and Methods, Writing the Findings/Results, Writing the 'Discussion', Preparing and using "Tables'.

**Module 3: STYLE OF WRITING** ***(06 Periods)***

Preparing and using Effective 'Graphs', Citing and Arranging References-I, Citing and Arranging References –II, Writing for Publication in a Scientific Journal.

**Module 4: REFERENCING** ***(06 Periods)***

Literature citations, Introductory remarks on literature citations, Reasons for literature citations, Bibliographical data according to ISO standards, Citations in the text, Copyright, and copyright laws, the text of the Technical Report, Using a word processing and desktop publishing (DTP) systems, Document or page layout, hints on editing Typographic details, Cross-references.

**Module 5: PRESENTATION** ***(06 Periods)***

Presentation with appropriate pointing, Dealing with intermediate questions, Review and analysis of the presentation, Rhetoric tips from A to Z.

***Total Periods: 30***

## EXPERIENTIAL LEARNING

1. Prepare a report on technologies of modern times that enriched the originality of research works and their impacts on society concerning plagiarism.
2. Make PowerPoint presentations on the various style of writing academic reports.
3. Error-free Reports are so important for successful communication and sharing of information. Prepare a detailed chart on proofreading techniques to make a report effective and error-free.
4. Design a logo for a company and write down the copy-right laws for that.
5. Read research articles from any international journal of science and technology and differentiate research writing from other academic and non-academic writings.
6. Write an organizational memo Include a heading, introduction, and summary at the beginning of your memo, and present the details of your discussion in a logical order. Use headings and topic or main-idea sentences to clarify the organization.
7. Prepare an appraisal report on the staff performance of your company.
8. Prepare a PowerPoint presentation on the annual performance report of a company.
9. Critically review and write a report on any one of the recently released products.
10. Read the newspaper and write a detailed report about the content coverage and analyse the factors for the popularity of the newspaper.

## RESOURCES

### TEXTBOOK


1. RC Sharma Krishna Mohan, *"Business Correspondence and Report"* McGraw-Hill Publishing. Writing," *Tata Company Limited, New Delhi"*, 3rd Edition, 2005 (reprint).
2. Patrick Forsyth, *"How to Write Reports and Proposals",* THE SUNDAY TIMES (Kogan Page), New Delhi, Revised 2ndEdition, 2010.


### REFERENCE BOOKS:


1. John Seely, *"The Oxford Writing & Speaking",* Oxford University Press, Indian Edition
2. Anne Eisenberg, "*A Beginner's Guide to Technical Communication"*, McGraw-Hill Education (India) Private Limited, New Delhi, 2013.


### VIDEO LECTURES:

1. https://vimeo.com/143714818
2. https://digitalmedia.sheffield.ac.uk/media/002.+The+Anatomy+of+a+Technical+Report/1_u8wntcge

### WEB RESOURCES:

1. http://www.resumania.com/arcindex.html
2. http://www.aresearchguide.com/writing-a-technical-report.htm
3. http://www.sussex.ac.uk/ei/internal/forstudents/engineeringdesign/studyguides/tec

   report writing

# SCHOOL CORE

**(MANDATORY COURSE)**

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CM207601** | **ESSENTIALS OF LEADERSHIP** | 2 | - | - | - | 2 |

**Pre-Requisite**

**Anti-Requisite**

**Co-Requisite** -

**COURSE DESCRIPTION:** This course is designed for learners who desire to improve their leadership, communications, and workplace skills.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Differentiate between leadership and management
**CO2.** Identify the values common among great leaders.
**CO3.** Discuss the power of positive expectations and how to apply it as a leader
**CO4.** Assess what, how, and to whom you should delegate.
**CO5.** Describe what it means to be an ethical leader.

### CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | 1 | - | - | - | 1 | - | - | - | - | - | - |
| **CO2** | 1 | 1 | 2 | 1 | - | 1 | - | - | - | - | - | - |
| **CO3** | 2 | - | 2 | - | 1 | - | - | - | - | 2 | - | - |
| **CO4** | 1 | 2 | - | 1 | - | - | - | - | - | 2 | - | - |
| **CO5** | 1 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | - |
| **Course Correlation Mapping** | **2** | **2** | **2** | **1** | **1** | **1** | **-** | **-** | - | **2** | **2** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION** ***(06 Periods)***

What is leadership, leadership vs management, leadership and change, Maxwell's 5 levels of leadership, how to move to the next level

**Module 2: LEADERSHIP VALUES & EXPECTATIONS** ***(06 Periods)***

14 Leadership Values, what matters most exercise. Expectations, The Pygmalion Effect, impact of positive expectations, setting expectations

**Module 3: DELEGATION** ***(06 Periods)***

Definition, why delegate, delegate/empower, why people don't delegate, steps for delegation - the IDEALS model..

**Module 4: ETHICS** ***(06 Periods)***

Definitions, introduction to ethics, ethics vs morals, self-assessment, Good People, Bad Choices examples, how to be an ethical leader, 8 Ethical Actions for Leaders.

**Module 5: COMMITMENT** ***(06 Periods)***

Introduction, significance of commitment, Universal Laws of Leadership, tips towards being accountable and committed leader.

***Total Periods:30***

## EXPERIENTIAL LEARNING

**LIST OF EXPERIMENTS:**

1. Collect the case studies related to successful leaders and their traits.
2. Different Case Studies Will be Given to students as per the topic that will be collected and evaluated.
3. The case studies will be collected as Assignments and the same will be evaluated.

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

**TEXT BOOKS:**


1. Anderson T, *Transforming leadership*, St. Lucie Press, Boca Raton, FL, 2nd ed 1998
2. Babiak, P. & Hare, R.D., *Snakes in suits: when psychopaths go to work*, Regan Books, New York, 2006


**REFERENCE BOOKS:**


1. Conger J, *Inspiring others: Th e language of leadership,* Academy of Management Executive, 5(1), 31-45, 1991
2. *Leadership Skills*. MTD Training & Ventus Publishing ApS, 2010


**VIDEO LECTURES:**

1. Marshall Goldsmith: The Essentials Of Leadership (fs.blog)
2. https://onlinecourses.nptel.ac.in/noc23_mg28/preview

**WEB RESOURCES:**

1. cdn2.hubspot.net/hubfs/4654529/Expert landing pages/Peter Cox/Resources/10 Leadership Essentials .pdf
2. 3-leadership-essentials-discovery-event-w.-no.-05.11.12.pdf (imd.org)

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202003** | **DATABASE MANAGEMENT SYSTEMS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This Course provides theoretical concepts and hands-on experience on Database systems, Database design, Relational model, Relational algebra, SQL queries, Constraints and triggers, PL/SQL, Schema refinement and normal forms, Transaction management, Concurrency control, Overview of storage and indexing.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyze and apply the concepts of ER-modeling and normalization to design viable data models for a given problem.

**CO2.** Formulate relational database schemas, apply suitable integrity constraints, for querying databases.

**CO3.** Use SQL to store, query, and manipulate data in relational databases.

**CO4.** Develop PL/SQL blocks to centralize database applications for maintainability and reusability.

**CO5.** Analyze transaction processing, concurrency control and storage methods for database management.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - |
| **CO2** | 1 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | - |
| **CO3** | 1 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | - |
| **CO4** | 2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | - | 2 | - |
| **CO5** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - |
| **Course Correlation Mapping** | **2** | **3** | **3** | **2** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN (08 Periods)**

**Introduction to Database Systems:** Database system applications, Purpose of database systems, View of data - Data abstraction, Instances and schemas, Data models; Database languages - Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.

**Introduction to Database Design:** Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.

**Module 2: RELATIONAL MODEL AND RELATIONAL ALGEBRA (08 Periods)**

**Relational Model:** ting and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.

**Relational Algebra:** Preliminaries, Relational Algebra operators.

**Module 3: SQL AND PL/SQL (10 Periods)**

**SQL:** Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers and active databases.

**PL/SQL:** Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions, Cursors, Database triggers.

**Module 4: SCHEMA REFINEMENT AND TRANSACTIONS (10 Periods)**

**Schema Refinement:** Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

**Transactions**: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability.

**Module 5: CONCURRENCY CONTROL, STORAGE AND INDEXING (09 Periods)**

**Concurrency Control:** Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Deadlock Handling.

**Storage and Indexing**: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; Comparison of file organizations.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1) Design and analyze an ER-Model for the following use case.

Road way Travels is in business since1977 with several buses connecting different places in India. Its main office is in Hyderabad. The company wants to computerize its operations in the following areas:

a) Reservations
b) Ticketing
c) Cancellations

Reservations:

Reservations are directly handled by booking office. Reservations can be made 60 days in advance in either cash or credit. In case the ticket is not available, await listed ticket is issued to the customer. This ticket is confirmed against the cancellation.

Cancellation and Modification:

Cancellations are also directly handed at the booking office. Cancellation charges will be charged. Wait listed tickets that do not get confirmed are fully refunded.

2) a) Implement Single Row functions-Character, Numeric and Date functions.

b) Implement Data Definition Language commands-Create, Alter, Drop, Truncate, and Rename.

c) Implement Data Manipulation Language commands-Insert, Select, Update, and Delete.

3) Implement various types of integrity constraints-NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.

4) a) Implement group functions with different operators such as aggregate operators, group by, having and order by.

b) Implement nested and correlated nested queries using set operators and set comparison operators.

5) a) Creation of views, synonyms, sequence, indexes and save point

b) Implement various types of joins-outer join and inner join.

## Basic PL/SQL:

6) Construct PL/SQL block for the following:

a) To determine whether a number is palindrome
b) To determine whether a number is an Armstrong number
c) To find greatest of three numbers
d) To display Fibonacci series

## Control Structures:

7) a) Write a programming PL/SQL to update the salary of a specific employee by 8% if the salary exceeds the mid-range of the salary against this job and update up to mid-

range if the salary is less than the mid-range of the salary, and display a suitable message.

b) Write a PL/SQL program to display the description against a student‘s grade using CASE statement.

## Exception Handling:

8) a) Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.

b) Construct the user-defined exceptions to get the salary of an employee and check it with the job‘s salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If his salary is above the range, raise the exception ABOVE_SALARY_RANGE.

## Functions

9) a) Write a function that accepts two numbers A and B and performs the following operations.

- Addition
- Subtraction
- Multiplication
- Division

b) Write a PL/SQL block that updates salary of an employee in Employee table by using incr function which takes employee number as argument and calculates increment and returns increment based on the following criteria.

- If salary<=3000, increment=30%ofsalary
- If salary > 3000 and <= 6000, increment = 20% of salary
- Else increment = 10% of salary

## Procedures:

10) a) Write a procedure that accepts two numbers and displays their sum

b) Write procedures to demonstrate IN, INOUT and OUT parameters

**Cursors:**

11) a) Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he/she has done in the past.

b) Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that’ specified by a passed-in parameter value.

## Triggers:

12) Develop a suitable student database application by considering appropriate attributes. Couple of attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled and internal assessment Using TRIGGERS for the following:

a) Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the concerned head of the department.

b) Whenever, the marks in an internal assessment test are entered, check if the marks are less than 40%; if so, notify the concerned head of the department.

## RESOURCES

**TEXT BOOKS:**


1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw Hill, 3rd Edition, 2014.
2. Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, Database System Concepts, McGraw Hill, 7th edition, 2019.


**REFERENCE BOOKS:**


1. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB publications, 4th Edition, 2017.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2015.
3. Thomas Connolly, Carolyn Begg, Database Systems, Pearson, 6th edition, 2019.
4. S.K.Singh, Database System Concepts, Design and Applications, 1st Edition, Pearson Education, 2006.
5. SatishAnsani, Oracle Database 11g: Hands-on SQL and PL/SQL, PHI, 2010.
6. Dr. Rajiv Chopra, Database Management Systems, Sultan Chand, 2016.
7. Pranab Kumar Das Gupta, P. Radha Krishna, Database Management System Oracle SQL and PL/SQL, PHI, 2nd Edition, 2009.


**VIDEO LECTURES:**

1. https://swayam.gov.in/nd1_noc19_cs46/preview
2. https://nptel.ac.in/courses/106105175
3. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
4. https://www.youtube.com/watch?v=MDQxqYVXiVU
5. https://www.youtube.com/watch?v=c5HAwKX-suM

**WEB RESOURCES:**

1. https://www.classcentral.com/course/swayam-introduction-to-database-systems-17660
2. https://www.scaler.com/topics/dbms/
3. https://www.academia.edu/27988617/Database_Management_System_DBMS_Tutorial
4. https://nptel.ac.in/courses/106104135
5. https://downloads.mysql.com/docs/mysql-tutorial-excerpt-5.7-en.pdf

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202004** | **DATA MINING** | 3 | - | 2 | - | 4 |

**Pre-Requisite** DATABASE MANAGEMENT SYSTEMS

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** The course covers the basic concepts of data mining and select and apply appropriate data pre-processing techniques, Data Cube Computation Methods and data mining algorithms. Association Rule Mining, Classification, and Clustering methods implemented to infer the valid conclusions in addition to forecasting time series, data mining trends and research frontiers.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyse pre-processing techniques, Data Cube Technology, data mining algorithms and identify frequent item sets.

**CO2.** Apply data mining techniques and tools to discover knowledge from text, and multimedia data.

**CO3.** Select and apply Classification and Clustering algorithms on pre-processed datasets to infer predictions effectively.

**CO4.** Apply data mining methods to forecasting time series and provide analytical solutions for societal issues.

**CO5.** Work independently or in team to solve problems with effective communications.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | **3** | **-** |

**Correlation Levels: 3: High; 2: Medium;1: Low**

## COURSE CONTENT

**Module 1: DATA MINING AND DATA PREPROCESSING (09 Periods)**

**Data Mining:** Motivated Data Mining, Kinds of Data to mined, kinds of patterns mined, Technologies Used, Kinds of applications targeted, Major issues in Data Mining.

**Data Preprocessing:** Need for Pre-processing the Data, Major Tasks in Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization

**Module 2: DATA CUBE TECHNOLOGY AND MINING FREQUENT PATTERNS, ASSOCIATIONS, AND CORRELATIONS (10 Periods)**

**Data Cube Technology :** Data Cube Computation, Data Cube Computation Methods, Multidimensional Data Analysis in Cube Space.

**Association Rule Mining:** Basic Concepts, Frequent Itemset Mining Methods: The Apriori algorithm for finding frequent itemsets using candidate generation, generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Pattern Evaluation Methods

**Module 3: CLASSIFICATION (09 Periods)**

**Classification**: **Basic Concepts of** Classification, Classification by Decision Tree Induction, Bayesian Classification, Rule-based classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Bayesian Belief Networks, Classification by Backpropagation, Support Vector Machines, Classification Using Frequent Patterns

**Module 4: CLUSTER ANALYSIS (08 Periods)**

**Clustering:** Cluster Analysis**,** Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning methods - k-means and k-mediods methods, CLARANS, Hierarchical Methods**-**Agglomerative and divisive hierarchical clustering, **Density-Based Methods:** DBSCAN, **Grid-Based Methods:** STING, Evaluation of Clustering, Outliers and Outlier Analysis.

**Module 5: FORECASTING TIME SERIES AND DATA MINING TRENDS AND RESEARCH FRONTIERS (09 Periods)**

**Forecasting Time Series:** Concepts of time series, Evaluating time series models, Analysis of the components of time series, Exponential smoothing models.

**Data Mining Trends and Research Frontiers:** Mining Complex Data Types, Data Mining Applications, Data Mining and Society, Data Mining Trends.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Create data sets in ARFF and CSV formats and load into the Weka Explorer.
2. Perform data preprocessing steps on weather nominal and student information data sets as follows:
   a) Handle missing values for categorical and nominal values.
   b) Select relevant attributes.
   c) Apply normalization techniques

3. Generate strong Association rules by applying Apriori algorithm on preprocessed dataset with Min_Sup=60% and Min_Conf=80%.
4. i) Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.
   (ii) Implement Bayesian Classification and analyze the results on 'iris' dataset.
5. Implement simple k-Means clustering algorithm on 'iris' dataset.
6. Use Experimenter WEKA component to rank the performance of j48, oneR, ID3, algorithms on 'weather nominal' dataset.
7. Verify ID3 classifier performance using Gain ratio and Ranker method using a Knowledge flow WEKA component.
8. Implement SVM / Decision tree classification techniques in R tool.
9. Implement clustering techniques in R tool.
10. Visualize data using any plotting framework in R tool.

## RESOURCES

### TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques," Elsevier, 3rd Edition, 2013.
2. G. K. Gupta, "Introduction to Data Mining with Case Studies," Easter Economy Edition, Prentice Hall of India, 2006.

### REFERENCE BOOKS:

1. Ian H. Witten, Eibe Frank, and Mark,"A Data Mining: Practical Machine Learning Tools and Techniques," Hall Morgan Kaufmann, 3rd Edition, 2011.
2. Mining of Massive Datasets by Anand Rajaraman and Jeff Ullman.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies," PHI, New Delhi, 3rd Edition, 2009.
4. Arun K Pujari, "Data Mining Techniques," Universities Press (India) Pvt. Ltd, 2nd Edition, 2001.

### SOFTWARE/TOOLS:

1. WEKA
2. R Studio

### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a4M3GdI5UFY
2. https://www.youtube.com/watch?v=ykZ-_UGcYWg&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc
3. https://www.youtube.com/watch?v=ykZ-_UGcYWg&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc
4. https://www.youtube.com/watch?v=N_whCVtfL9M&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc&index=4
5. https://www.youtube.com/watch?v=hEQkqpmtx-Y&list=PLLspfyoOYoQcI6Nno3gPkq0h5YSe81hsc&index=5

**WEB RESOURCES:**

1. https://www.cs.waikato.ac.nz/ml/weka/book.html
2. http://infolab.stanford.edu/~ullman/mmds/book.pdf
3. Open source tools for data mining: http://eprints.fri.uni-lj.si/893/1/2008-OpenSourceDataMining.pdf
4. https://www.kaggle.com/datasets
5. https://nptel.ac.in/courses/106/105/106105174/

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202005** | **COMPUTER NETWORKS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Network topology, Protocols, Physical layer, Error detection and Correction, Medium access, Ethernet, Routing protocols, IP addressing, TCP, UDP, Congestion control, DNS, Email, HTTPS.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Interpret different types of network topologies, layers and protocols.
**CO2.** Solve problems related to flow control, error control and congestion control in data transmission.
**CO3.** Evaluate sub netting and routing algorithms for finding optimal paths in networks.
**CO4.** Analyze various congestion control mechanisms and identify appropriate transport layer protocols.
**CO5.** Assess the impact of wired and wireless networks in the context of network protocols such as Ethernet, Bluetooth, DNS, WWW, E-Mail, and Streaming.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | 2 | - | - | - | - | 2 | - | - | - | - | - | - | - | - | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | - | **3** | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION AND PHYSICAL LAYER (09 Periods)**
**Introduction:** Uses of computer networks, Types, Network technology from local to

global, Examples of networks, Network protocols, Reference models.

**Physical Layer:** Guided transmission media, Wireless transmission, Using the spectrum for transmission, Communication satellites, Comparing different access networks.

**Module 2: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER (10 Periods)**

**Data Link Layer:** Data link layer design issues, Error detection and correction, Elementary data link protocols.

**Medium Access Control Sub layer:** ALOHA, Carrier sense multiple access protocols, Collision free protocols. Ethernet, Wireless LANs, Bluetooth, Data link layer switching.

**Module 3: NETWORK LAYER (10 Periods)**

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Any cast routing; Traffic management at the network layer, Software Defined Networking (SDN), Network layer in the internet-The IP version-4 protocol, IP addresses, IP version-6, Internet control protocols, OSPF, BGP.

**Module 4: TRANSPORT LAYER (08 Periods)**

UDP – Introduction to UDP, Remote procedure call, Real-time transport protocols; TCP – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control; Performance issues.

**Module 5: APPLICATION LAYER (08 Periods)**

Domain Name System - The DNS Lookup Process, The DNS Name Space and Hierarchy, DNS Queries and Responses, Name Resolution. Electronic mail-Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web-Architectural overview, HTTP, HTTPS; Streaming audio and video- Digital Audio, Video, Streaming Stored Media, Real-Time Streaming.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Implement the following data link layer framing methods.
    i) Character count
    ii) Character stuffing
    iii) Bit Stuffing
2. Design and develop a program to compute checksum for the given frame 1101011011 using CRC-12, CRC-16, and CRC-CCIP. Display the actual bit string transmitted. Suppose any bit is inverted during transmission. Show that this error is detected at the receiver's end.
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijkstra's algorithm to compute the shortest path through a network.
5. Implement distance vector routing algorithm for obtaining routing tables at each node.

**Packet Tracer Simulator:**

6. a) Create a simple LAN with hubs and switches and monitor the data flow.
   b) Construct a LAN with single/multiple router and share data to local and remote network.
7. Create and implement a standard access list that blocks the student's section from accessing the server section.
8. Simulate OSPF routing protocol using packer tracer.

**NS2 Simulator:**

9. Simulate star/mesh network topology used in LAN using TCP/UDP connection.
10. Simulate distance vector/link state routing algorithm.

## RESOURCES

**TEXT BOOKS:**


1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson, 6th Edition, 2022.
2. William Stallings, Data and Computer Communications, 10th Edition, Pearson Education, 2013.


**REFERENCE BOOKS:**


1. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, 5th Edition, 2017.
2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 8th Edition, 2022.


**SOFTWARE/TOOLS:**

1. Software: J2SDK, Eclipse/Netbeans
2. NS-2, Packet Tracer

**VIDEO LECTURES:**

1. http://nptel.ac.in/courses/106105081
2. http://nptel.ac.in/courses/106106091
3. https://archive.nptel.ac.in/courses/106/105/106105183/
4. https://www.youtube.com/watch?v=frUQMHXhnvs
5. https://www.youtube.com/watch?v=k_lfL93zDNQ

**WEB RESOURCES:**

1. Virtual Labs (Computer Networks Lab – http://vlabs.iitb.ac.in/vlabs-dev/labs_local/ computer-networks/ labs/explist.php)

2. Virtual Labs (Advanced Network Technologies Virtual Lab - http: //vlabs.iitkgp.ernet.in /ant)
3. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html
4. https://www.ibm.com/in-en/cloud/learn/networking-a-complete-guide
5. https://ipcisco.com/cisco-packet-tracer-configuration-examples/
6. https://www.isi.edu/nsnam/ns/
7. https://www.cisco.com/c/dam/global/fi_fi/assets/docs/SMB_University_120307_Networking_Fundamentals.pdf

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202006** | **DATA STRUCTURES AND ALGORITHMS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Analyze step by step and develop algorithms to solve real world problems. Implementing various data structures like Stacks, Queues, Linked Lists, Trees and Graphs, various searching & sorting techniques

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand compare functions using asymptotic analysis and describe the relative merits of worst-, average-, and best-case analysis.
**CO2.** Analyzing various linear data structures and Stacks.
**CO3.** Implementing data structures like Queues, Linked Lists.
**CO4.** Apply data structures like Trees and Graphs.
**CO5.** Understanding various searching & sorting techniques

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | 3 | - |
| **CO2** | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO3** | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **CO4** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | - | - | - | - | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | - | **3** | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

### COURSE CONTENT

**Module 1: INTRODUCTION TO DATA STRUCTURE (09 Periods)**
**Basics:** Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms- Average, best and worst case analysis).
**Introduction To Data Structure:** Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non Linear Data Structures

**Module 2: LINEAR DATA STRUCTURE ARRAY & STACKS (10 Periods)**
**Linear Data Structure Array:** Representation of arrays, Applications of arrays, sparse matrix

and its representation. **Stack:** Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi.

**Module 3: QUEUES & LINKED LIST (09 Periods)**

**Queue:** Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue.

**Linked List:** Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.

**Module 4: TRANSPORT LAYER (08 Periods)**

Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees- Some balanced tree mechanism, AVL trees, 2-3 trees, Height Balanced, Weight Balance.

Graph-Matrix Representation Of Graphs, Elementary Graph operations, Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree.

**Module 5: SORTING And SEARCHING (08 Periods)**

**SORTING And SEARCHING :** Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting On Several Keys, Linear Search, Binary Search

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Introduction to structures & pointers in C.
2. Write a Program to find the Factorial of a Given Number using Recursive Function.
3. Write a Program for Implementation of Stacks Using Arrays.
4. Write a Program for Implementation of Stacks Using Linked Lists.
5. Write a Program for Implementation of Queues Using Arrays.
6. Write a Program for Implementation Linked Lists.
7. Write a Program to Implement Binary-Tree Algorithm for Operations with INSERT, DELETE, and DISPLAY.
8. Write a Program to implement circular queues using arrays.
9. Write a Program to sort the given number using bubble sort, Merge sort, Quick sort.
10. Write a Program to implement the following searching techniques Sequential and binary search

## RESOURCES

### TEXT BOOKS:


1. D. Samanta, **Classic Data Structures**, 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012
2. Ellis Horowitz and Sartaj Sahni, **Fundamentals of Data Structures in C**, 2nd Edition, Universities Press, 2008.


### REFERENCE BOOKS:


1. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.

2. Fundamentals of Data Structures in C++-By Sartaj Sahani.
3. Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher-Thomson Learning.

**SOFTWARE/TOOLS:**

1. Software: J2SDK, Eclipse/Netbeans
2. C++ Turbo Editor

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://swayam.gov.in/nd2_cec19_cs04/preview
3. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O
4. https://www.youtube.com/playlist?list=PLrqxgoIHbaCQPHa2LnGX0f-dCIH2MWlFS
5. https://www.youtube.com/playlist?list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR

**WEB RESOURCES:**

1. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. https://www.hackerrank.com/domains/data-structures
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://discuss.codechef.com/t/data-structures-and-algorithms/6599
5. https://books.goalkicker.com/AlgorithmsBook/

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA204001** | **OBJECT ORIENTED PROGRAMMING THROUGH JAVA** | 3 | - | 2 | 4 | 5 |

**Pre-Requisite** PYTHON PROGRAMMING

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** this course is emphasize on the fundamentals structure design with classes including development, testing, implementation and documentation. This course also focuses on understanding and practical mastery of object oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Apply object oriented programming constructs to solve computational problems.
**CO2.** Use Exception handling and multithreading mechanisms to create efficient software applications.
**CO3.** Create Web based applications using collections frameworks to solve real world problems.
**CO4.** Design and develop GUI using applets and swings for internet and system based applications.
**CO5.** Work independently or in team to solve problems with effective communication.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | 3 |
| **CO2** | 3 | 3 | 3 | - | - | - | 2 | - | - | - | - | 2 | 3 | - | 3 |
| **CO3** | 3 | 3 | - | - | - | - | - | - | - | - | 2 | - | 3 | - | 3 |
| **CO4** | 2 | 3 | 3 | - | - | - | - | 2 | - | - | - | - | 3 | - | - |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **-** | **-** | **2** | **2** | 3 | **3** | **2** | **2** | **3** | - | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

### Module 1: OOPS FUNDAMENTALS (09Periods)

**Introduction:** History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope and life time of variables, Operators, Control statements, Type conversion and casting, Arrays.

**Concepts Of Classes And Objects:** Introducing methods, Method overloading, Constructors, Constructor overloading, Usage of static with data and method, Access control, this key word, Garbage collection, String class, StringTokenizer.

### Module 2: INHERITANCE, INTERFACE AND PACKAGES (09Periods)

Inheritance basics, Types of inheritance, Member access rules, Usage of super key word, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces; Packages - defining, creating and accessing a package, importing packages, access control in packages.

### Module 3 EXCEPTION HANDLING AND MULTITHREADING (10 Periods)

**Exception Handling:** Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, Creating user defined exception;

**Multithreading:** Concepts of multithreading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

### Module 4 COLLECTION FRAMEWORK (8 Periods)

**Collection Framework:** Collections Overview, Collection Interfaces - List, Set, Map, List - ArrayList, Linked List, Vector, Set - HashSet, TreeSet, Map - HashTable, HashMap, Accessing a collection via an Iterator, comparator, comparable.

### Module 5 GUI PROGRAMMING (09 Periods)

**GUI Programming With Applets:** Applets - Applet Class, Applet skeleton, Simple Applet; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.

**Exploring Swing Controls:**JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

### OOPS Fundamentals

1. a) Develop a Java application for generating Electricity bill.

   Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:

   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - >501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - > 501 units - Rs. 7 per unit

   b) Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using Constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.

2. a) Create a class Student which has data members as name, branch, roll no, age, sex, marks in five subjects. Display the name of the student and his percentage who has more than 70%.Use array of objects.

   b) Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imaginary parts to equal values and third which takes two argument is used to initialized real and imaginary to two different values.

### Inheritance

3 a) Create a base class basic_info with data members name, roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.

   b) Create class first with data members book no, book name and member function getdata and putdata. Create a class second with data members author name, publisher and members getdata and showdata. Derive a class third from first and second with data member no of pages and year of publication. Display all these information using array of objects of third class.

4 A High School application has two classes: The Person superclass (Name, age, Gender) and the Student subclass (RegNo, Dept, CGPA).Using inheritance, create two new classes, Teacher and College Student. Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g., "Computer Science", "Chemistry", "English", "Other"). The College Student class will extend the Student class by adding a year (current level in college) and major (e.g., "Electrical Engineering", "Communications", "Undeclared"). Create objects and test the functionality of all the methods.

5 Develop a java application for generating pay slip on different category of employees using the concept of inheritance.

**Exception Handling and Multithreading**

6 Consider two integers x and y as input and compute the value of x/y.

Implement a class which raise an exception if x and y are not signed integers or if y is zero.

7 a) Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number

b) Write a program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

**Collection Framework**

8 Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

**GUI Programming**

9 a) Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with "STOP" or "READY" or "GO" should appear above the buttons in selected color. Initially, there is no message shown.

b) Write an Applet that computes the payment of a loan on the amount of the loan, the interest rate and the number of months. It takes one parameter from the browser. Monthly; if true, the interest rate is per month, otherwise the interest rate is annual.

c) Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field. (Hint: use swings).

## PROJECT BASED LEARNING:

**Faculty shall provide Projects relevant to the contents of the course.**

**Sample Projects:**

1. **CALENDER APPLICATION**
   Develop a calendar application that uses many windows properties to make it colorful, for example, to indicate the vacation, it uses the red foreground color. The calendar can be used for two purposes. First to see the date and month as usual calendars and second to find out the day corresponding to given date. Some of the salient features of the project are
   1. It uses various windows properties to make the program colorful although it has lack of graphics.
   2. It entirely uses java code which is written in simple manner with lots of comments and important notes can be added.
   3. The date with such notes appears different than others with red background color
   4. The months can be navigated using arrow keys.

**TICKET RESERVATION SYSTEM**

**2.** Develop Ticket reservation system to manage details of seats, passenger, trains,

Bookings and stations. The features required to be implemented are as follows

a. Provides searching facility based on factors such as seats, trains, booking and stations
b. Manage the information of passengers
c. Shows the information of the seats and trains
d. Provide filter on train, booking, time and station
e. Information Management of booking
f. Export excel report for trains, passengers and station
g. Export pdf for booking details

## RESOURCES

### TEXT BOOKS:


1. Herbert Schildt, "Java the complete reference", 11th edition, McGraw Hill, Education, 2018.
2. C. Thomas Wu, "An Introduction to Object-Oriented Programming with Java 5th edition", McGraw-Hill Higher Education 2010.


### REFERENCE BOOKS:


1. J. Nino and F.A. Hosch, "An Introduction to programming and OOPS design using Java", 3rd edition, John Wiley & sons, 2008.
2. P. Radha Krishna, "Object Oriented Programming through Java", 1st edition, Universities Press, 2007.

**SOFTWARE/TOOLS:**

1. Software: Eclipse / Net beans / JDK 1.7
2. Java compatible web browser

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106105191
2. https://www.udemy.com/course/java-tutorial/

**WEB RESOURCES:**

1. https://www.tutorialspoint.com/java/java_tutorial.pdf

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA204002** | **WEB TECHNOLOGIES** | 3 | - | 2 | 4 | 5 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides Concepts of HTML, Java Script, and Developing Web Applications using Servlets, JSP, Adopting Tomcat Server and XAMP Server for deploying Web Applications.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on HTML, CSS and Client-side Scripting

**CO2.** Design and develop web Applications using HTML, JavaScript, Servlets, JSP.

**CO3.** Apply Servlets, and JSP to implement Societal E-Commerce applications to infer potential insights

**CO4.** Analyze 2-tier, 3-tier and MVC architectures, Servlets Life cycle and JSP Life cycle, Directory structure of servlets and JSP to design web application

**CO5.** Analyze and Solve real time problems using Server-side technologies, Tomcat Server and XAMPP Server for deployment of web applications.

**CO6.** Work independently or in team to solve problems with effective communications.

### CO-PO-PSO Mapping Table

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 2 | 3 | 3 | 3 | - | - | - | - | 3 | - | - | 3 | 3 | 3 | 3 |
| **CO4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO6** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - | - |
| ***Course Correlation Level*** | **3** | **3** | **3** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTERNET AND THE WORLD WIDE WEB AND HTML** ***(09 Periods)***

**World Wide Web (WWW):** World Wide Web and its evolution, uniform resource locator (URL), browsers – internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. search engine, web saver – apache, IIS, proxy server, HTTP protocol.

**Introduction to HTML:** Elements of HTML Document, HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formating: b, i, small, sup, sub, Spacing: Pre, Br, Formatting Text

Phrases: span, strong, tt, Image element, Anchors, Lists: Ordered and Unordered and Definition,Tables, Frames, Forms: Form Elements, ID attributes, Class Attributes of HTML Elements, Meta Tag, Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags, HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events.

**Module 2: CASCADING STYLE SHEETS (CSS) AND CLIENT-SIDE SCRIPTING** ***(10 Periods)***

Cascading Style Sheets (CSS), CSS Syntax, Inserting CSS: Inline, Internal, External, ID and Class Selectors, Colors, Backgrounds, Borders, Text, Font, List, Table, CSS Box Model, Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin, Positioning: Relative, Float, Absolute, CSS3 Borders, Box Shadows, Text Effects and shadow, Basics of Responsive Web Designs, Media Queries, Introduction to Bootstrap.

Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

**Module 3: XML** ***(09 Periods)***

**XML:** Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

**Module 4: SERVLETS** ***(09 Periods)***

**Introduction to Servlets:** Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

**Module 5: JSP** ***(08 Periods)***

**Introduction to JSP:** The Anatomy of a JSP Page, JSP Processing, Declarations, directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Design the following static web pages required for an online book store web site.

   1) HOME PAGE:

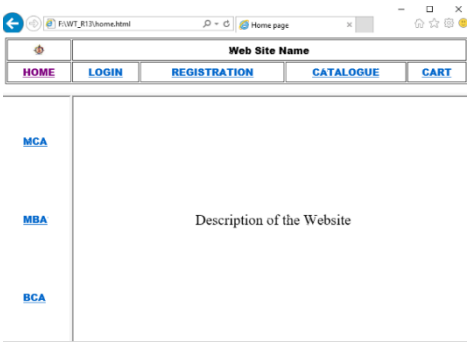
   The static home page must contain three frames.

   **Top frame:** Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).

   **Left frame:** At least four links for navigation, which will display the catalogue of respective links.

   For e.g.: When you click the link "MCA" the catalogue for MCA Books should be displayed in the Right frame.

   **Right frame**: The pages to the links in the left frame must be loaded here. Initially this page contains description of the web site.




2. **LOGIN PAGE:** Login page must contain Login field, Password field, Submit and reset buttons.

3. **CATALOGUE PAGE:** The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following: 1. Snap shot of Cover Page. 2. Author Name. 3. Publisher. 4. Price. 5. Add to cart button.

4. **REGISTRATION PAGE:**

   Create a "registration form "with the following fields

   1) Name (Text field)

   2) Password (password field)

   3) E-mail id (text field)

   4) Phone number (text field)

   5) Sex (radio button)

   6) Date of birth (3 select boxes)

7) Languages known (check boxes – English, Telugu, Hindi, Tamil)

8) Address (text area)

5. Design a web page using CSS (Cascading Style Sheets) which includes the following:

   A. Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles.
   B. Set a background image for both the page and single elements on the page.
   C. Control the repetition of the image with the background-repeat property.

6. Write an XML file which will display the Book information which includes the following:

   1) Title of the book

   2) Author Name

   3) ISBN number

   4) Publisher name

   5) Edition

   6) Price

   Write a Document Type Definition (DTD) to validate the above XML file.

7. Implement a JAVA Servlet Program to implement a dynamic HTML using Servlet (user name and password should be accepted using HTML and displayed using a Servlet).
8. Design a JAVA Servlet Program to Download a file and display it on the screen (A link has to be provided in HTML, when the link is clicked corresponding file has to be displayed on Screen).
9. Design a JAVA Servlet Program to implement RequestDispatcher object using include() and forward() methods.
10. Implement a JAVA Servlet Program to implement sessions using HTTP Session Interface.
11. Design a JAVA JSP Program to implement verification of a particular user login and display a welcome page

## PROJECT BASED LEARNING

**Project - 1:Design a web application for selling products online with the following features.**

Mobile website option **-** The online store should be built on a responsive design template and its features need to be available to all users, at any time, from anywhere and in any device.

Image options - The photos should also be taken from different points of view to give you a clearer idea of the product. Image options should include viewing angles, zoom,

multiple images, and more.

Detailed product description - The description should often include the important details, such as the expiration date, size dimensions, weight, manufacturers date, and practical uses

must be included in a good product description.

Order Tracking - The customers should be able to track their ordered products by logging into an account created upon registration.

Payment Options - An online website should allow credit card/debit card/net banking for payment.

**Project – 2: Design a social website with the following features.**

Build Profile - Members allow to build their profiles.

Upload content - The Social Networking Sites allow members to upload text messages, photographs, audio and video files. All posts are arranged in descending order with the last post coming first.

Build conversations - Content posted by members can be browsed and commented upon by all members who form part of the community. Content can also be tagged from third party sites on subjects that interest the group.

## RESOURCES

### TEXT BOOKS:


1. Uttam K Roy," Web Technologies ",2nd Edition, Oxford University Press, 2010.
2. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery*, Dreamtech Press, FirstEdition, 2011.


### REFERENCE BOOKS:


1. Harvey M. Deitel and Paul J. Deitel, "Internet and World Wide Web How to Program", 4th Edition, Perason publications, 2006.
2. Snig Bahumik, *Bootstrap Essentials*, PACKT Publishing, First Edition, 2015. (e-book).
3. Thomas A. Powell, *The Complete Reference: HTML and CSS,*Tata McGraw Hill, Fifth Edition, 2010.
4. Andrea Tarr, *PHP and MySQL*, Willy India, First Edition, 2012.


### SOFTWARE/TOOLS:

1. Editor: Notepad++
2. Technologies: HTML, CSS, Servlets, JSP

### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=Q33KBiDriJY
2. https://www.coursera.org/learn/html-css-javascript-for-web-developers?=
3. https://www.edx.org/course/using-javascript-jquery-and-json-in-django

4. https://www.edx.org/course/building-web-applications-in-django
5. https://www.udemy.com/course/web-technology-for-entrepreneurs/
6. https://www.edx.org/course/html5-apps-and-games
7. https://www.classcentral.com/course/openhpi-web-technologies-3517
8. https://www.edx.org/course/css-basics

**WEB RESOURCES:**

1. https://www.w3schools.com/js/
2. https://www.geeksforgeeks.org/web-technology/
3. https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/
4. https://css-tricks.com/
5. https://davidwalsh.name/css-optional

## PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201003** | **SOFTWARE ENGINEERING** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** **-**

**Co-Requisite** **-**

**COURSE DESCRIPTION:** This course provides a detailed discussion on concepts of Software Engineering, Software Process Models, Conventional and Agile Process Models, Software Requirements Engineering Process, System Analysis, Architectural Design, User Interface Design and Re-engineering, Software Testing, Risk and Quality Management.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand fundamental concepts of software engineering and analyze process models required to develop a software system.

**CO2.** Analyze software requirements and model requirements for the given scenario.

**CO3.** Apply design concepts and metrics for software development.

**CO4.** Apply testing strategies and techniques for quality software.

**CO5.** Analyze risks in software development life cycle and apply risk strategies to mitigate risks.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO2** | 2 | 3 | - | - | - | 3 | 3 | 2 | - | - | 2 | - | 3 | - | - |
| **CO3** | 2 | 3 | 3 | 2 | - | 2 | 2 | - | - | - | 3 | - | 3 | - | - |
| **CO4** | 2 | - | - | - | 2 | 3 | - | - | - | - | - | - | 3 | - | - |
| **CO5** | 2 | 3 | - | - | 2 | 3 | - | - | - | - | - | - | 3 | - | - |
| **Course Correlation Mapping** | **2** | **3** | **3** | **2** | **2** | **3** | **3** | **2** | - | **-** | **3** | **-** | **3** | - | - |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: SOFTWARE ENGINEERING AND SOFTWARE PROCESS (11 Periods)**

**A Generic view of process**: The Nature of Software, Software Engineering- Software Engineering Layers; The Software Process, Software Engineering Practice, Software myths.

**Process models:** A Generic Process Model, Prescriptive Process Models-The Waterfall Model, Incremental Process Models, Specialized Process Models; The Unified Process, Agile Development-Agility, Agile Process, Extreme Programming (XP), Scrum, Dynamic System Development Method, Agile Modeling (AM), Agile Unified Process (AUP).

**Module 2: REQUIREMENTS ENGINEERING AND MODELING (07 Periods)**

**Requirements Engineering:** Functional and non-functional requirements, The software requirements document, Requirements specifications, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

**Requirements Modeling:** Requirements Analysis, Data Modeling Concepts, Flow-Oriented Modeling, Scenario based Modeling, UML Models that supplement the Use Case, Case study on Requirements modeling for Web and Mobile Apps.

**Module 3 DESIGN ENGINEERING AND METRICS (09 Periods)**

**Design using UML:** Class Diagram - Terms and concepts, Use case Diagram - Terms and concepts, Activity Diagrams - Terms and concepts, Interaction diagrams - Terms and concepts, State machine Diagram- Terms and concepts, Component Diagram- Terms and concepts, Deployment Diagram- Terms and concepts.

**Process and Project Metrics:** Metrics in the process and project domains, Software Measurement, Metrics for software quality.

**Module 4 SOFTWARE TESTING STRATEGIES AND APPLICATIONS (08 Periods)**

**Testing strategies:** A strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Validation testing, System testing, The art of debugging.

**Testing Conventional Applications:** Software testing fundamentals, White box testing- Basis path testing, Control structure testing; Black box testing, Object oriented testing methods.

**Module 5 RISK, QUALITY MANAGEMENT AND REENGINEERING (10 Periods)**

**Risk and Quality Management:** Reactive and Proactive risk strategies, Software risks, Risk Mitigation Monitoring and Management (RMMM), RMMM plan, Formal Technical Reviews (FTR), Software Quality Assurance (SQA)-Tasks, Goals and Metrics; Software reliability.

**Reengineering:** Introduction, Business Process Reengineering (BPR), Software Reengineering, Restructuring, Reverse engineering, Forward engineering.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Identify Functional and Non-Functional Requirements for:

   a. Online Ticket Reservation for Railways
   b. Recruitment Procedure for Software Industry

2. **Online Ticket Reservation for Railways**

   **Problem Statement:** Computer plays an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description. Model using Visual modelling tools in different views i.e. component view, Deployment view.

3. **Recruitment Procedure for Software Industry**

   **Problem Statement:** In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company. The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate. Model using Visual modelling tools in different views i.e. Use case view, logical view

## RESOURCES

### TEXT BOOKS:


1. Roger S. Pressman, Software Engineering - A Practitioner's Approach, McGraw-Hill International Edition, Eigth Edition, 2015.
2. Ian Sommerville, Software Engineering**,** Pearson Education, Ninth Edition, 2011.


### REFERENCE BOOKS:


1. Grady Booch, James Rum Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Second Edition, Pearson Education, 2009.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers, Third Edition, 2007.
3. Shely Cashman Rosenblatt, Systems Analysis and Design, Thomson Publications, Sixth Edition, 2006.

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106105087/
2. https://nptel.ac.in/courses/106105182/

**WEB RESOURCES:**

1. Agile Modeling:https://www.techtarget.com/searchsoftwarequality/definition/agile-software-development
2. Functional and Non Functional Requirements: https://www.linkedin.com/learning/software-design-developing-effective-requirements/functional-vs-non-functional
3. Software Metrics and Measures: https://www.youtube.com/watch?v=bnydxXPN_rI
4. Risk Management: https://www.youtube.com/watch?v=8DstdqQBjps

# PROGRAM CORE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202007** | **CLOUD COMPUTING** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This Course provides a detailed discussion on Virtualization, Cloud Computing Fundamentals along with Deployment Models. Able to understand Cloud Computing Architecture to work with Cloud adopting Cloud Computing Mechanisms and implementing Cloud Security Mechanisms in Cloud Service Models.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate the concepts of Cloud Computing, Cloud-Enabling Technology, Cloud Architectures.

**CO2.** Apply virtualization and develop virtual environments for the deployment of cloud applications.

**CO3.** Design applications using cloud service models salesforce.com (SaaS), Google App Engine (PaaS), Amazon (IaaS) and deploy in cloud.

**CO4.** Identify and analyze the Cloud-Enabling Technologies and architectures for developing the applications to solve e-commerce problems.

**CO5.** Adhere to ethics and adapt cloud security mechanisms and Cloud-Based Security Groups for providing security to societal applications.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 3 | - | 3 | - | | | - | - | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | - | - | 3 | - | | | - | - | - | - | - | 3 | 3 |
| CO4 | 2 | 3 | 3 | - | 3 | - | | | - | - | - | - | - | 3 | 3 |
| CO5 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **-** | - | - | **3** | **-** | **3** | - | **-** | **3** | **3** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

### Module 1: FUNDAMENTAL CLOUD COMPUTING (10 Periods)

**Understanding Cloud Computing:** Origins and Influences, Concepts and Terminology, Goals and Benefits, Risks and Challenges.

**Fundamental Concepts and Models:** Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

### Module 2: CLOUD COMPUTING MECHANISMS AND ARCHITECTURE (11 Periods)

**Cloud-Enabling Technology:** Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

**Fundamental Cloud Architectures:** Workload Distribution, Resource Pooling, Dynamic Scalability, Elastic Resource Capacity, Service Load Balancing, Cloud Bursting, Elastic Disk Provisioning, Redundant Storage.

### Module 3: CLOUD COMPUTING ADVANCED ARCHITECTURES (12 Periods)

**Advanced Cloud Architectures:** Hypervisor Clustering, Load Balanced Virtual Server Instances, Non Disruptive Service Relocation, Zero Downtime, Cloud Balancing, Resource Reservation, Dynamic Failure Detection and Recovery, Bare-Metal Provisioning, Rapid Provisioning, Storage Workload Management.

**Specialized Cloud Architectures:** Direct I/O Access, Direct LUN Access, Dynamic Data Normalization, Elastic Network Capacity, Cross-Storage Device Vertical Tiering, Intra Storage Device Vertical Data Tiering, Load Balanced Virtual Switches, Multipath Resource Access, Persistent Virtual Network Configuration, Redundant Physical Connection for Virtual Servers, Storage Maintenance Window.

### Module 4: CLOUD SECURITY (11 Periods)

**Fundamental Cloud Security:** Threat Agents, Cloud Security Threats, Additional Considerations, Case Study Example.

**Cloud Security Mechanisms:** Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-On, Cloud-Based Security Groups, Hardened Virtual Server Images.

### Module 5: CLOUD SERVICE MODELS (11 Periods)

**Cloud Service Models:** Software as a Service (SaaS) - Characteristics, Examples and Applications. Platform as a Service (PaaS) - Characteristics, Examples and Applications. Infrastructure as a Service (IaaS) - Characteristics, Examples and Applications.

**Case Study:** SaaS: Salesforce.com, Facebook.com; PaaS: Google App Engine, MS-Azure and IBM Bluemix; IaaS: Amazon EC2, Amazon S3 and Netflix.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format.
2. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF

BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX.

3. Prepare a ppt on cloud computing – Introduction, models, services, and Architectures. PPTs should contain explanations, images and at least 20 slides
4. Create your resume in a neat format using google cloud Programs on PaaS.
5. Create an EC2 instance and invoke Ubuntu operating system with a given set of configuration on amazon web services under IaaS.
6. Create S3 bucket and store a file in it using AWS.
7. Configure web server on Amazon Linux instance with ElasticIP.
8. Develop a web application which contains employee salary information and calculate gross and total sal using the formula DA=10% OF BASIC HRA=30% OF BASIC PF=10% OF BASIC IF BASIC<=3000 12% OF BASIC IF BASIC>3000 TAX=10% OF BASIC IF BASIC<=1500 =11% OF BASIC IF BASIC>1500 AND BASIC<=2500 =12% OF BASIC IF BASIC>2500 NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX.
9. Generating reports in Salesforce admin.
10. Process of User Management in Salesforce admin.
11. Procedure of Data Management in Salesforce admin.
12. Procedure of providing data security using control access to data using point and click tools in Salesforce admin.

## RESOURCES

### TEXT BOOKS:


1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini "Cloud Computing- Concepts, Technology & Architecture," Pearson Publication, 2014.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Pvt. Ltd, 2011.
3. George Reese "Cloud Application Architectures," O'Reilly Publications, 2009.


### REFERENCE BOOKS:


1. Thomas Erl and Ricardo Puttini "Cloud Computing- Concepts, Technology & Architecture," Pearson, 2013.
2. John W. Rittinghouse, James F. Ransome, "Cloud Computing implementation, Management and Security," CRC Press, ISBN: 9788120341609, Taylor & Francis group, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible," Wiley India Pvt Ltd, 2011.
4. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud computing principles and paradigms", John Wiley and Sons, 2011.


### SOFTWARE/TOOLS:

1. Google App Engine
2. Amazon Web Services
3. Sales Force

**VIDEO LECTURES:**

1. https://youtu.be/uroryFU78gM
2. https://youtu.be/Pg5nj90xh68
3. https://youtu.be/2Dd2ducs-ic
4. https://youtu.be/Ijkvx1u0w6o
5. https://youtu.be/sMlOsYBMRag

**WEB RESOURCES:**

1. www.salesforce tutorial.com
2. Htpps:// trailhead.salesforce.com/en/home
3. https://MKyong.com/tutorials/google-App- engine-tutorial/
4. https://aws.amazon.com

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202008** | **DATA ANALYTICS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Data Mining

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and understanding the need of Big Data, challenges and different analytical architectures, Installation and understanding of Hadoop Architecture and its ecosystems, Processing of Data with Advanced architecture.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools

**CO2.** Access and Process Data on Hadoop Distributed File System

**CO3.** Manage Job Execution in Hadoop Environment

**CO4.** Ability to understand the importance of Big Data in Social Media and Mining

**CO5.** Analyze the data with R

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 2 | - | 2 | - | - | 1 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** | **-** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO BIG DATA AND HADOOP** **(09 Periods)**

Introduction to Big Data: Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

**Module 2: BIG DATA TECHNOLOGIES** **(09 Periods)**

Hadoop's Parallel World – Data discovery – Open Source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

**Module 3: INTRODUCTION HADOOP** **(09 Periods)**

Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

**Module 4: HADOOP ARCHITECTURE** **(09 Periods)**

Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework.

**Module 5: DATA ANALYTICS WITH R** **(09 Periods)**

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. (i) Perform setting up and Installing Hadoop in its three operating modes:

   a) Standalone

   b) Pseudo distributed

   c) Fully distributed

   (ii) Use web based tools to monitor your Hadoop setup.

2. Hadoop commands

3. Implement the following file management tasks in Hadoop:

   i) Adding files and directories.

   ii) Retrieving files.

   iii) Deleting files

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm

5. Write a Map Reduce program that mines weather data.

6. Implement Matrix Multiplication with Hadoop Map Reduce

7. Practice on Hive Installation, Table Creation and Deletion, Loading Data into Hive, Partitioning, Bucketing and Joins.

## RESOURCES

### TEXT BOOKS:


1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.


### REFERENCE BOOKS:


1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)

2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.

3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.

4. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.

5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.

6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.


### SOFTWARE/TOOLS:

- Hadoop ( https://hadoop.apache.org/releases.html)
- Cassandra (http://cassandra.apache.org/download/)

### VIDEO LECTURES:

- https://onlinecourses.nptel.ac.in/noc24_cs20/preview
- https://www.youtube.com/watch?v=ZUdlc5LsmHA

### WEB RESOURCES:

- Big Data Analytics Tutorial (tutorialspoint.com)
- What is Big Data? - GeeksforGeeks
- hackerrank-solutions · GitHub Topics · GitHub
- What is Big Data - javatpoint

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201004** | **INFORMATION RETRIEVAL SYSTEMS** | 3 | - | - | - | 3 |

**Pre-Requisite** Data Mining
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** The main objective of this course is to present the scientific support in the field of information search and retrieval. This course explores the fundamental relationship between information retrieval, hypermedia architectures, and semantic models, thus deploying and testing several important retrieval models such as vector space, Boolean and query expansion. It discusses implementation and evaluation issues of new algorithms like clustering, pattern searching, and stemming with advanced data/file structures, indirectly facilitating a platform to implement comprehensive catalogue of information search tools while designing an e-commerce web site.
**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate genesis and diversity of information retrieval situations for text and hyper media
**CO2.** Describe hands-on experience store, and retrieve information from www using semantic approaches.
**CO3.** Demonstrate the usage of different data/file structures in building computational search engines.
**CO4.** Analyse the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
**CO5.** Analyze ranked retrieval of a very large number of documents with hyperlinks between them and the Internet or Web search engine

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | 3 | - |
| **CO2** | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO3** | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **CO4** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | 3 | 2 | - | - | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | - | **3** | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION (09 Periods)**
**Introduction:** Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language models.

**Module 2: RETRIEVAL UTILITIES (10 Periods)**
**Retrieval Utilities:** Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.

**Module 3: RETRIEVAL UTILITIES (10 Periods)**
Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier.

**Module 4: EFFICIENCY (08 Periods)**
Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection

**Module 5: DISTRIBUTED INFORMATION RETRIEVAL (08 Periods)**
Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of Distributed retrieval, web search

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1 Presentation on image query processing i.e. about QBIC

2 Presentation on one of the case studies of Information Retrieval System

## RESOURCES

### TEXT BOOKS:


1. David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition( Distributed by Universal Press), 2004
2. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.


### REFERENCE BOOKS:


1. Soumen Chakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
2. Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=qIXvczunFLg
2. https://www.youtube.com/watch?v=MD3Ferad0oM

**WEB RESOURCES:**

1. Information Storage and Retrieval Systems: Theory and Implementation By Kowalski (UNIT I to UNIT VI)
2. Modern Information Retrieval by Ricardo Beeza-Yates
3. International Journal of Multimedia Information Retrieval (IJMIR)
4. International Journal of Information Retrieval Research (IJIRR)

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201005** | **DATA SCIENCE AND STATISTICAL MODELING** | 3 | - | - | - | 3 |

**Pre-Requisite** Data Mining
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a introduce the field of data science, the nature and structure of data. The importance and application of statistics in analyzing the data. Develop the skills in using data science techniques for solving data intensive problems. Understand learning concepts that is vital for data science and concepts of supervised and unsupervised learning.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Memorize the statistics concepts applicable to data science
**CO2.** Demonstrate data analysis, manipulation and visualization of data using Python libraries such as Pandas, Matplotlib and Plotly etc.
**CO3.** Enumerate machine learning algorithms.
**CO4.** Analyze the various applications of data science.
**CO5.** To demonstrate the clustering algorithms.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 1 | 3 | 3 | 1 | 3 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| **CO2** | 2 | - | 2 | 2 | - | 2 | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO3** | - | 3 | 2 | - | 3 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **CO4** | 2 | - | 2 | 2 | - | 2 | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 1 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | - | **3** | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO PROBABILITY (09 Periods)**

**Descriptive Statistics:** Measures of central tendency – mean, median, mode, hormonic mean and geometric mean.
**Measures of dispersion:** mean deviation from mean, standard deviation and variance.
**Central moments:** Covariance and correlation, rank correlation.
**Sampling distributions:** Hypothesis testing, definition of random variable and probability.

**Module 2: INTRODUCTION TO STATISTICS (9 Periods)**

**Probability distributions:** Bernoulli, Binomial, Poisson.
**Continuous probability distributions:** Gaussian, exponential, Chi-square. Definition of Bayes probability. What Is data science, How does data science relate to other fields, Eigen values &Eigen vectors, Sparse matrices.

**Module 3: PYTHON FOR DATA SCIENCE (11 Periods)**

**Python for Data Analysis:** Introduction to Numpy, Numpy Arrays and indexing, Introduction to pandas, Series, Data frames, Missing data, Groupby, Merging Joining and Concatenating, read csv and json, Cleaning Data.
**Python for Data Visualization:** Matplot lib library, Seaborn Distribution, Matrix and Regression Plots, Introduction to SKlearn and Plotly.

**Module 4: REGRESSION (08 Periods)**

Data Preprocessing in Python, Regression, Simple Linear regression, Multiple Linear Regression, Polynomial regression, Support Vector Regression(SVR), Decision Tree Regression.

**Module 5: SUPERVISED LEARNING -CLASSIFICATION (08 Periods)**

**Introduction to Supervised Learning:** Logistic Regression, K-Nearest Neighbors(KNN), Support vector Machine(SVM), Naïve Bayes, Decision Tree Classification, Random Forest Classification.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1 Execute programs using python libraries such as Numpy, Pandas
2 Execute and solve data visualization problems with python libraries like matplotlib, Seaborn and Plotly**.**
3 Evaluate various classification techniques.

## RESOURCES

**TEXT BOOKS:**

1. A Hands On Introduction to DataScience, Cambridge University Press, ISBN10: 1108472443, 2020.
2. Principles of DataScience-Learn the techniques and math you need to start making sense of your data by SinanOzdemir,

**REFERENCE BOOKS:**

1. Joel Grus, Data Science from Scratch, Oreilly media,2015.

2. Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, February11, 2013.
3. Mark Gardener, Beginning R The statistical Programming Language, Wiley, 2015.
4. Han ,Kamber, and J Pei, Data Mining Concepts and Techniques,3rd edition, Morgan Kaufman,2012.
5. Linear Algebra and Its Applications, 4thEdition,GilbertStrang

**VIDEO LECTURES:**

1. https://www.dataquest.io/blog/best-free-tools-data-science/
2. https://www.youtube.com/watch?v=NOIfMY0KajE
3. https://youtu.be/GGL6U0k8WYA
4. https://www.youtube.com/watch?v=fn1rKKNLuzk&list=PL15FRvx6P0OWTlNBS_93NHG2hIn9cynVT
5. https://www.youtube.com/watch?v=2pWv7GOvuf0&list=PLqYmG7hTraZDM-OYHWgPebj2MfCFzFObQ

**WEB RESOURCES:**

1. https://intellipaat.com/blog/tutorial/data-science-tutorial/
2. https://www.guru99.com/data-science-tutorial.html
3. https://www.edureka.co/blog/data-science-tutorial/
4. https://www.programmer-books.com/introducing-data-science-pdf/
5. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119092919
6. https://www.digiteum.com/data-visualization-techniques-tools

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201010** | **INTERNET OF THINGS** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on Internet of Things components, Domain applications, Communication models, Sensors, Connectivity, Prototyping, Hardware, Design Methodology, Development platforms, Data Analytics for IoT, IoT Security and hands-on experience on IoT applications.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand IoT Architecture, communication technologies and various applications of IoT.

**CO2.** Analyze sensor technologies and IoT related protocols.

**CO3.** Identify suitable hardware platforms and cloud services for developing IoT applications.

**CO4.** Understand generic design methodology for various IoT applications.

**CO5.** Understand data analytics concepts and security issues in the context of IoT.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | 2 | 2 | - | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 |
| **Course Correlation Mapping** | **2** | **3** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION AND DOMAIN APPLICATIONS (09 Periods)**

**Introduction to Internet of Things:** Definition, Conceptual Framework, Architectural View, Technology behind IoT, Communication Technologies, Data Enrichment, Data consolidation and Device management at Gateway.

**IoT and M2M:** M2M, Difference between IoT and M2M, SDN and NFV for IoT.

**Domain Specific IoTs:** Home automation, Cities, Environment, Health and Life Style.

**Module 2: SENSORS AND CONNECTIVITY (09 Periods)**

**Sensors:** Sensor Technology, Actuators, RFID Technology.

**Connectivity**: Internet Connectivity, Internet-Based Communications, IP Addressing in the IoT, Medium Access Control, Application Layer Protocols.

**Module 3: PROTOTYPING AND HARDWARE (08 Periods)**

**Prototyping:** Embedded Computing Basics, Embedded platforms for prototyping.

**Hardware:** Things always connected to the Internet/Cloud, Amazon Web Services for IoT.

**Module 4: DESIGN METHODOLOGY AND CASE STUDIES (10 Periods)**

**Design Methodology:** Purpose and Requirements specifications, Process Specifications, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional View Specification, Operational View Specification, Device and Component integration, Application development.

**Case Studies Illustrating IoT Design:** Home Automation, Cities.

**Module 5: DATA ANALYTICS AND SECURITY (09 Periods)**

**Data Analytics for IoT:**Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis.

**IoT Security:** Vulnerabilities, Security Requirements and Threat analysis, Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
   b) Design and Simulate Servo motor interfacing with Arduino.
2. a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
   b) Design and Simulate Flame Sensor interfacing with Arduino.
3. Design and Implement to capture Gas Sensor and send sensor data to cloud from your NodeMCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.

## RESOURCES

**TEXT BOOKS:**


1. Arshdeep Bahga, Vijay Madisetti, "*Internet of Things – A hands-on approach*," University Press, 2015.
2. Raj Kamal, "*Internet of Things- Architecture and Design Principles*," Mc Graw Hill, 2017.


**REFERENCE BOOKS:**


1. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things,"* Wiley Publishing, 2013.
2. Charles Bell, "*Beginning Sensor Networks with Arduino and Raspberry Pi,*" Apress, 2013.
3. Marco Schwartz, "*Internet of Things with the Arduino Yun,*" Packt Publishing, 2014.
4. Matt Richardson, Shawn Wallace, "*Getting Started with Raspberry Pi,"* Maker Media, Inc, 2012.


**SOFTWARE/TOOLS:**

1. Software: Arduino IDE/ Raspberry Pi OS

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106105166

**WEB RESOURCES:**

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://www.javatpoint.com/iot-internet-of-things

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201006** | **MOBILE COMPUTING** | 3 | - | - | - | 3 |

**Pre-Requisite** Computer Networks
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides to develop an understanding of the ways that mobile technologies can be used for teaching and learning. They will also consider the impact of mobile computing on the field of education.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand concepts of Mobile Communication.
**CO2.** Analyze next generation Mobile Communication System.
**CO3.** Understand network and transport layers of Mobile Communication.
**CO4.** Analyze various protocols of all layers for mobile and ad hoc wireless communication networks.
**CO5.** Understand IP and TCP layers of Mobile Communication.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | 1 | - | 3 | - |
| **CO2** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO3** | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **CO4** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | - | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **3** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | - | **3** | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

### COURSE CONTENT

**Module 1: INTRODUCTION (09 Periods)**

Introduction to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing — Spread spectrum -MAC Protocols — SDMA- TDMA- FDMA- CDMA

**Module 2: MOBILE TELECOMMUNICATION SYSTEM (10 Periods)**

Introduction To Cellular Systems — GSM — Services & Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security — GPRS- UMTS — Architecture — Handover — Security

**Module 3: MOBILE NETWORK LAYER (10 Periods)**

Mobile IP — DHCP — Adhoc– Proactive Protocol-DSDV, Reactive Routing Protocols — DSR, AODV , Hybrid Routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc Networks ( VANET) – MANET Vs VANET — Security.

**Module 4: MOBILE TRANSPORT AND APPLICATION LAYER (08 Periods)**

Mobile TCP– WAP — Architecture — WDP — WTLS — WTP –WSP — WAE — WTA Architecture — WML

**Module 5: MOBILE PLATFORMS AND APPLICATIONS (08 Periods)**

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1 Cisco Certification on Mobility Fundamentals.

2 Cisco Certification on Intro to Packet Tracer Mobile.

## RESOURCES

### TEXT BOOKS:

1. Mobile ComputingTechnology,Applications and service creation ,Asoke K Telukder, Roopa R Yavagal by TMH.
2. Mobile Computing,Raj Kamal by Oxford

### REFERENCE BOOKS:

1. Wireless Communications & Networks, Second Edition,William Stallings by Pearson
2. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
3. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition,TMH

### VIDEO LECTURES:

1. http://www.wirelessdevnet.com/
2. http://www.protocols.com/

### WEB RESOURCES:

1. https://developer.apple.com/
2. https://www.udemy.com
3. http://nptel.ac.in

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202009** | **DATABASE MANAGEMENT ADMINISTRATION** | 3 | - | 2 | - | 4 |

**Pre-Requisite** DBMS

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Topics covered include- relational database, object-oriented database, SQL, ER model, data storage, query processing.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand relational database and object-oriented database.

**CO2.** Formulate relational database using SQL.

**CO3.** Describe ER model and normalization for database design.

**CO4.** Analyze issues in data storage and query processing.

**CO5.** Demonstrate the role and issues in management of data.

## CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO2** | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO5** | - | - | 3 | - | 3 | - | - | - | 3 | - | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**Module 1: INTRODUCTION: (07 Periods)**

Database system, Characteristics (Database Vs File System), Database Users(Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence.

**Module 2: RELATIONAL MODEL: (09 Periods)**

Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

**Module 3: ENTITY RELATIONSHIP MODEL: (11 Periods)**

Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. SQL: Creating tables with relationship, implementation of key and integrity constraints.

**Module 4: SCHEMA REFINEMENT (NORMALIZATION): (09 Periods)**

Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF).

**Module 5: TRANSACTION CONCEPT: (09 Periods)**

Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

**1. Activity: Database vs. File System Analysis**

Have students compare the efficiency of database systems versus traditional file systems by organizing a debate or creating a comparative analysis report. Include aspects like data redundancy, security, and ease of access.

**2. Activity: Role-Play as Database Users**

Create a role-play activity where students assume the roles of different database users, such as database administrators, software developers, and end-users, to explore their perspectives and requirements from a database system.

## RESOURCES

**TEXT BOOKS:**

1. Database Management Systems, 3rded, , Raghurama Krishnan, Johannes Gehrke, TMH,
2. Database System Concepts,5thed,Silberschatz, Korth, TMH, 2005.

**REFERENCE BOOKS:**

1. Introduction to Database Systems, 8thed, C J Date, PEA, 2004.
2. Database Management System, 6thedRamezElmasri, Shamkant B. Navathe, PEA, 2019.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos

Coronel, Steven Morris, Peter Robb, Cengage Learning.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=T7AxM7Vqvaw

**WEB RESOURCES:**

3. https://www.javatpoint.com/dbms-tutorial
4. https://www.tutorialspoint.com/dbms/index.htm
5. https://www.geeksforgeeks.org/dbms/
6. https://www.scaler.com/topics/dbms/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA202010 | PROGRAMMING IN C# AND .NET FRAMEWORK | 3 | - | 2 | - | 4 |

**Pre-Requisite** Object Oriented Programming through Java

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** .Net Framework Overview, C# Programming Concepts, String class, OOPS concepts, Delegates and events, Exception Handling, garbage collector, generics and collection, Basics of Windows Programming, Windows Forms, menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling, ADO.Net-Object Model.

**COURSE OUTCOMES:** *After successful completion of this course, the students will be able to:*

**CO1.** Understand .Net Framework and C# Programming Concepts

**CO2.** Describe the OOP Concepts and Exception Handling methods.

**CO3.** Apply multiple Event handling methods.

**CO4.** Describe ADO.Net-Object Model and Data Bound controls .

**CO5.** Create ASP.net Framework related applications with valid controls.

### CO-PO-PSO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 |
| CO2 | 2 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 3 | - | 3 |
| CO4 | 2 | 2 | 3 | - | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| CO5 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **2** | **2** | **2** | **2** | **1** | **-** | **-** | **-** | **-** | **2** | **-** | **2** | **2** | **2** |

**Correlation Level:** **3- High** **2-Medium** **1- Low**

## DETAILED SYLLABUS:

**Module – 1 INTRODUCTION TO .NET FRAMEWORK (9 periods)**

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL , Introduction to Visual Studio.Net-C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods , Conditional statements, loops, arrays , Collection classes: ArrayList , HashTable, Stack ,Queue, indexers and properties.

**Module – 2 INTRODUCTION TO C# (9 periods)**

String class: methods and properties of string class, enumerations, boxing and unboxing, OOPS concepts: Encapsulation, data hiding, inheritance, interfaces, polymorphism, operator overloading, overriding Methods, Static Class members, Delegates and events. Exception Handling, garbage collector, generics and collection

**Module – 3 EVENT DRIVEN PROGRAMMING IN WINDOWS (9 periods)**

Basics of Windows Programming- Event Driven Programming, Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, imagelist, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.

**Module – 4 ADO.NET-OBJECT MODEL (9 periods)**

Introduction to ADO.Net-Object Model- System. Data Namespace- Data Bound controls-Connected Mechanism-Disconnected mechanism-.Net Data Providers.

**Module – 5 FILES, STREAMS AND ASP .NET FRAMEWORK (9 periods)**

Files: System.IO, directory and file types, Stream readers and stream writers, working with binary data. Overview of the ASP.net Framework: Using the Standard Controls, Using the Validation Controls, Using the Rich Controls.

***Total Periods: 45***

***Topics for self-study are provided in the lesson plan***

## EXPERIENTIAL LEARNING:

1. Write a program to C# to find the smallest single digit factor for a given value.

2. Write a program in C# to print a number if it is prime; otherwise display the largest factor of that number.

3. Write a C# programs to demonstrate the concepts of Structures and Enumerations.

4. Write a C# programs to demonstrate the concepts of Constructors and Inheritance.

5. Write a C# programs to demonstrate the concepts of Polymorphism.

6. Write a C# programs to demonstrate the concepts of Label, Text Box and Button controls.

7. Write a C# programs to demonstrate the concepts of Combo Box and List Box controls.

8. Create a Windows application in C# for registration form and fill the details and when you click the submit button it display the details in the message box.

9. Create a Windows application in C# having two text boxes and three buttons named as factorial, prime, factorial series. When you click any button the resultant value will be displayed on the second textbox.

10. Create a ADO.NET application in C# to verify if the connection is established with OLEDB and MS-ACCESS.

11. Create a ADO.NET applications in C# to demonstrate the Data Reader, Data Set, Data Adapter and Data View Objects.

12. write a program in C# using StreamReader to read line from file.

**TEXT BOOKS:**

1. C# 4.0 the Complete Reference by Herbert Schildt

2. Latest version of Andrew Trolsens C# text from Apress(Pro C# 5.0 and the .NET Framework 4.5)

**REFERENCE BOOKS:**

1. Robert Powel, Richard Weeks, C# and the .NET Framework, Techmedia

**VIDEO LINKS:**

1. https://www.nptelvideos.com/video.php?id=1751&c=21

2. https://www.nptelvideos.com/visualbasic_net/?pn=1

**WEB RESOURCES:**

1. https://www.javatpoint.com/net-framework

2. https://youtu.be/E1UAorR4Vps

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202011** | **R PROGRAMMING** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Computational Statistics

**Anti-Requisite**

**Co-Requisite**

**COURSE DESCRIPTION:** Introduction to R, R Programming Structures, Doing Math and Simulation in R, Creating Graphs, Probability Distributions, correlation and Regression and Random Forests.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Apply R programming constructs to store and manipulate datasets.
**CO2.** Develop modules using R programming constructs to solve statistical problems.
**CO3.** Perceive data models to perform descriptive and inferential statistical analysis to identify trends, patterns in data.
**CO4.** Create effective visualization using Histograms, Bar plots, Box plots, Scatter plots for exploratory data analysis.
**CO5.** Work independently to solve problems with effective communication.

### CO-PO-PSO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 1 | 1 | 1 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **2** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **3** | - | **-** |

**Correlation Level:** **3- High** **2-Medium** **1- Low**

## COURSE CONTENT

**Module1: INTRODUCTION TO R (08 Periods)**

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

**Module2: R PROGRAMMING STRUCTURES (10 Periods)**

R Programming Structures, Control Statements, Loops, -Looping Over Nonvector Sets,-If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

**Module3 DOING MATH AND SIMULATION IN R (10 Periods)**

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files.

**Module4 GRAPHICS (8 Periods)**

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

**Module5 PROBABILITY DISTRIBUTIONS AND REGRESSION MODELS (9 Periods)**

Probability Distributions, Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA. Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, -Poisson Regression-other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines-Decision-Random Forests.

**Total Periods:45**

## EXPERIENTIAL LEARNING:

Datatypes, Variables, Operators, Data structures – Vectors, Arrays, Matrices, Lists, Data frames; Object oriented programming – S3, S4 classes; Selection statements – if statement, if else statement, switch statement; Iterative statements – For loop, While loop, Repeat loop, Nested loops; Functions – Creating functions, Default values for arguments, Return values, Environment and scope issues, Recursion.

1. Create the vectors:
   a) (1, 2, 3, . . . , 19, 20)
   b) (20, 19, . . . , 2, 1)
   c) (1, 2, 3, . . . , 19, 20, 19, 18, . . . , 2, 1)
   d) (4, 6, 3) and assign it to the name tmp.

   For parts (e), (f) and (g) look at the help for the function rep.
   e) (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3) where there are 10 occurrences of 4.
   f) (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3, 4) where there are 11 occurrences of 4, 10 occurrences of 6 and 10 occurrences of 3.

g) (4, 4, . . . , 4, 6, 6, . . . , 6, 3, 3, . . . , 3) where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.

2. a) Write R code that will generate a vector with the following elements. "aa" "ba" "ca" "da" "ea" "ab" "bb" "cb" "db" "eb" "ac" "bc" "cc" "dc" "ec" "ad" "bd" "cd" "dd" "ed" "ae" "be" "ce" "de" "ee"

b) Write a R program to create a Dataframes which contain details of 5 employees and display summary of the data.

3. a) Create a vector of a data set and treat it as an object. Using the vector and object perform (.) dot product and (x) cross product. Take your own data.

b) "Fizzbuzz" is a simple programming challenge often used at interviews to test very basic programming skill. Your goal is the following: for the numbers 1 to 100, print "fizz" if the number is a multiple of 3, "buzz" if the number is a multiple of 5, "fizzbuzz" if the number is a multiple of both 3 and 5, and simply print the number otherwise.

4. a) Imagine a high school with 1000 lockers all in a row, numbered 1 to 1000 in order. At the start, all of them are closed. 1000 students are sent, one after the other, to change the state of a set of lockers (from open to closed or closed to open). The first student changes the state of all lockers. The second changes the state of every other one (2, 4, 6, 8, . . . ). The third changes the state of every third one (3, 6, 9, 12, . . . ). This process continues until all 1000 students have gone. Write a R program to determine which lockers are open at the end of this process?

b) Write a function chomp() that, given a string, removes from the string any occurrence of the character &, as well as the character to the left of each & character. So, for example, your function should return: > chomp ( " a&c " ) " c " > chomp ( " a&" ) " " > chomp ( " abc " ) " abc "

5. a) Write a function which takes a single argument which is a matrix. The function should return a matrix which is the same as the function argument but every odd number is doubled.

b) Write a function that takes an array of numbers x and returns the smallest number in the array.

**Importance and applications of statistical learning, Types of data, Types of variables, Frequency distributions, Measures of center – Mean, Median, Mode; Measures of spread – Range, Percentile, Quartiles & Interquartile range, Standard deviation, Variance; Correlation and Covariance.**

6. a) Compute descriptive statistics for the data given below.

X: 14, 20, 22, 19, 15, 18, 30, 27
Y: 16, 25, 27, 20, 16, 18, 27, 23

b) Write a R script which will compute the mean and variance of the vector x <- 1:100. Compare with R's internal mean() and var() functions.

7. Write a function to compute running medians. Running medians are a simple

smoothing method usually applied to time-series. For example, for the numbers 7,5, 2, 8, 5, 5, 9, 4, 7, 8, the running medians of length 3 are 5, 5, 5, 5, 5, 5, 7, 7. The first running median is the median of the three numbers 7, 5, and 2; the second running median is the median of 5, 2, and 8; and so on. Your function should take two arguments: the data (say, x), and the number of observations for each median (say, length).

8. Write a R program to perform data import/export (.csv, .xlxs) operations using data frames in R.

9. Write a R program to create bell curve of a random normal distribution.

10. Write a R program to design correlation matrix by choosing appropriate dataset.

## RESOURCES

### TEXT BOOKS:

1. The Art of R Programming, Norman Matloff, Cengage Learning
2. R for Everyone, Lander, Pearson

### REFERENCE BOOKS:

1. Sandip Rakshit, R for Beginners, McGraw Hill, 2017.
2. Seema Acharya, Data analytics using R, McGraw Hill, 2018.

### VIDEO LECTURES:

1. https://www.classcentral.com/course/rprog-1713
2. https://www.youtube.com/playlist?list=PLVext98k2evi8mDNRo4MwIgVgSmwM3cS8
3. https://www.udemy.com/topic/r-programming-language/

### WEB RESOURCES:

1. https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf
2. https://www.tutorialspoint.com/r/r_tutorial.pdf
3. https://www.tutorialsduniya.com/notes/r-programming-notes/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA202012 | PROGRAMMING WITH ANGULAR JS | 3 | - | 2 | - | 4 |

**Pre-Requisite** Object Oriented Programming through JAVA.

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Java Script; Angularjs concepts; Directives and Expressions; Filters; Modules; Forms; services; Server Communication; Views; AngularJS Animation; Deployment Considerations.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Demonstrate knowledge on JavaScript, AngularJS and AngularJS Components.
**CO2.** Design and Develop Single Page Applications (SPA) by analyzing AngularJS and JavaScript
**CO3.** Analyze Declarative vs. Procedural Programming, Model View Controller, Filters.
**CO4.** Implement AngularJS applications by analyzing controllers and directives.
**CO5.** Apply CSS Animation, Transforms and Transitions to add animation in AngularJS applications.

**CO-PO-PSO Mapping Table:**

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | 1 | - |
| CO2 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 |
| CO4 | 1 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 1 | - |
| CO5 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 1 | - |
| **Course Correlation Mapping** | **2** | **2** | **2** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **1** | **1** |

**Correlation Level: 3-High 2-Medium 1-Low**

## DETAILED SYLLABUS:

**MODULE – I: OVERVIEW OF JAVASCRIPT AND BASICS OF ANGULARJS (9 Periods)**
JavaScript: Inclusion of Scripts on a Page, Statements, Functions, Parameters and Return Values, Types and Variables, Primitive Types, JavaScript Operators, Working with Objects, Control Flow, Working with Arrays, Callbacks, and JSON.
AngularJS: Framework, Declarative vs. Procedural Programming, Directives and Expressions, Model View Controller (MVC).

**MODULE – II: FILTERS, MODULES AND DIRECTIVES (9 Periods)**

Filters: Filter, Built-in Filters- Number Filter, Date Filter, limitTo Filter. Modules: Module, Bootstrapping AngularJS, Creating a Custom Filter Directives: Directives, Usage of Directives, Built-in Directives, Event-Handling Directives, Using the API Documentation, Creating a Custom Directive, AngularJS Data Binding an AngularJS Controllers.

**MODULE –III: WORKING WITH FORMS AND SERVICES (9 Periods)**
Forms: HTML Forms, AngularJS Forms, Validating Forms. Services: Services, Use of Services and Creating Services

**MODULE – IV: SERVER COMMUNICATION AND VIEWS (9 Periods)**
Server Communication: Server Communication, Handling Returned Data, Handling Errors. Views: Installing the ngRoute Module, Usage of URL Routes, Defining Routes, Route Parameters, Eager vs. Conservative Routes, Route Configuration Options and HTML5 Mode.

**MODULE – V: ANGULARJS ANIMATION AND DEPLOYMENT CONSIDERATIONS (9 Periods)**
Angula JS Animation: CSS Animation, Transforms, Transitions and Applying Animations. Deployment Considerations: Configuration, Testing, Error Handling, Hide Unprocessed Templates, Minification and Bundling, Managing the Build Process and Deployment.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Create a Static Website using HTML
2. Enhance the Static website created with CSS HTML
3. Implement front end form validation with java script Implement percentage calculator with JS DOMHTML,CSS, Basic programming.
4. Implementing Jquery in web application HTML, CSS, Java script
5. Implement a simple calculator with Angular JS Implement shopping cart with Angular JSHTML,CSS
6. Design Order Form with a total price updated in real time, which contains name of five products and their prices. Create a bill amount for all the products and calculate GST on the billing amount and display total amount.

7. Implement AngularJs to create your Resume.
8. Use Practical No.06 and initialize prices to 0 ( zero) when form loads. (use module, controller & directive).

**OUTPUT**


9. Design a webpage which takes one number as an input and generate its factorial number (use module, controller).
10. Design a webpage which takes inputs product name, product quantity and price. Generate table of entered values. When user clicks on table column title , it should sort that column values. (use filter, array).
11. Design a webpage which display product name and product price using AngularJS $http Service from database. Display the content in tabular format.

Topics for self-study are provided in the lesson plan.

**TEXT BOOK:**

1. Andrew Grant, "Beginning AngularJS, " Apress, 1st Edition, 2015.

**REFERENCE BOOKS**

1. Brad Dayley, "Node.js, MongoDB, and AngularJS Web Development," 2nd Edition, 2018.

2. Agus Kurniawan, "AngularJS Programming by Example," 1st Edition, 2014.

**VIDEO LECTURES:**

1.https://www.youtube.com/watch?v=zKkUN-mJtPQ&list=PL6n9fhu94yhWKHkcL7RJmmXyxkuFB3KSl

2. https://www.youtube.com/watch?v=NSWzs-Jt65w

**WEB RESOURCES:**

- https://www.w3schools.com/angular/
- https://www.studocu.com/in/document/government-engineering-college bhavnagar/electronics-and-communication/190163116026-angular-js-practicals/25526714
- https://www.tutorialspoint.com/angularjs/index.htm

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202013** | **PROGRAMMING IN RUBY** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Object Oriented Programming through JAVA.

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on basics of Ruby Programming concepts, Object oriented programming, Control Structures, arrays, stack, queues, Enumerations, applications of Ruby Programming, Exception Handling Concepts.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate Knowledge on Ruby Constructs, Data types in Ruby, Variables, Constants, and Control Structures in Ruby Running a Ruby program.
**CO2.** Apply the concepts of regular expressions for searching patterns in strings.
**CO3.** Develop and use Ruby modules to provide solutions to problems.
**CO4.** Apply the knowledge of file operations in Ruby for file processing.
**CO5.** Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

## CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO5 | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

### Module 1: INTRODUCTION TO RUBY (07 Periods)

Introduction to Ruby Programming, what is Ruby and its history, Installing and setting up Ruby environment, Basic syntax and data types in Ruby, Variables, Constants, and Control Structures in Ruby Running a Ruby program.

**Module 2: OOPS IN RUBY (09 Periods)**

Object-Oriented Programming in Ruby, understanding objects and classes, Creating classes and objects in Ruby, Encapsulation, Inheritance, and Polymorphism in Ruby, Access modifiers in Ruby, Modules and Mixins in Ruby.

**Module 3: RUBY DATA STRUCTURES AND ALGORITHMS (11 Periods)**

Ruby Data Structures and Algorithms, Arrays and Hashes in Ruby, Working with Strings and Regular Expressions in Ruby, Using Enumerators in Ruby, Recursion and Iteration in Ruby, Sorting and Searching algorithms in Ruby.

**Module 4: WEB DEVELOPMENT IN RUBY (09 Periods)**

Web Development with Ruby, Introduction to Ruby on Rails, creating a basic web application using Ruby on Rails, MVC architecture in Ruby on Rails, Routing, Controllers, and Views in Ruby on Rails, Databases and Active Record in Ruby on Rails.

**Module 5: ADVANCED TOPICS IN RUBY (09 Periods)**

Advanced Topics in Ruby Programming, Meta programming in Ruby, Ruby gems and libraries, Testing in Ruby using RSpec, Debugging techniques in Ruby, Performance optimization in Ruby.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. How to Install Ruby language for Windows Operating System by using Ruby Installer.
2. Ruby program to print Hello World!
3. Ruby program to find the area of the rectangle
4. Ruby program to check leap year
5. Ruby program to print power of a number
6. Ruby program to print Fibonacci series
7. Ruby program to check whether the given number is prime or not
8. Ruby program to find factorial of a given number
9. Ruby program to calculate the sum of all even numbers
10. Ruby program to calculate the sum of all odd numbers up to N
11. Ruby program to count the number of digits in a number
12. Ruby program to print multiplication table of a number

## RESOURCES

**TEXT BOOKS:**

1. The Ruby Programming Language: Everything You Need to Know (Greyscale Indian Edition) Paperback – 10 January 2008 by O'REILLY.

2. Ruby Programming for Beginners: The Simple Guide to Learning Ruby Programming Language Fast! Paperback – 17 December 2019.

**REFERENCE BOOKS:**

1. Ruby on Rails for Beginners: Rails Web Development Programming and Coding Tutorial Paperback – 28 September 2015.
2. "The Ruby Programming Language" by David Flanagan and Yukihiro Matsumoto "Learn Ruby the Hard Way" by Zed A. Shaw.

**SOFTWARE/TOOLS:**

1. www.educba.com/ruby-tools/

2. https://github.com/sidekiq/sidekiq

**VIDEO LECTURES:**

1. https://www.udemy.com/course/introduction-to-ruby-on-rails/
2. https://www.youtube.com/watch?v=t_ispmWmdjY
3. https://www.youtube.com/watch?v=Dji9ALCgfpM
4. https://www.youtube.com/watch?v=MXlZCgh2M6A
5. https://www.youtube.com/watch?v=Dji9ALCgfpM&t=56s

**WEB RESOURCES:**

1. Ruby Basic Programs (includehelp.com)
2. https://www.javatpoint.com/what-is-ruby
3. https://www.tutorialspoint.com/ruby/index.htm
4. https://www.w3schools.io/languages/ruby-introduction
5. https://www.geeksforgeeks.org/ruby-for-beginners/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201007** | **THEORY OF COMPUTATION** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

Finite automata; Nondeterministic Finite automata; Regular expressions; Applications of the pumping lemma; Context-Free Grammars; Normal forms for context-free grammars; pushdown automata; Chomsky hierarchy of languages; Turing machines.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Design finite state machines to recognize formal languages
**CO2.** Understand formal languages using automata.
**CO3.** Analyze different types of grammars in formal languages.
**CO4.** Construct context free grammars for context free languages
**CO5.** Apply Turing machine for different computational problems

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | 3 |
| CO2 | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | - | 2 | - | 3 |
| CO5 | - | 3 | 3 | - | 3 | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: FINITE AUTOMATA: (07 Periods)**

Introduction to Finite automata, the central concepts of automata theory, Deterministic finite automata, Nondeterministic Finite automata, the equivalence of DFA and NDFA, Finite automata with epsilon-transitions, Conversion of epsilon-NFA to NFA and DFA.

**Module 2: REGULAR EXPRESSIONS AND LANGUAGES: (11 Periods)**

Regular expressions, Identity rules, Finite automata and Regular expressions, Applications of regular expressions, Pumping lemma for regular languages, Applications of the pumping lemma.

**Module 3: CONTEXT-FREE GRAMMARS (09 Periods)**

Context-Free Grammars, Parse trees, Applications of context free grammars, Ambiguity in grammars and languages, Normal forms for context-free grammars, the pumping lemma for context-free languages.

**Module 4: PUSH DOWN AUTOMATA (09 Periods)**

Definition of the pushdown automaton, the languages of a PDA, Equivalence of PDA's and CFG's, Deterministic pushdown automata.

**Module 5: TURING MACHINE (09 Periods)**

Turing machine model, Representation of Turing machine, Language acceptability by Turing machine, Design of Turing machine, Techniques for Turing machine construction.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1**.** Imagine you are part of a team developing a new programming language designed to efficiently handle string parsing and pattern matching in text files, tasks that are common in data analysis. Your role involves specifying the pattern matching feature, which must be capable of recognizing patterns described by regular expressions and those that require nested structures (like matching parentheses).

2. Consider a project where you are tasked with improving the search functionality of an online library's website, allowing users to find books and articles based not just on keywords, but also on complex patterns within the text (e.g., specific phrase structures or citation formats).

## RESOURCES

**TEXT BOOKS:**


1. John E. Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd Edition, 2011.
2. John C Martin, Introduction to Languages and the Theory of Computation, TMH, 4th Edition, 2010

**REFERENCE BOOKS:**

1. K.L.P. Mishra and N. Chandrasekaran, Theory of Computer Science: Automata Languages and Computation, PHI Learning, 3rd Edition, 2009.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=3om5BDSkeW4
2. https://www.youtube.com/watch?v=XslI8h7cGDs

**WEB RESOURCES:**

1. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/
2. https://www.javatpoint.com/automata-tutorial
3. https://www.tutorialspoint.com/automata_theory/index.htm
4. https://www.etutorialspoint.com/index.php/theory-of-computation

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202014** | **LINUX PROGRAMMING** | 3 | - | 2 | - | 4 |

**re-Requisite** Operating Systems

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** LINUX operating system features; Architecture of LINUX operating system; LINUX environment; Shell Script; Signals and Sockets

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate Knowledge on LINUX operating system and utilities.

**CO2.** Analyse the Bourne shell, LINUX files, processes and signals to solve problems in Linux operating system.

**CO3.** Design and develop the programs by using LINUX system tools like vi editor, File, Text, Network and Backup utilities to solve computational problems.

**CO4.** Select and apply appropriate techniques such as semaphores, Messages and Shared Memory to develop inter Process communication in Linux.

**CO5.** Work independently or in teams to solve problems with effective Communication.

### CO-PO-PSO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO2** | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | - | 2 | - | 3 |
| **CO5** | - | 3 | 3 | - | 3 | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**MODULE -I: INTRODUCTION TO LINUX FILE SYSTEM (9 Periods)**

**Linux Utilities**- Introduction to Linux file system, vi editor, File handling utilities, security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, seed–scripts, operation, addresses, commands, applications, awk- execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk.

**MODULE-II: SHELL PROGRAMMING (8 Periods)**

**Working With The Bourne Shell:** shell, shell responsibilities, pipes and input Redirection, output redirection, here documents, shell as a programming language, shell meta characters, shell variables, shell commands, the environment, control structures, functions, shell script examples, debugging shell scripts.

**MODULE -III: LINUX FILE, DIRECTORIES and API (10 Periods)**

**Linux Files:** File types, file systems, File attributes, i-nodes, application program interface to files, kernel support files, relationship of C stream pointers and file descriptors, directory files.

**Directories**: Creating, removing and changing Directories- mkdir, rmdir, chdir, obtaining current working directory-getcwd, directory contents, scanning directories- opendir, readdir, rewin functions.

**File API's**: General file APIs, file and record locking, directory file APIs, device file APIs, general file class, regfile class for regular class, dirfile class for directory files, FIFO file class, device file class, symbolic link file class, file listing program.

**MODULE -IV: LINUX PROCESSES AND SIGNALS (9 Periods)**

**Linux Processes**: LINUX kernel support for processes, process APIs, process attributes, change process attributes, Process control - Process creation, replacing a process image, waiting for process, Process termination, internal and external commands, process states and zombies, orphan process, system call interface for process management – fork, vfork, exit, wait, wait pid, exec family, process groups, sessions and controlling Terminal, differences between threads and processes.

**Signals:**LINUX kernel support for signals, signal, signal mask, sigaction, SIGCHLD Signal and the waitpid API, the sig set jmpandsiglongjmp APIs, kill, alarm Interval timers, POSIX. 1b timers, timer class.

**MODULE -V: INTERPROCESS COMMUNICATION AND SOCKETS AND REMOTE PROCEDURE CALLS (9 Periods)**

**Inter process Communications:** Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different system, IPC methods, the UNIX System V IPC methods, UNIX System V messages, Messages Example, UNIX system V semaphores, Semaphore Example, UNIX System V shared memory, Shared memory Example.

**Sockets:** Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs.

**Remote Procedure Calls:** RPC library functions, programming interface, classes.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Execute the following Linux commands.
2. File Handling Utilities and Disk utilities
3. Text Processing Utilities and Backup utilities
4. Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
5. Write a shell script that deletes all lines containing the specified word in one or more

files supplied as arguments to it.

6. Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
7. Write a shell script to find factorial of a given number.
8. Write an awk script to implement below using case control structure.
9. Splitting a Line into Fields.
10. Print multiplication table of a given number
11. Write a C program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.
12. Write a C program to create a Zombie process.
13. Write a C program that illustrates how an orphan is created.
14. Write a C program that illustrates how to execute two commands concurrently with a command pipe.
15. Write a C program that illustrate communication between two unrelated process using named pipe.
16. Write a C program to create a message queue with read and write permissions twrite3 messages to it with different priority numbers.
17. Write a C program that receives the messages (From the above message queue specified in and display them.
18. Write a C program that illustrates suspending and resuming processes using signals
19. Write client and server programs (using c) for interaction between server and client processes using Unix Domain sockets.
20. Write a C program that illustrates two processes communicating using shared memory.

## RESOURCES

### TEXT BOOKS:


1. T. Chan, "UNIX system programming using C++", PHI, 2008.
2. Sumitabha Das, "UNIX Concepts and Applications", TMH,4th Edition, 2008.


### REFERENCE BOOKS:


1. W.R. Stevens, "UNIX Network Programming", PearsonEducation, 2008
2. Graham Glass, King Ables, "UNIX for programmers andusers", Pearson Education, 3rd Edition, 2003.
3. Kernighan and Pike, "UNIX programming environment", Pearson Education, 2006.
4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts," JohnWileyandSons.Inc,8th Edition,2009


### VIDEO LECTURES:

1.https://www.youtube.com/watch?v=_OHi608AbeA&list=PLVlQHNRLflP8WncRgkwFqTOzRf_GSgl00

2.https://www.youtube.com/watch?v=xzEd3yojcHo&list=PLWPirh4EWFpGsim4cuJrh9w6-yfuC9XqI

### WEB RESOURCES:

1. https://nptel.ac.in/courses/117/106/117106113/
2. https://www.edx.org/course/linux-basics-the-command-line-interface
3. https://training.linuxfoundation.org/resources/free-courses/introduction-to-linux/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202015** | **NATURAL LANGUAGE PROCESS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Computational Statistics/ Python Programming

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Language Modeling, Regular Expressions, Text Normalization, Word level analysis, PoS Tagging and Entropy models; Context free grammars and Parsing techniques; Semantics and pragmatics, Discourse analysis and lexical resources.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Show sensitivity to linguistic phenomena and an ability to model them with formal grammars

**CO2.** Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems

**CO3.** Able to design, implement, and analyze NLP algorithms

**CO4.** Able to design, implement, and analyze NLP algorithms

**CO5.** Able to design different language modeling Techniques.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | - | - | - | 3 | 3 | 3 | - | - | 2 | - | 3 | 3 | - |
| CO3 | 2 | 3 | 3 | 3 | - | 2 | 2 | - | - | - | 3 | - | 3 | 3 | - |
| CO4 | 3 | - | - | - | 3 | 3 | - | - | - | - | - | - | 3 | - | - |
| CO5 | 2 | 3 | - | - | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | - | **-** | **3** | **-** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: FINDING THE STRUCTURE OF WORDS (11 Periods)**

**Finding the Structure of Words:** Words and Their Components, Issues and Challenges, Morphological Models

**Finding the Structure of Documents:** Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

**Module 2: SYNTAX ANALYSIS (09 Periods)**

**Syntax Analysis:** Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

**Module 3: SEMANTIC PARSING (08 Periods)**

**Semantic Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

**Module 4: HADOOP ARCHITECTURE (07 Periods)**

Predicate-Argument Structure, Meaning Representation Systems, Software.

**Module 5: DATA ANALYTICS WITH R (10 Periods)**

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohension and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling

**Total Periods: 45**

## EXPERIENTIAL LEARNING

**LIST OF EXERCISES:**

1. To Study Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming).
2. To Study Morphological Analysis.
3. N gram Model
4. POS Tagging
5. Chunking
6. Named Entity Recognition
7. Virtual Lab on Word Generator
8. Mini Project based on NLP Processor

**TEXT BOOKS:**

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

**REFERENCE BOOKS:**

1. Speech and Natural Language Processing - Daniel Jurafsky& James H Martin, Pearson Publications.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=d4gGtcobq8M
2. https://www.youtube.com/watch?v=fNxaJsNG3-s

**WEB RESOURCES:**

1. https://www.udemy.com/course/data-science-natural-language-processing-in-python/?
2. https://www.tutorialspoint.com/natural_language_processing/index.htm
3. https://www.javatpoint.com/nlp
4. www.udemy.com/learn-today/online-course

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202016** | **COMPUTER GRAPHICS AND MULTIMEDIA** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Design two dimensional graphics.
**CO2.** Apply two dimensional transformations.
**CO3.** Design three dimensional graphics.
**CO4.** Apply three dimensional transformations.
**CO5.** Apply Illumination and color models.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | 3 | 2 | 3 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| **CO2** | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 3 | - |
| **CO3** | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **CO4** | 3 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | 3 | - |
| **Course Correlation Mapping** | **3** | **3** | **2** | **2** | **3** | **2** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | **-** | **3** | **-** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: ILLUMINATION AND COLOR MODELS (09 Periods)**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading

the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**Module 2: TWO-DIMENSIONAL GRAPHICS (10 Periods)**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**Module 3: THREE-DIMENSIONAL GRAPHICS (10 Periods)**

Three dimensional concepts; Three dimensional object representations – Polygon surfacesPolygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - BSpline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**Module 4: MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING (08 Periods)**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

**Module 5: HYPERMEDIA (08 Periods)**

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1 Study of Fundamental Graphics Functions.

2 Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm

3 Implementation of Circle drawing algorithms: Bresenham's Algorithm, Mid-Point Algorithm

4 Programs on 2D and 3D transformations 5

5 Write a program to implement Cohen Sutherland line clipping algorithm

6 Write a program to draw Bezier curve.

7 Using Flash/Maya perform different operations (rotation, scaling move etc..) on objects

8 Create a Bouncing Ball using Key frame animation and Path animation.and Path animation.

9 Write a program to perform 2D Transformation on a line.

10 Write a program to draw balloons using in build graphics function and translate it from bottom left corner to right top corner of screen.

## RESOURCES

### TEXT BOOKS:


1. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007 [ UNIT I – III ]
2. Andleigh, P. K and KiranThakrar, —Multimedia Systems and Design‖, PHI, 2003. [ UNIT IV,V ]


### REFERENCE BOOKS:


1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications‖, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice‖, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, —Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics‖, CRC Press, 2010.


### SOFTWARE/TOOLS:

1. Software: J2SDK, Eclipse/Netbeans
2. C++ Turbo Editor
3. **Python IDLE**

### VIDEO LECTURES:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://swayam.gov.in/nd2_cec19_cs04/preview
3. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O
4. https://www.youtube.com/playlist?list=PLrqxgoIHbaCQPHa2LnGX0f-dCIH2MWlFS
5. https://www.youtube.com/playlist?list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR

### WEB RESOURCES:

1. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. https://www.hackerrank.com/domains/data-structures
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://discuss.codechef.com/t/data-structures-and-algorithms/6599
5. https://books.goalkicker.com/AlgorithmsBook/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202021** | **CLOUD PRACTITIONER** | 3 | - | 2 | - | 4 |

**Pre-Requisite** CLOUD COMPUTING

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** A Course provides a detailed discussion on Fundamental of Cloud and AWS Environment. Able to work with AWS Resources along with various services of core computing, Database, and Networking of AWS adopting EC2 Pricing Models. A course also covers to Automate AWS Workloads with the Imperative Approach and the Declarative Approach with launch Configurations and Launch Templates, Auto Scaling Groups, Scaling Actions and Configuration Management.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1**. Demonstrate the concepts of Cloud and AWS Environment,
Cloud Architectures to work with AWS in Virtual Private Cloud.

**CO2**. Apply AWS resources to work with AWS Management Console for AWS Console Mobile Application.

**CO3**. Analyze core compute services, EC2 pricing models, core storage and database services for AWS Implementation.

**CO4**. Identify and use core networking services for automating AWS Workload with AWS CLI, EC2 in cloud.

**CO5.** Work independently or in team to solve problems with effective communications.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| **CO2** | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 |
| **CO3** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 |
| **CO4** | 2 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 |
| **CO5** | - | - | - | - | - | - | - | - | 3 | - | 3 | - | - | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **-** | **-** | **-** | **3** | **-** | **3** | - | **-** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium;1: Low**

## COURSE CONTENT

**Module 1: FUNDAMENTAL OF CLOUD AND AWS ENVIRONMENT (8 Periods)**

**Fundamental of Cloud:** Concepts of Cloud Computing, Highly Available and Scalable Resources, Professionally Secured Infrastructure, Metered Payment Model.

**AWS Environment:** AWS Global Infrastructure: AWS Regions, Regionally Based Services, Globally Based Services, Service Endpoint, AWS Global Infrastructure: Availability Zones, Availability Zone Designations, Availability Zone Networking, Availability Zones and High Availability, AWS Global Infrastructure: Edge Locations, Edge Locations and Cloud Front, Regional Edge Cache Locations, The AWS Shared Responsibility Model, Managed Resources, Unmanaged Resources, Service Health Status, AWS Acceptable Use Policy.

**Module 2: WORKING WITH AWS RESOURCES (9 Periods)**

**Working with AWS Resources:** The AWS Management Console, Accessing the AWS Management Console, Opening a Service Console, Working with Shortcuts, Selecting a Region, The Account Name Menu, Resource Groups, Tag Editor, Tagging Strategies, The AWS Console Mobile Application, The AWS Command Line Interface, Requirements, Installation, Software Development Kits, Mobile Software Development Kits, Internet of Things Device Software Development Kits ,CloudWatch, CloudWatch Metrics. CloudWatch Alarms, CloudWatch Dashboards, CloudWatch Logs, CloudWatch Events, API and Non-API Events, Management and Data Events, Event History, Trails, Log File Integrity Validation

**Module 3: THE CORE COMPUTE SERVICES AND EC2 PRICING MODELS (8 Periods)**

**The Core Compute Services:** Deploying Amazon Elastic Compute Cloud Servers, Amazon Machine Images, EC2 Instance Types, Server Storage: Elastic Block Store and Instance, Store Volumes.

**EC2 Pricing Models:** Simplified Deployments through managed Services, Amazon Lightsail, AWS Elastic Beanstalk, Deploying Container and Serverless Workloads, Containers, Serverless Functions.

**Module 4: THE CORE STORAGE AND DATABASE SERVICES (10 Periods)**

**The Core Storage Services:** Simple Storage Service, Objects and Buckets,S3 Storage Classes, Access Permissions, Encryption, Object Life Cycle Configurations, S3 Glacier, Archives and Vaults, Retrieval Options, AWS Storage Gateway, File Gateways, Volume Gateways, Tape Gateways, AWS Snowball, Hardware Specifications, Security, Snowball Edge,

**The Core Database Services:** Database Models, Relational Databases, Structured Query Language, Non-relational (No-SQL) Databases, Amazon Relational Database Service, Database Engines Licensing, Instance Classes, Scaling Vertically, Storage, Scaling Horizontally with Read Replicas, High Availability with Multi-AZ, Backup and Recovery, Determining Your Recovery Point Objective, DynamoDB, Items and Tables, Scaling Horizontally.

**Module 5: THE CORE NETWORKING SERVICES AND AUTOMATING AWS WORKLOADS (10 Periods)**

**The Core Networking Services:** Virtual Private Cloud, VPC CIDR Blocks, Subnets, Internet Access, Security Groups , Network Access Control Lists, VPC Peering, Virtual Private Networks, Direct Connect, Route, Resource Records, Domain Name Registration, Hosted Zones, Routing Policies, Health Checks, Traffic Flow and Traffic Policies, CloudFront.

**Automating AWS Workloads:** The Imperative Approach, The Declarative Approach, Infrastructure as Code, CloudFormation, Templates, Stacks, CloudFormation vs. the AWS CLI, AWS Developer Tools, CodeCommit,, CodeBuild, CodeDeploy, CodePipeline, EC2 Auto Scaling, Launch Configurations and Launch Templates, Auto Scaling Groups, Scaling Actions, Configuration Management, Systems Manager, OpsWorks,

**Total Periods:45**

## EXPERIENTIAL LEARNING

1. Amazon User Account Creation by access URL with account number. Add Security credentials with Enabling Multi-Factor Authentication to Secure Your Access.
2. Create an EC2 instance and invoke Ubuntu operating system with a set of configuration on amazon web services under IaaS.
3. Create New Amazon Elastic Block Store (Amazon EBS) EBS Volume to EC2 Instance for provides persistent block storage volumes for use with Amazon EC2 instances in the AWS Cloud.
4. Creating Amazon Machine Image (AMI) for provides the information required to launch an instance, which is a virtual server in the cloud.
5. Create your First EC2 windows instance
6. Assign Elastic IP Addresses to Instance (Static IP Address)
7. Amazon Elastic File System: Amazon Elastic File System (Amazon EFS) provides simple, scalable file storage for use with Amazon EC2. With Amazon EFS, storage capacity is elastic, growing and shrinking automatically as to add and remove files, to applications to store as they require, when they need it.
8. Launch RDS Instance Amazon Relational Database Service (Amazon RDS) which is a web service that makes it easier to set up, operate, and scale a relational database in the cloud.
9. Accessing MySQL Instance Using Workbench.
10. Create AWS S3 Bucket – (Object Storage) Amazon Simple Storage Service (Amazon S3) which is storage for the Internet. Use Amazon S3 to store and retrieve any amount of data at any time, from anywhere on the web.
    i) AWS S3 Lifecycle Management
    ii) S3 Bucket Replication to Cross-Region
    iii) S3 Bucket Policies to control Access
11. Create VPC – Virtual Private Cloud (isolated Network)
    i) Create subnets
    ii) Create Internet gateway and attach to VPC
    iii) Create Virtual Private Gateway and Attach to VPC

## RESOURCES

**TEXT BOOKS:**


1. Ben Piper and David Clinton "AWS Certified Cloud Practitioner," John Wiley & Sons, Inc., ISBN: 978-1-119-49070-8,2019.
2. Cloud Practitioner (CLF-C01) Cert Guide, 1/E by Anthony Sequeira, PEARSON INDIA
3. Aws Certified Cloud Practitioner by Neville Dawson, Dilaber Consulting Ltd


**REFERENCE BOOKS:**


1. Dennis Hutten "AWS: The Beginners Guide to Amazon Web Services",ASIN : B0757XM97V,2017.
2. Gordon Wong, "AWS Basics: Beginner's Guide," Createspace Independent Pub, ISBN: 978-1542885751, February 2017.
3. Aurobindo Sarkar and Amit Shah, "Learning AWS," ISBN:978-1784394639, Packt Publishing,2015
4. Bernard Golden, "Amazon Web Services for Dummies, ISBN:: 978-1118571835,Dummies; 1st edition,2013.
5. Andreas Wittig and Michael Wittig "Amazon Web Services in Action", Manning; 2nd edition, 2018.


**SOFTWARE/TOOLS:**

1. Amazon EC2
2. Amazon S3
3. Amazon DynamoDB
4. AWS Aurora

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=SOTamWNgDKc
2. https://www.youtube.com/watch?v=3hLmDS179YE
3. https://www.youtube.com/watch?v=XjPUyGKRjZs

**WEB RESOURCES:**

1. https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2
2. https://aws.amazon.com/training/digital/aws-cloud-practitioner-essentials/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202017** | **CLOUD ARCHEITECTURE AND DESIGN** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Cloud computing

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Topics covered include- distributed system models, different cloud service models, service oriented architectures, cloud programming and software environments, resource management.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand fundamentals and various paradigms of computing

**CO2**. Demonstrate cloud characteristics and models.

**CO3**. Identify the ways in which the cloud can be programmed and deployed.

**CO4**. Recognize the services and platform of cloud

**CO5**. Design different cloud services from different vendors.

## CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 |
| CO2 | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO5 | - | - | - | - | 3 | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: COMPUTING PARADIGMS: (07 Periods)**

High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing,

Optical Computing, Nano computing

**Module 2: CLOUD COMPUTING FUNDAMENTALS: (09 Periods)**

Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity.

**Module 3: CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT (11 Periods)**

Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud.

**Module 4: CLOUD SERVICES AND PLATFORMS (09 Periods)**

Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers.

**Module 5: CLOUD SERVICE PROVIDERS (09 Periods)**

Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM.

**Total Periods: 45**

## EXPERIENCE LEARNING

1. Implement a parallel algorithm using MPI. Measure and compare its performance on a single core versus multiple cores.

2. Configure a distributed file system on a cluster and simulate a node failure. How does the system respond?

3. Create a small application that utilizes both cloud and grid computing. Analyze and document the differences in setup, cost, and performance.

4. Deploy a VM on a cloud platform, install a web server, and dynamically adjust its resources based on simulated load.

5. Use a cloud storage service to host and manage a static website. Explore the service's interface for asset management and access control.

6. Setup a VPC and demonstrate the configuration of its network connectivity using subnets, gateways, and route tables.

7. Migrate a local web application to the cloud. Document the migration process, focusing on changes in the application architecture and deployment.

8. Deploy a Hadoop cluster using a cloud service and run a MapReduce job. Discuss the impact of different Hadoop schedulers on the job execution.

9. Use a cloud-based analytics service to analyze a dataset. Highlight key findings and how cloud analytics can influence business decisions.

10. Compare the execution of a serverless function (e.g., AWS Lambda vs. Google Cloud Functions) in terms of performance, cost, and ease of use.

## RESOURCES

### TEXT BOOKS:


1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Arshadeep Bhaga, Vijay Madisetti, "Cloud Computing A Handson Approach", Universities Press, 2018


### REFERENCE BOOKS:


1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.
4. Chris Hay, Brian Prince, "Azure in Action" Manning Publications [ISBN: 9781935182481],2010.
5. Henry Li, "Introducing Windows Azure" Apress; 1 edition [ISBN: 978-14302-2469- 3],2009.


### VIDEO LECTURES:

1. https://www.youtube.com/results?search_query=nptel+cloud+computing
2. https://www.youtube.com/watch?v=2LaAJq1lB1Q&pp=ygUYY2xvdWQgY29tcHV0aW5nIHBsYXlsaXN0

### WEB RESOURCES:

1. https://www.javatpoint.com/cloud-computing
2. https://www.geeksforgeeks.org/architecture-of-cloud-computing/
3. https://www.guru99.com/architecture-of-cloud-computing.html
4. https://www.w3schools.in/cloud-computing/cloud-computing-architecture

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202018** | **CLOUD ARCHITECT** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Cloud computing

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Virtualization and Containerization technologies, VPC, VPN, Cloud architecture design principles, cloud service providers, Hybrid and Nulti-cloud strategies, Cloud security and Identity management, Cloud Migration, integration and deployment strategies, Cloud Cost optimization, Cloud Monitoring and governance frameworks.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the concepts of cloud architecture, benefits, virtualization and containerization technologies, network architectures to create VPC, VPN.

**CO2.** Analyze the pricing models and cost management strategies to implement cloud architecture design principles.

**CO3.** Design applications by using hybrid and multi-cloud architectures and provide security by using network security and firewalls.

**CO4.** Solve complex problems by cloud migration, integration and deployment strategies by implementing cost optimization tools.

**CO5.** Make use of governance frameworks, self service provisioning and monitoring strategies in the development of applications.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 |
| CO2 | 3 | - | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO5 | - | - | - | - | 3 | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: CLOUD ARCHITECTURE, INFRASTRUCTURE AND NETWORKING (09 Periods)**

**Introduction to Cloud Architecture:** Importance of cloud architecture, cloud adoption, Benefits and challenges of cloud adoption.

**Cloud Infrastructure and Networking:** Virtualization and containerization technologies, Cloud infrastructure components (compute, storage, network), Network architectures and connectivity options (VPC, VPN, Direct Connect), Cloud-based security and compliance considerations.

**Module 2: CLOUD ARCHITECTURE DESIGN PRINCIPLES AND CLOUD SERVICE PROVIDERS (09 Periods)**

**Cloud Service Providers:** Overview of major cloud providers (e.g., AWS, Azure, Google Cloud), Comparison of cloud platforms and services, Pricing models and cost management strategies.

**Cloud Architecture Design Principles:** Scalability, elasticity, and high availability, Fault tolerance and disaster recovery, Resilient and distributed system design, Performance optimization and monitoring.

**Module 3: HYBRID AND MULTI-CLOUD ARCHITECTURES & CLOUD SECURITY AND IDENTITY MANAGEMENT (09 Periods)**

**Hybrid and Multi-Cloud Architectures:** Integrating on-premises infrastructure with the cloud, Hybrid cloud architectures and use cases, Multi-cloud strategies and considerations.

**Cloud Security and Identity Management:** Cloud security best practices, Identity and Access Management (IAM) in the cloud, Network security and firewall configurations, Data encryption and key management.

**Module 4 CLOUD MIGRATION AND DEPLOYMENT STRATEGIES & CLOUD COST OPTIMIZATION (09 Periods)**

**Cloud Migration and Deployment Strategies:** Assessing and planning cloud migration projects, Lift-and-shift, re-platforming, and refactoring approaches, Cloud-native application development and deployment, Continuous integration and deployment (CI/CD) in the cloud.

**Cloud Cost Optimization:** Cost models and pricing considerations, Resource provisioning and right-sizing, Monitoring and optimization tools, Reserved instances and spot instances.

**Module 5 CLOUD GOVERNANCE AND MANAGEMENT (09 Periods)**

**Cloud Governance and Management:** Cloud governance frameworks and best practices, Resource tagging and organization, Service catalog and self-service provisioning, Cloud monitoring, logging, and auditing.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

**1. Setting Up a Virtual Private Cloud (VPC):**

Create a VPC with multiple subnets and define network ACLs (Access Control Lists) and security groups.

Configure private and public subnets, internet gateways, and NAT gateways.

Establish connectivity between on-premises infrastructure and the cloud VPC using VPN or Direct Connect.

**2. Implementing High Availability and Load Balancing:**

Deploy a highly available architecture using load balancers, autoscaling groups, and multiple instances across availability zones.

Test the failover and load balancing capabilities by simulating traffic spikes or instance failures.

**3. Securing Cloud Resources:**

Implement security best practices by configuring network security groups, implementing SSL/TLS certificates, and setting up Web Application Firewalls (WAF).

Use IAM (Identity and Access Management) to manage user access and permissions to different cloud resources.

Perform security audits and vulnerability assessments using security tools and services provided by the cloud platform.

**4. Implementing Serverless Architecture:**

Build a serverless application using services like AWS Lambda, Azure Functions, or Google Cloud Functions.

Implement event-driven architecture by integrating services like SNS (Simple Notification Service), SQS (Simple Queue Service), or Pub/Sub.

**5. Data Storage and Database Management:**

Set up and configure cloud-based storage services such as Amazon S3, Azure Blob Storage, or Google Cloud Storage.

Provision and manage databases using services like Amazon RDS, Azure SQL Database, or Google Cloud SQL.

Implement backup and disaster recovery strategies for databases.

**6. Containerization and Orchestration:**

Use Docker to containerize applications and create Docker images.

Deploy and manage containers using container orchestration platforms like Kubernetes, AWS ECS (Elastic Container Service), Azure Kubernetes Service, or Google Kubernetes Engine.

**7. Cloud Migration and Hybrid Architecture:**

Perform a lift-and-shift migration of an on-premises application to the cloud platform of your choice.

Implement a hybrid architecture by connecting on-premises infrastructure with cloud resources using VPN or Direct Connect.

**8. Cost Optimization and Resource Management:**

Monitor and analyse cloud resource usage to identify cost optimization opportunities.

Implement cost-saving techniques such as rightsizing instances, leveraging reserved instances, or using spot instances.

Implement automated resource provisioning and management using Infrastructure as Code (IAC) tools like AWS CloudFormation or Azure Resource Manager.

**9. DevOps and Continuous Integration/Deployment (CI/CD):**

Set up a CI/CD pipeline using tools like Jenkins, AWS CodePipeline, Azure DevOps, or Google Cloud Build.

Automate application deployments, testing, and infrastructure provisioning using infrastructure-as-code principles.

## RESOURCES

### TEXT BOOKS:


1. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", PHI publisher, 1st Edition, 2013.

2. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models", Wiley CIO series, 1st Edition, 2014.

3. Joe Baron, Hisham Baz, and Tim Bixler "AWS Certified Solutions Architect - Official Study Guide", Sybex, Study Guide, 2016.


### REFERENCE BOOKS:


1. Ritesh Modi "Azure for Architects", Packt Publishing Limited, Standard Edition, 2017.

2. Dan Sullivan "Google Cloud Certified Professional Cloud Architect Study Guide", Sybex, 1st Edition, 2019.

3. Andrea Mauro and Paolo Valsecchi "Mastering VMware vSphere 6.7", Packt Publishing, 2nd Edition, 2019.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=-8O32k26RWA
2. https://www.youtube.com/watch?v=sd0qz4HnbpE

### WEB RESOURCES:

1. www.opengroup.org/subjectareas/cloud-computing
2. www.cloudcomputing-news.net
3. www.reddit.com/r/cloudcomputing
4. www.cncf.io
5. www.thecloudcast.net
6. www.microsoft.com/en-us/ignite

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201008** | **CRYPTOGRAPHY AND NETWORK SECURITY** | 3 | - | - | - | 3 |

**Pre-Requisite** Computer Networks

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

This course provides a detailed discussion and study of techniques for secure communication in the presence of third parties. More generally, it is about constructing and analyzing protocols that overcome the influence of attackers or outside people and which are related to various aspects in information security such as data confidentiality, data integrity, authentication, and non-repudiation.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.

**CO2.** Apply the different cryptographic operations of symmetric cryptographic algorithms

**CO3.** Apply the different cryptographic operations of public key cryptography

**CO4.** Apply the various Authentication schemes to simulate different applications.

**CO5.** Understand various Security practices and System security standards

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 3 |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION (07 Periods)**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture .

**Module 2: SYMMETRIC CRYPTOGRAPHY (09 Periods)**

Algebraic structures - Modular arithmetic-Euclid‘s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis, Block cipher design principles

**Module 3: PUBLIC KEY CRYPTOGRAPHY (10 Periods)**

Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm -RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**Module 4: MESSAGE AUTHENTICATION AND INTEGRITY (09 Periods)**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**Module 5: SECURITY PRACTICE AND SYSTEM SECURITY (10 Periods)**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Simulate a network attack on a test system and implement basic security mechanisms as per the OSI security architecture. Document the steps and results.

2. Create a set of security policies for a hypothetical organization, focusing on legal, ethical, and professional aspects. Present your policies in a report.

3. Implement the SDES algorithm in a programming language of your choice. Perform encryption and decryption of a sample text and analyze the output.

4. Conduct differential cryptanalysis on a simplified version of the DES algorithm. Report your findings and the implications for DES's security.

5. Implement the RSA algorithm and demonstrate key generation, encryption, and decryption processes with a simple text message.

6. Simulate the Diffie-Hellman key exchange mechanism in a program and discuss its significance in secure communications through a brief report.

7. Implement a digital signature using the DSS algorithm. Test its integrity by modifying the signed document and attempting to verify the signature.

8. Develop a simple application that uses SHA-256 for hashing documents. Demonstrate how a small change in the document produces a significant change in the hash.

9. Configure a firewall to block and allow specific types of traffic on a network you set up. Document the configuration process and the rationale behind your rules.

10. Implement basic email security using PGP. Send encrypted and signed emails within a test environment and verify their integrity and authenticity.

## RESOURCES

### TEXT BOOKS:


1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006

2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.


### REFERENCE BOOKS:


1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd


### SOFTWARE/TOOLS:

1. https://www.wireshark.org/
2. https://gnupg.org/

### VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/106105031/L01.html
2. https://www.youtube.com/watch?v=o_yhTB0kP0Q
3. https://www.coursera.org/lecture/managing-network-cybersecurity/cryptography-and-network-security-w9SuJ

### WEB RESOURCES:

1. https://www.tutorialspoint.com/cryptography/index.htm
2. https://www.geeksforgeeks.org/cryptography-introduction/
3. https://www.gatevidyalay.com/tag/cryptography-and-network-security-tutorial/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201009** | **CYBER SECURITY** | 3 | - | - | - | 3 |

**Pre-Requisite** Computer Networks

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Cybercrime, Cyberoffenses, Phishing, Identity theft, Cybercrime in mobile and wireless devices, Organizational measures for handling mobile devices, Security implications on using mobile devices, Tools and methods used in cybercrime, Forensics of computer and organizational implications.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyze the methods of cybercrime, information security, cyber criminals.
**CO2.** Illustrate the Cyber offenses, Categories of cybercrime and how criminals plan the attacks.
**CO3.** Investigate tools used for cybercrime to protect computational assets
**CO4.** Illustrate the concepts of Cyber forensics, Digital Forensics Science, Digital Evidence, Collecting Electronic Evidence, Network Forensics.
**CO5** Study the IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**Module 1: CYBER CRIME (09 Periods)**

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Global perspective on cybercrimes

**Module 2: CYBER OFFENSES AND ATTACKS (10 Periods)**

Cyber offenses: Categories of cybercrime, How criminals plan the attacks, Social engineering, Cyberstalking, Cybercafe and cybercrimes, Botnets, Attack vector.
Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft)

**Module 3: TOOLS AND METHODS USED IN CYBERCRIME (10 Periods)**

Proxy servers and anonymizers, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

**Module 4: COMPUTER FORENSICS (08 Periods)**

Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Digital Forensics Life Cycle -The Digital Forensics Process, The Phases in Computer Forensics/Digital Forensics, Precautions to be Taken when Collecting Electronic Evidence, Network Forensics

**Module 5: IPR ISSUES (08 Periods)**

Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social computing and the associated challenges for organizations, Forensics best practices for organizations

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. steps to attack a victim computer by using "ProRat" trojan tool
2. Perform the packet sniffing mechanism by download the “wireshark” tool and extract the packets
3. Perform the task of creating mail messages by using fake mail id by using the "fake mailer" website ( https://emkei.cz)

### TEXT BOOKS:


1. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. Nilakshi Jain, **Ramesh Menon, Cyber Security and Cyber Laws, Wiley, 2020.**


### REFERENCE BOOKS:


1. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Cybersecurity Essentials, 1st Edition, Sybex, 2018.
2. Erdal Ozkaya, Cybersecurity: The Beginner's Guide, 1st Edition, Packt Publishing, 2019.
3. Yuri Diogenes, Erdal Ozkaya, Cybersecurity: Attack and Defense Strategies, 2nd Edition, Packt Publishing, 2019.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=JcaYwZ5fqjU&t=27s
2. https://www.youtube.com/watch?v=z5nc9MDbvkw

**WEB RESOURCES:**

1. http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf
2. Alessandro Parisi, Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing, 2019.

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201011** | **ETHICAL HACKING** | 3 | - | - | - | 3 |

**Pre-Requisite** Computer Networks

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Ethical hacking, Network and computer attacks, Foot printing, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.
**CO2.** Select and apply foot printing and port scanning tools to discover vulnerabilities of the computer system.
**CO3.** Investigate hacking techniques and tools to maintain computer security.
**CO4.** Analyze Ethical Hacking intrusion prevention.
**CO5.** Analyze cryptosystems and network protection systems for information security.

### CO-PO-PSO Mapping Table

| Course Out come | Program Out comes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | - | - | - | - | 3 | - | - | - | - | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | - |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | - |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | - |
| **CO5** | 2 | 2 | 2 | 2 | | | - | - | - | - | - | - | 2 | 2 | - |
| **Course Correlation Mapping** | **3** | **2** | **3** | **2** | **3** | **2** | **-** | **1** | **-** | **-** | **-** | **-** | **3** | **2** | **-** |

**Correlation Levels: 3: High; 2:Medium; 1:Low**

## COURSE CONTENT:

**Module 1 ETHICAL HACKING,NETWORK AND COMPUTERATTACKS (9 Periods)**

**Introduction to Ethical Hacking**: The role of security and penetration testers, Penetration-Testing methodologies, What you can and cannot do legally.

**Network and Computer Attacks:** Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attack son networks and computers, Addressing physical security.

**Module 2 TCP/IP CONCEPTS AND SOCIAL ENGINEERING (9 Periods)**

**TCP/IP Concepts:** Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing.
**Social Engineering:** What is social engineering, What are the common types of attacks, Understand insider attacks, Understand identity theft, Describe phishing attacks, Understand online scams, Understand URL obfuscation, Social engineering counter measures.

**Module 3 FOOTPRINTINGANDPORTSCANNING (9 Periods)**

**Foot printing:** Using web tools for foot printing, Conducting competitive intelligence, Using domain name system zone transfers.
**Port Scanning:** Port scanning, Using port scanning tools, Conducting ping sweeps, Understanding scripting.

**Module 4 SYSTEM HACKING (9 Periods)**

System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files, Steganographytechnologies,Howtocoveryourtracksandevidences;Sniffers-Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking - Spoofing vs.hijacking,Typesofsessionhijacking,Sequenceprediction,Stepsinperformingsession hijacking, Preventing session hijacking.

**Module 5 CRYPTOGRAPHY, NETWORK PROTECTION SYSTEMS (9Periods)**

Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography attacks.
Network Protection Systems: Understanding routers, Firewalls, Honeypots

## EXPERIENTIAL LEARNING :

1. Analyze Windows Server 2019 vulnerabilities as reported by CVE. Write a detailed report on Memory Corruption Vulnerability.

2. User SQL Injection

Build a Web Application running with LAMP (Linux, Apache, MySQL and PHP) architecture introducing 'User SQL Injection' and write injection queries. User Input:Users are presented with a website that has a form with an empty query box. Users put their injection in the box and submit the form. One level does not have an input box, but rather asks the user to

perform a SQL injection through a GET request. Each level has a provided query, which is what the user input will be inserted into. The provided query is given for the first few levels but is removed later to provide a challenge.

For the user input, the user should input an injection that allows them to log in as a specific user, in this example, the injection**admin'#**allows the user to log in as admin.

**Fetch Entries:** The rows of the table are traversed and entries are retrieved that match the SQL query. When username is given with value**admin'#**, the row of the table with username "**admin**" will be fetched.

**Website Output:** One or more rows in the requested data is displayed on the website as a tabular form.

Display all rows of a table:

In the first level, users may be given a form with an input box asking for a username. After submitting a username, all rows in the table users_level1 that matched the given username will be retrieved and displayed. The challenge of this level is to use SQL injection to display all rows of this table, even though the user does not know all the usernames. The query with the injection is

**SELECT username FROM users_level1 WHERE username = '' OR ''=''**

where the text in red is the user input. The WHERE clause now checks if the username is the empty string, or if the empty string is equal to the empty string. As the second comparison will always be true, all rows

**TEXTBOOKS:**


1. Michael T. Simpson, Kent Backman, James E. Corley, Hands-On Ethical Hacking and Network Defense, 3rdEdition, Cengage Learning, 2017.
2. KimberlyGraves,CEH:OfficialCertifiedEthicalHackerReviewGuide,Wiley,2007.


**REFERENCEBOOK:**


1. MichaelGregg, Certified Ethical Hacker(CEH)Certguide,3rdEdition,Pearson,20


**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=3Kq1MIfTWCE&list=PLWKjhJtqVAbnklGh3FNRLECx_2D_vK3mu
2. https://www.youtube.com/watch?v=6d0VY37lNfA&list=PL1dx_7g6scPKn5_x2NJ6pONit1dJ1OaYU

**WEB RESOURCES:**

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://www.youtube.com/watch?v=t8nwQ6At0CU&list=PL7AT7LU4byRKMBCEWpeZ4QOd2VWvdIHXU

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201012** | **SOFTWARE PROJECT MANAGEMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** Software Engineering

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

Software project management and its importance, Plans, methods and methodologies, Software processes and process models, Stepwise project planning, Software effort estimation, Cost estimation, Activity planning, Plan models, Critical path and critical activities, Risk management, Resource allocation, Monitoring and control, Managing people, Software quality.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

| | |
|---|---|
| **CO1** | Apply knowledge of software project management, project plans, process models for efficient implementation and completion of projects. |
| **CO2** | Estimate effort for the project to assign and schedule available resources in the most effective and economical way possible. |
| **CO3** | Develop network models for sequences of activities in a project for effective project management. |
| **CO4** | Identify the risk factors, monitor the progress and quality of projects to take mitigating actions. |
| **CO5** | Recognize the need for organizational behavior, teamwork and communication to improve the performance on projects. |

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 1 | 3 | 1 | - | 1 | - | - | 1 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **2** | **-** | **2** | **-** | **-** | **2** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTIONTO SOFTWARE PROJECT MANAGEMENT (09 Periods)**

Importance of software project management, Defining project, Software projects versus other types of project, Contract management and technical project management, Activities covered by software project management, Plans, methods and methodologies, Categorizing software projects, Project charter, Stakeholders, Setting objectives, The business case, Project success and failure, Management and management control, Project management life cycle, Traditional versus modern project management practices.

**Module 2: PROJECT PLANNING (09 Periods)**

Step wise project planning, Select project, Identify project scope and objectives, Identify project infrastructure, Analyze project characteristics, Identify project products and activities, Estimate effort for each activity, Identify activity risks, Allocate resources, Review/publicize plan, Execute plan/lower levels of planning

**Module 3: PROJECT APPROACH AND EFFORT ESTIMATION (09 Periods)**

Build or buy, Choosing methodologies and technologies, Software processes and process models, Choice of process models, Spiral model, Software prototyping, Incremental delivery, Agile methods, Software effort estimation techniques, Bottom-up estimating, The top-down approach and parametric models, Albrecht function point analysis, COCOMO II.

**Module 4: RESOURCE ALLOCATION, MONITORING AND CONTROL (09 Periods)**

Identifying resource requirements, Scheduling resources, Creating critical paths, Publishing resource schedule, Cost schedules, Scheduling sequence. Creating framework, Review, Visualizing progress, Cost monitoring, Earned value analysis, Prioritizing monitoring

**Module 5: RISK MANAGEMENT (09 Periods)**

Risk, Categories of risk, Risk management approaches, A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

**1.** Imagine you are initiating a new software project to develop an application that addresses a current market gap in educational technology. Create a comprehensive project charter that includes a definition of the project, identification of stakeholders, and setting clear objectives. Additionally, draft a business case that justifies the investment in this project based on market research and potential ROI. Reflect on how different project management methodologies (traditional vs. modern) could affect the execution of this project.

2. For a software project aimed at developing a mobile health tracking application, perform a step-by-step project planning exercise. Start by defining the project scope and objectives, then identify the necessary infrastructure and project characteristics. Proceed to estimate the effort for each activity, identify risks, and allocate resources. Conclude by drafting a plan review and publication strategy. Reflect on how executing the plan and adapting lower levels of planning could respond to unforeseen project challenges.

3. Choose an existing open-source software project and pretend you are part of the project management team at its initiation. Re-plan the project using the information available about its scope, objectives, and infrastructure. Make effort estimates for key activities, identify risks, and propose a resource allocation plan. Compare your plan with the project's actual development path and results. Discuss the differences and what could have been improved in the planning phase.

## RESOURCES

### TEXT BOOKS:


1. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, 6th Edition, McGraw Hill, 2018


### REFERENCE BOOKS:


1. Michele Sliger and Stacia Broderick, The Software Project Manager's Bridge to Agility, Addison-Wesley, 2008.
2. S.A. Kelkar, Software Project Management: A Concise Study, PHI, 2012.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=hCmf20BUWUg
2. https://freevideolectures.com/course/4071/nptel-software-project-management
3. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

### WEB RESOURCES:

1. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
2. https://www.javatpoint.com/software-project-management

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201013** | **SOFTWARE ARCHITECTURE AND DESIGN PATTERNS** | 3 | - | - | - | 3 |

**Pre-Requisite** SOFTWARE ENGINEERING

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

The architectural pattern captures the design structures of various systems and elements of software so that they can be reused. During the process of writing software code, developers encounter similar problems multiple times within a project, within the company, and within their careers

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the architecture, creating it and moving from one to any, different structural patterns.
**CO2.** Analyze the architecture and build the system from the components
**CO3.** Design creational and structural patterns.
**CO4.** Learn about behavioral patterns.
**CO5.** Analyze the architectural structures.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 1 | 3 | 1 | - | 1 | - | - | 1 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **2** | **-** | **2** | **-** | **-** | **2** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1:** **(09 Periods)**

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

**Module 2:** **(09 Periods)**

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

**Module 3:** **(09 Periods)**

Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational patterns – Factory, Abstract Factory, Prototype and Singleton

**Module 4:** **(09 Periods)**

Structural patterns – Composite, Decorator, Adapter, Façade and Flyweight.

**Module 5:** **(09 Periods)**

Behavioral patterns- Chain of responsibility, Command, Interpreter, Mediator, State, Template and Observer.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Conduct an architectural evaluation of a software system you are familiar with, using the Architecture Tradeoff Analysis Method (ATAM) to assess its quality attributes. Identify at least two architectural decisions that significantly impact the system's performance and security. Propose alternative decisions and predict how they would alter the system's attributes. Summarize the lessons learned about balancing competing quality attributes through architectural design decisions.

2. Create a catalog of creational patterns for your organization or a hypothetical software development context. For each pattern, provide a description, when to use it, its benefits, and potential drawbacks. Present this catalog to peers or stakeholders and gather feedback on its usability and completeness. Reflect on the role of pattern catalogs in solving design problems and facilitating pattern selection and usage.

## RESOURCES

### TEXT BOOKS:


1. Len Bass, Paul Clements & Rick Kazman, Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
2. Erich Gamma, Design Patterns, 1st Edition, Pearson Education,1995.

**REFERENCE BOOKS:**


1. Luke Hohmann , Beyond Software architecture, Addison wesley, 2003.
2. David M. Dikel, David Kane and James R. Wilson, Software architecture, 1st Edition, Prentice Hall,2001


**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=0DmE2uA1dOw
2. https://www.youtube.com/watch?v=lTkL1oIMiaU
3. https://www.udemy.com/course/software-architecture-learnit/

**WEB RESOURCES:**

1. https://www.tutorialspoint.com/software_architecture_design/software_architecture_design_tutorial.pdf
2. https://www.cs.toronto.edu/~sme/CSC340F/slides/21-architecture.pdf
3. https://www.tutorialspoint.com/software_architecture_design/index.htm

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA202019 | SOFTWARE TESTING AND QUALITY ASSURANCE | 3 | - | 2 | - | 4 |

**Pre-Requisite** Software Engineering

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Software Testing basics: Goals, Defects, Terminology, Methodology, Software Testing Life Cycle (STLC) in Software Development Life Cycle (SDLC), Verification and Validation; Software Testing Techniques: White box testing, Black Box Testing, Regression testing; Test Management: Test Planning, Design and Specifications; Test Automation: Tool selection and Guidelines, Software Quality Assurance.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand concepts of Software Testing, Terminology and Methodology, Test Management and Metrics to analyze Software testing and Software Quality Assurance concepts for maintain the quality of the software.

**CO2.** Analyze Testing Techniques, Regression Testing and Test Automation strategies to Synthesis the quality of software.

**CO3.** Analyze and apply the Software Quality Factors, Pre-project software quality components.

**CO4.** Analyse test metrics and testing tools to measure the quality of software in real time applications.

**CO5.** Workindependentlyorinteamstosolveproblemswitheffective Communication.

### CO-PO-PSO Mapping Table

| Course Outcome | Program Outcomes | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| **CO2** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | - | - |
| **CO3** | 1 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | - | - |
| **CO4** | 2 | 2 | 3 | - | - | - | - | 2 | - | - | - | 3 | - | - |
| **CO5** | - | - | - | - | - | 2 | - | - | 2 | 2 | - | 2 | 1 | 3 |
| **Level of correlation of the course** | **2** | **3** | **2** | **2** | **3** | **2** | - | **2** | **2** | **2** | **-** | **3** | **1** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

### UNIT-I : INTRODUCTION TO SOFTWARE TESTING (9 Periods)

Introduction, Evolution of Software Testing, Myths and Facts, Goals and Psychology of Testing, Definitions, Model for Software Testing, Terminology, Software Testing Life Cycle, Software Testing Methodology, Static vs Dynamic Testing.

**Verification and Validation**: Verification and Validation Activities, Verification of High-Level Design and Low-Level Design.

### UNIT-II: TESTING TECHNIQUES (9 periods)

**White Box Testing**

Need of white-box testing, Logic coverage criteria, basis path testing, Graph matrices, Loop testing, Data flow testing, Mutation testing.

**Black Box Testing**

Boundary Value Analysis (BVA), Equivalence class testing, State table-based testing, Decision table-based testing, Cause-effect graphing based testing, Error guessing.

### UNIT-III: REGRESSION AND AUTOMATION (9 periods)

**Regression Testing**: Progressive vs. regressive testing, Regression testing produces quality software, Regression testability, Objectives of regression testing, Regression testing types, Regression testing techniques.

**Automation and Testing Tools**: Need for automation, Categorization of testing tools, Selection of testing tools, Costs incurred in testing tools, Guidelines for automated testing.

### UNIT-IV: INTRODUCTION TO SOFTWARE QUALITY AND ASSURANCE (9 Periods)

**Software Assurance:** The software quality challenge, Software quality, Software quality factors Management and its role in software quality assurance.

**Components of SQA**: The components of the software quality assurance system.

**Pre-project Software Quality Components**: Contract review, Development and quality plans.

### UNIT- V: TEST METRICS AND SOFTWARE QUALITY METRICS (9 Periods)

**Test Metrics**: Definition of Software Metrics, Classification of Software Metrics, Size

Metrics. **Software Quality**: Quality metrics, Cost of Quality.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Write the installation procedure of selenium and Java.
2. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in)
3. Design the test cases for testing the e-commerce application
4. Test the e-commerce application and report the defects in it.
5. Develop the test plan and design the test cases for an inventory control system.
6. Execute the test cases against a client server or desktop application and identify the defects.
7. Test the performance of the e-commerce application.
8. Automate the testing of e-commerce applications using Selenium.
9. Integrate TestNG with the above test automation.
10. Mini Project:
    a. Build a data-driven frame work using Selenium and TestNG
    b. Build Page object Model using Selenium and TestNG
    c. Build BDD frame work with Selenium, Test NG and Cucumber

## RESOURCES

### TEXTBOOKS


1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.
2. Naresh Chauhan, Software Testing: Principles and Practices, Oxford University Press,2 nd Edition, 2016.
3. M. G. Limaye, "Software Testing: Principles and Techniques and Tools," Tata McGraw –Hill Education, 1 st Edition, 2012
4. Unmesh Gundecha, Satya Avasarala,"SeleniumWebDriver3PracticalGuide"-SecondEdition2018


### REFERENCES


1. Kshira sagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance-Theory and Practice," John Wiley and Sons, Inc., 2008, ISBN 978-0-471-78911-6 2.
2. Fenton, Pfleeger, "Software Metrics: A Rigourous and practical Approach", Thomson Brooks/Cole, ISBN 981-240-385-X.
3. Boris Beizer, "Software Testing Techniques," Dream Tech Press, 2nd Edition, 2004.
4. William E. Perry, Effective Methods for Software Testing, WILLEY, 3rdEdition
5. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press,1997


### VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2. https://www.youtube.com/watch?v=LNSG-yssisA&t=1s

### WEB RESOURCES:

1. https://www.coursera.org/courses?query=quality%20assurance
2. https://www.geeksforgeeks.org/software-testing-vs-quality-assurance/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201014** | **OPTIMIZATION TECHNIQUES** | 3 | - | - | - | 3 |

**Pre-Requisite** Computational Statistics

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Introduction to optimization; classical optimization techniques; classification of optimization problems; linear programming; Transshipment and Travelling salesman problem; non-linear programming; un-constrained non-linear programming; constrained non-linear programming; dynamic programming; Genetic Algorithm; Ant Colony Optimization.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Model and solve unconstrained optimization problems.

**CO2.** Apply LP Techniques and Conduct Sensitivity analysis for real life Problems.

**CO3.** Apply Non-Linear Programming techniques for real life problems.

**CO4**. Analyze various complex problems by using Dynamic programming approaches.

**CO5.** Model and solve complex problems using evolutionary algorithms to optimize the parameters.

## CO-PO-PSO Mapping Table:

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| **CO3** | 3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| **CO4** | 3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | - |
| **CO5** | 3 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | - |

## COURSE CONTENT:

**Module -1: CLASSICAL OPTIMIZATION TECHNIQUES (09 periods)**

Introduction, Engineering applications of optimization, Statement of an optimization problem, Design vector, Design constraints, Constraint surface, Objective function, Classification of

optimization problems, Single variable optimization, Multi variable optimization without constraints, Multi variable optimization with equality constraints - Lagrange multipliers method; Multi variable optimization with inequality constraint - Kuhn Tucker conditions.

**Module -2: LINEAR PROGRAMMING (09 periods)**

Introduction, Formulation, Primal Simplex method, Dual simplex method, Sensitivity Analysis, Goal programming.

**Module –3: NON-LINEAR PROGRAMMING (09 periods)**

One dimensional minimization methods, classification - Fibonacci method, quadratic interpolation method; classification of unconstrained minimization methods - Powell's method, steepest descent method (Cauchy's method); classification of constrained optimization techniques - interior and exterior penalty function methods.

**Module –4: DYNAMIC PROGRAMMING (09 periods)**

Multistage decision processes, Concept of sub optimization and Principle of optimality, Computational procedure in dynamic programming - Calculus method, Tabular method; Linear Programming problem by dynamic programming approach, Applications - reliability problem, shortest path problem, and capital budgeting problem.

**Module 5: EVOLUTIONARY OPTIMIZATION ALGORITHMS (09 periods)**

Introduction to Evolutionary optimization, genetic algorithm-Mathematical Modeling of Genetic algorithm, Ant Colony Optimization, particle swarm Optimization and differential evolution techniques.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Implement a genetic algorithm to optimize the layout and component selection for a small wind farm to maximize energy production under budget constraints.

2. Use particle swarm optimization (PSO) to design an optimal marketing campaign for a new product launch.

**TEXT BOOKS:**


1. Singiresu S Rao, Engineering Optimization: Theory and Practice, New Age International, 3rdEdition, 2013.
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Engineering Optimization: Methods and applications, Wiley India Pvt. Ltd., 2nd Edition, 2006.
3. Dan Simon, Evolutionary Optimization Algorithms, John Wiley & Sons, 2013.


**REFERENCE BOOKS:**


1. C Mohan and Kusum Deep, Optimization Techniques, New Age International Publishers, 1st Edition, 2010.

Hamdy A. Taha, Introduction to Operations Research, PHI, 10th edition, 2017.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=84HOL_EiJ4M
2. https://www.youtube.com/watch?v=lBXdFu6Rwn4

**WEB RESOURCES:**

1. https://www.geeksforgeeks.org/optimization-techniques-set-1-modulus/
2. https://books.askvenkat.org/optimization-techniques-pdf-free-download/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA203001** | **OBJECT ORIENTED MODELING AND DESIGN** | 3 | - | - | 4 | 4 |

**Pre-Requisite** Software Engineering
**Anti-Requisite** -
**Co-Requisite** -

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Demonstrate knowledge on Things, principles of Object Oriented Development.

**CO2** Analyze the specifications of Class, Use case, Activity, Sequence and State diagrams and develop models using pre conditions and post conditions.

**CO3** Design application artifacts to construct the Logical, Behavioral and Architectural model of an Application.

**CO4** Solve complex system behavior using common modeling techniques of things.

**CO5** Make use of UML Tool such as Rational Rose or Visual Paradigm to design Class, Use Case, Sequence, Collaboration, Activity, State Chart, Component and Deployment Diagrams for an application.

## CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | 2 |
| **CO4** | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | - | - | - | 3 |
| **CO5** | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 |
| **Course Correlation Mapping** | **2** | **2** | **2** | **2** | **1** | **-** | **1** | **-** | - | **-** | **1** | **-** | **2** | **1** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO UML (09 Periods)**

The meaning of Object Orientation, object identity, Importance of modeling, principles of modeling, object-oriented modeling, An overview of UML, conceptual model of the UML, Architecture.

**Classes** – Terms and concepts, Common Modeling Techniques.

**Relationships –** Modeling simple dependencies, single Inheritance and structural relationships, Common Mechanisms and UML Diagrams.

**Module 2: STRUCTURAL MODELING (09 Periods)**

Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Instances.

**Class Diagrams –** Terms, concepts, modeling techniques for Class Diagram, Modeling Simple collaboration, Logical database Schema, Forward and Reverse Engineering.

**Object Diagrams –** Modeling object structures, Forward and Reverse engineering.

**Module 3 BASIC BEHAVIORAL MODELING (09 Periods)**

**Use cases** – Terms and Concepts, Common Modeling techniques.

**Use case Diagrams –** Terms and Concepts, Common Modeling Techniques.

**Sequence Diagrams –** Terms and Concepts, Modeling flows of control by time ordering; **Collaboration Diagrams –** Terms and Concepts, Modeling flows of control by Organization, Forward and Reverse Engineering.

**Module 4 ADVANCED BEHAVIORAL MODELING (09 Periods)**

**Activity Diagrams –** Terms and Concepts, Modeling a workflow, Modeling an operation, forward and reverse Engineering.

Events and Signals, State Machines, Processes and Threads, Time and Space, State Chart Diagrams – Modeling Reactive Objects.

**Module 5 ARCHITECTURAL MODELING (09 Periods)**

**Component Diagrams** – Terms and Concepts, Modeling Source Code, Modeling Physical Database, Forward and Reverse Engineering;

**Deployment Diagrams** – Terms and Concepts, Modeling Embedded System, Modeling Distributed System, Forward and Reverse Engineering.

Patterns and Frameworks, Artifact Diagrams.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Annotated Requirement Specification and Linguistic Analysis of Leave Management System.
2. Implementation of class and object diagrams using Visual Paradigm for Leave Management System.
3. Implementation of Usecase and Interaction diagrams using Visual Paradigm for Leave Management System.
4. Implementation of Activity and State Chart diagrams using Visual Paradigm for Leave Management System.
5. Implementation of Component and Deployment diagrams using Visual Paradigm for Leave Management System.
6. Draw the UML diagrams using Visual Paradigm for Library Management System.
7. Draw the UML diagrams using Visual Paradigm for Railway Reservation System.

**RESOURCES**

**TEXT BOOK:**

1. Grady Booch, James Ram Baugh and Ivar Jacobson, "The Unified Modeling Language User Guide," Pearson Education, 1999.

**REFERENCE BOOKS:**

1. John W. Satzinger, Robert B. Jackson and Stephen D. Burd, "Object-Oriented Analysis and Design with the Unified Process," Cengage Learning, 2004.

2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons and David Fado, "UML 2: Toolkit," Wiley India Pvt. Ltd., 2004.

**VIDEO LECTURES:**

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105153/

**WEB RESOURCES**

1. https://courses.cs.washington.edu/courses/cse403/11sp/lectures/lecture08-uml1.pdf
2. https://www.uml-diagrams.org/index-examples.html

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202020** | **MOBILE APPLICATION DEVELOPMENT** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Object Oriented Programming through JAVA

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Mobile platforms; Mobile User Interface and tools; Introduction to Android; Activities; Views; Menus; Layouts; widgets; Fragments; Building a Location Tracker Communication between a Service and an Activity.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Demonstrate knowledge on mobile platforms, mobile user interface and user interface design requirements.

**CO2.** Understanding user interfaces widgets.

**CO3.** Construct mobile applications on the Android Platform using different layouts for playing video and audio.

**CO4.** Acquire the Information Using Dialogs and Fragments by the mobile applications for the Android operating system.

**CO5.** Develop mobile applications involving Menus and Action Bars.

**CO-PO-PSO Mapping Table:**

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | 2 | 1 |
| CO2 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | 3 | 1 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | 2 | 1 | - |
| CO5 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 1 | - |
| **Course Correlation Mapping** | **3** | **2** | **3** | **2** | **3** | **2** | **2** | **1** | **-** | **-** | **-** | **-** | **3** | **2** | **2** |

**Correlation Level: 3-High 2-Medium 1-Low**

## COURSE CONTENT:

**Module - I: INTRODUCTION TO ANDROID (9 periods)**

Android versions, Features and architecture, The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

**Module - II: BASIC WIDGETS (9 periods)**

The Role of Android Application Components, Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

**Module-III: BUILDING BLOCKS FOR ANDROID APPLICATION DESIGN (9 periods)**

Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video

**Module - IV: SELECTION WIDGETS AND FETCHING INFORMATION USING DIALOGS AND FRAGMENTS (9 Periods)**

Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control.Dialogs, Selecting the Date and Time in One Application, Fragments, Creating Special Fragments**.**

**Module - V: BUILDING MENUS (9 Periods)**

Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

**Total Periods: 45**

**Topics for self-study are provided in the lesson plan**

## EXPERIENTIAL LEARNING:

1. Create "Hello World" Application.
2. Create an application using the Activity class.
3. Create an application using EditText control.
4. Creating an application that allows choosing options using CheckBox control.
5. Creating an application that allows choosing options using RadioButton control.
6. Creating an application that allows choosing options using two sets of RadioButton controls.
7. Create an application using Linear Layout
8. Create an application using Relative Layout
9. Create an application to play Audio and Video clips

10. Create an application using Menus.
11. Create an application using ActionBar.
12. Create an application to display a Drop-Down List Action Bar.

**TEXT BOOKS:**


1. B.M Harwani, Android Programming, Pearson Education.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd edition, Pearson Education.


**REFERENCE BOOKS:**


1. Neils Smyth "Android Stduio Development Essentials," Creative Space Independent publishing platform, Seventh edition 2016.
2. Paul Deital and Harvey Deital, "Android How to Program," Detial associates publishers, First Edition, 2013.
3. James C Sheusi, Android application Development for Java Programmers, Cengage Learning.
4. W.FrankAbleson, Robi Sen, Chris King, C.Enrique Ortiz., Android In Action,Dreamtech.
5. RetoMeier,Professional Android 4 applications development, Wiley India.
6. Wei- Meng Lee, Beginning Android 4 applications development, Wiley India


**VIDEO LECTURES:**

1. https://developer.android.com/guide
2. https://nptel.ac.in/courses/106/106/106106147/

**WEB RESOURCES:**

1. https://source.android.com/devices
2. https://android-app-development-documentation.readthedocs.io/en/latest/
3. https://www.udemy.com/course/the-complete-android-oreo-developer-course/
4. https://www.youtube.com/playlist?list=PLknSwrodgQ72X4sKpzf5vT8kY80HKcUSe

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201015** | **USER EXPERIENCE/ INTERFACE DESIGN (UX/UI)** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** User experience (UX), usability and UI design.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand Importance and Characteristics of User interface design
**CO2.** Create User Interface Design process AND Business functions
**CO3.** Design System menus, navigation schemes
**CO4.** Demonstrate screen-based controls and device-based controls
**CO5.** Identify prototypes and test plans of user interface

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | - | 2 | - | 3 |
| CO5 | - | - | - | - | - | - | - | - | 3 | 3 | - | 3 | 2 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **3** | **3** | **3** | **-** | **3** | **2** | **-** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

### COURSE CONTENT

**Module 1: THE IMPORTANCE OF USER INTERFACE: (07 Periods)**

Defining the User Interface, The Importance Of Good Design, The Benefits of Good Design, A Brief History of The Human-Computer Interface-Introduction of The Graphical User Interface, The Blossoming of The World Wide Web, A Brief History of Screen Design

**CHARACTERISTICS OF GRAPHICAL AND WEB USER INTERFACES:** The Graphical User

Interface, The Web User Interface, Principles of User Interface Design.

**Module 2: THE USER INTERFACE DESIGN PROCESS: (09 Periods)**

Obstacles and Pitfalls in the Development Path, Usability, The Design Team.

**KNOW YOUR USER OR CLIENT:** Understanding How People Interact with Computers, Important Human Characteristics in Design, Perception, Memory, Sensory Storage, Visual Acuity, Human Considerations in Design-The User's Knowledge and Experience.

**Module 3: UNDERSTAND THE BUSINESS FUNCTION: (11 Periods)**

Business Definition and Requirements Analysis, Determining Basic Business Functions, Design Standards or Style Guides, System Training and Documentation Needs.

**UNDERSTAND THE PRINCIPLES OF GOOD SCREEN DESIGN:** Human Considerations In Screen Design, Interface Design Goals, Statistical Graphs

**Module 4: DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES: (09 Periods)**

Structures of Menu, Functions Of Menus, Formatting And Phrasing Of Menus, Navigating Menus, Kinds Of Graphical Menus, Window Characteristics, Components Of A Window, Types Of Windows, Window Operations, Web Systems.

**Module 5: SELECTING THE PROPER DEVICE-BASED CONTROLS: (09 Periods)**

Characteristics of Device-Based Controls, Presentation Controls, Write Clear Text and Messages, Provide Effective Feedback and Guidance and Assistance, Create Meaningful Graphics, Icons And Images.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Assume the role of a UI/UX designer tasked with revamping the user interface of an existing e-commerce website.

2. Create a timeline that traces the evolution of user interfaces from the introduction of the graphical user interface to the current state of web user interfaces.

## RESOURCES

**TEXT BOOKS:**

1. The Essential Guide to User Interface Design, Second Edition, Wilbert O. Galitz, 2002.

**REFERENCE BOOKS:**

1. User Interface Design, A Software Engineering Perspective, Soren Lauesen.
2. User Interface Design and Evolution, Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha, 2005

**VIDEO LECTURES:**

1. https://www.coursera.org/learn/UXdesign
2. https://www.edx.org/course/UX-design
3. https://www.udemy.com/course/UX

**WEB RESOURCES:**

1. https://www.coursera.org/articles/ui-vs-ux-design
2. https://www.simplilearn.com/how-to-become-ui-ux-designer-article
3. https://intellipaat.com/blog/ui-ux-design-tutorial/

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201016** | **BLOCKCHAIN TECHNOLOGIES** | 3 | - | - | - | 3 |

**Pre-Requisite** Computer Networks

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Distributed Systems, Blockchain, Types of blockchains, Decentralization, Bitcoin, Alternative Coins, Smart Contracts, Ethereum 101, Applications of Ethereum, Scalability Challenges in Privacy and Security, Current Landscape.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the concepts of distributed Systems, decentralization and blockchain technology for the development of an application.

**CO2.** Select and use the Bitcoins, Smart Contracts and Ethereum 101 for the development of distributed systems and decentralized systems.

**CO3.** Analyze the issues and challenges of scalability, privacy and security in monetizing the businesses using blockchain technology.

**CO4.** Develop and deploy the applications using BlockApps, Eris platforms.

**CO5.** Commit to ethics and cyber regulations to perform encryption, multiparty computation, smart governance using Smart contract security.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **CO1** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | 3 |
| **CO2** | 1 | 3 | 2 | - | 2 | - | 2 | - | - | - | - | 2 | 3 | - | 3 |
| **CO3** | 1 | 3 | - | 2 | - | - | - | - | - | - | 2 | - | 3 | - | 2 |
| **CO4** | 1 | 2 | 3 | 2 | - | - | - | 2 | - | - | - | - | 3 | - | - |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | 3 |
| **Course Correlation Mapping** | **2** | **3** | **2** | **2** | **2** | **-** | **2** | **2** | **3** | **3** | **2** | **2** | **3** | - | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: DISTRIBUTED SYSTEMS AND DECENTRALIZATION (10 Periods)**

**Distributed Systems:** CAP Theorem, Byzantine Generals Problem, Consensus, History of blockchain, Generic Elements, Features, Applications, Tiers, Types of blockchain, CAP Theorem & blockchain, Benefits and limitations of blockchain.

**Decentralization:** Decentralization using blockchain, Methods of decentralization, Routes to Decentralization, blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for decentralization.

**Module 2: DIGITAL CURRENCY (10 Periods)**

**Bitcoin:** Concepts, Transactions, Blockchain, Bitcoin Payments.

**Alternative Coins:** Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash.

**Module 3 SMART CONTRACTS AND ALTERNATIVE BLOCKCHAINS (8 Periods)**

**Smart Contracts**: History, Ricardian contracts, Smart Contract Templates, Oracles, Smart Oracles, Deployment of Smart Contracts on Blockchains.

**Alternative Blockchains:** Kadena; Platforms: BlockApps, Eris

**Module 4 ETHEREUM 101 (8 Periods)**

**Ethereum**: Ethereum blockchain, Elements of Ethereum blockchain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining, Clients and wallets, Ethereum network, Applications developed on Ethereum, Scalability and Security Issues.

**Module 5 CHALLENGES AND CURRENT LANDSCAPE (09 Periods)**

**Scalability and Other Challenges**: **Scalability**: Block size increase, Block internal reduction, Invertible Bloom lookup tables, Sharding, State channels, Private blockchain, Proof of Stake.

**Privacy**: Indistinguishability obfuscation, Homomorphic encryption, Zero knowledge proofs, State channels, Secure multiparty computation, Usage of hardware to provide confidentiality, Coinjoin, Confidential transactions, MimbleWimble;

**Security**: Smart contract security.

**Current Landscape:** Emerging Trends, Improvement proposals; Blockchain research: Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus Algorithms, Scalability, Code Obfuscation.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Use of blockchain technology in different sectors.
2. Application of blockchain technology in higher education.
3. Impact of blockchain technology on economy.

## RESOURCES

### TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain," Packt Publishing Ltd., 2017

### REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach," VPT Books, 2017.
2. Josh Thompsons, "Blockchain: The Blockchain For Beginners Guide To Blockchain Technology and Leveraging Blockchain Programming," Create Space Independent Publishing Platform, 2017

### VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105184/
2. https://medium.com/moatcoin/part-6-blockchain-simplified-notes-nptel-892f13875555

### WEB RESOURCES:

1. http://www.hands-on-books-series.com/assets/Bahga-Madisetti-Blockchain-Book-Code.zip

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202022** | **DEVOPS APPLICATION DEVELOPMENT** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Cloud Computing

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Introduces the methodologies, tools, and insights of the DevOps process and what it can do for an organization. The course covers development, deployment and operations including infrastructure as code, continuous deployment, testing automation, validation, monitoring and security.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand different actions performed through Version control tools like Git.

**CO2.** Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

**CO3.** To Perform Automated Continuous Deployment

**CO4.** To do configuration management using Ansible

**CO5.** Understand to leverage Cloud-based DevOps tools using Azure DevOps

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 3 | - | - | - | - | 3 | 3 | 3 | 3 | - |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | - | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 3 | - | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 | - | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **2** | **3** | **3** | **-** | **3** | **-** | **3** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO DEVOPS (09 Periods)**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

**Module 2: COMPILE AND BUILD USING MAVEN & GRADLE (09 Periods)**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build usingGradle.

**Module 3: CONTINUOUS INTEGRATION USING JENKINS (09 Periods)**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

**Module 4: CONFIGURATION MANAGEMENT USING ANSIBLE (09 Periods)**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

**Module 5: BUILDING DEVOPS PIPELINES USING AZURE (09 Periods)**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Builda sample code, Modify azure-pipelines.yaml file

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud
4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle

## RESOURCES

**TEXT BOOKS:**


1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

**REFERENCE BOOKS:**


1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020by Mitesh Soni

2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", FirstEdition, 2015.

3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible forDevOps", Second Edition, 2016.


**SOFTWARE/TOOLS:**

1. 2. **GitHub, VMware Workstation, VMware Fusion, or Oracle's VirtualBox software**

3. should meet the following specifications:

    1) **CPU Capabilities** – A dual core 64 bit CPU, with four threads (Intel hyper-threading) is required. An Intel i5 or i7 type chip or the AMD equivalent is recommended.
    2) **Computer Memory** – 8 GB of RAM required, 16 GB or more recommended.
    3) **Disk** – 500 GB of disk space for your coursework is required. A Solid-state disk is recommended.
    4) **Operating System** – A recent version of Windows or Apple OS X.
    5) **Internet connection** – A broadband Internet connection is required such as provided by cable connections or DSL.

    You must have administrative rights on your computer in order to install software.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=hQcFE0RD0cQ

2. https://www.youtube.com/watch?v=lpk7VpGqkKw

3. https://www.youtube.com/watch?v=UAY_YSPQryo

**WEB RESOURCES:**

1. https://www.javatpoint.com/devops

2. https://azure.microsoft.com/en-in/solutions/devops/tutorial/

3. https://www.edureka.co/blog/devops-tutorial

# PROGRAM ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201017** | **REAL TIME OPERATING SYSTEMS** | 3 | - | - | - | 3 |

**Pre-Requisite** Object Oriented Programming through JAVA

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

This course provides a detailed discussion and understanding real-time operating systems can allow you to Perform tasks within a guaranteed worst-case timeframe. Carefully prioritize different sections of your program. Run loops with nearly the same timing each iteration.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Ability to Describe real-time operating system requirements and design issues

**CO2.** Ability to Illustrate role of operating systems in memory and I/O devices management

**CO3.** Ability to Apply concepts of inter-task communication and synchronization via shared memory,message queues, signals, semaphores

**CO4.** Ability to Examine challenges arising in design problems when developing embedded applications in multi tasking systems

**CO5.** Ability to Develop programs using system proved timers, signals, mutual exclusion, semaphores,message queues and exception handlers

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | |
| CO3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 1 | 2 | 1 | - | 1 | - | - | 1 | 3 | 3 | 3 | 3 | |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | | **-** | **3** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels:** **3: High;** **2: Medium;** **1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO OPERATING SYSTEM (09 Periods)**

Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Operating System services, user OS Interface, System Calls, Types of System Calls, OS Structure

**Module 2: OPERATING SYSTEM CONCEPTS (09 Periods)**

Process Concept, Process Scheduling, Operations on Processes, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues

**Module 3: PROCESS SYNCHRONIZATION (09 Periods)**

Process Synchronization - The critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Memory Management and Virtual Memory and File System Interface.

**Module 4: REAL TIME OPERATING SYSTEM (09 Periods)**

Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems, Basic architecture of an RTOS, components in RTOS, kernel, objects, scheduler, Multitasking, context switch, Scheduling types, Task states, Task management.

**Module 5: RTOS SERVICES (09 Periods)**

Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell Exceptions and Interrupts- Programmable interrupt controller-Priority scheme- Task and stack Interrupt nesting- Interrupt processing in two contexts.

**Total Periods: 45**

## EXPERIRENTIAL LEARNING:

1. Create a timeline project that traces the evolution of operating systems from simple batch systems to modern real-time and distributed systems.
2. Develop a small program that creates multiple threads to perform different tasks simultaneously, such as sorting arrays or generating Fibonacci sequences, to demonstrate the concept of multithreading.

## RESOURCES

**TEXT BOOKS:**


1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition,Wiley Student Edition
2. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011


**REFERENCE BOOKS:**


1. Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson
2. Embedded Systems- Architecture, Programming and Design by Raj kamal, 2007, TMH.

**VIDEO LECTURES:**

1. https://www.digimat.in/nptel/courses/video/106105172/L13.html
2. https://www.coursera.org/lecture/real-time-systems/rtos-overview-RIAFe

**WEB RESOURCES:**

1. https://www.freertos.org/tutorial/index.html
2. https://embetronicx.com/tutorials/rtos/freertos/rtos-basic-tutorial-for-beginners/
3. https://www.javatpoint.com/real-time-operating-system

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201029** | **FULL STACK WEB DEVELOPMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Hypertext markup language (HTML), Features of HTML5, Cascading style sheets (CSS), JavaScript, JQuery, Bootstrap, Hypertext preprocessor (PHP), MySQL.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on web page design elements, dynamic content and database interaction.

**CO2.** Analyze user requirements to develop web applications.

**CO3.** Design client-server applications using web technologies.

**CO4.** Demonstrate problem solving skills to develop enterprise web applications.

**CO5.** Use HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO3** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO4** | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **Course Correlation Mapping** | 2 | 2 | 3 | 2 | 3 | - | 3 | - | 3 | 3 | - | - | 3 | - | 3 | - |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: HTML AND CSS** ***(09 Periods)***

***HTML5:*** Introduction, HTML5 document structure, Creating editable content, Checking spelling mistakes, Exploring custom data attributes, Client-Side storage, Drag and drop feature, Offline web applications, Web communications, Cross-Document messaging and desktop notifications.

***CSS3:*** Introduction, CSS selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text styles, Creating boxes, Displaying, Positioning and floating elements, Features of CSS3, Media queries.

**Module 2: JAVASCRIPT AND JQUERY** ***(10 Periods)***

***Javascript:*** Overview of JavaScript, JavaScript functions, Events, Image maps and animations, JavaScript objects, Working with browser and document objects.

***JQuery:*** Introduction, JQuery Selectors, Events, Methods to access HTML elements and attributes, Introduction to AJAX.

**Module 3: BOOTSTRAP** ***(09 Periods)***

Getting started with Bootstrap, Creating responsive layouts using Bootstrap CSS - Basic HTML structure for Bootstrap, Responsive classes, Rendering images, The grid system, Constructing data entry forms, Packaged components in Bootstrap - The page header, Glyphicons, The navigation bar, Badges, Alerts, Toolbars and button groups, Panels.

**Module 4: INTRODUCTION TO PHP** ***(09 Periods)***

Introduction, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Functions, Arrays, Embedding PHP code in web pages, Object Oriented PHP.

**Module 5: PHP WEB FORMS AND MYSQL** ***(08 Periods)***

***PHP Web forms:***PHP and web forms, Sending form data to a server, Working with cookies and session handlers.

***PHP with MySQL:***Interacting with the database, Prepared statement, Database transactions.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Explore Basic HTML Tags and Elements.
2. Familiarize with JS, and CSS, Animation using sample webpage
3. Design a Webpage using advance HTML Form tags input–date, time, number, email, HTML5 Header And Footer, spell check and editable areas.
4. Write a JavaScript/JQuery code to validate the following fields of the Registration web page.
   a. First Name/Last Name - should contain only alphabets and the length should not be less than 8 characters.

b. Username - It should contain combination of alphabets, numbers and underscore. It should not allow spaces and special symbols.

c. Password - It should not less than 8 characters in length and it contains one uppercase letter and one special symbol.

d. Date of Birth - It should allow only valid date; otherwise display a message stating that entered date is invalid. Ex. 29 Feb. 2009 is an invalid date.

e. Postal Code: It must allow only 6 digit valid number.

f. Mobile No. - It should allow only numbers and total number of digits should be equal to 10.

g. e-mail id - It should allow the mail id with the following format: Ex. mailid@domainname.com

5. Design a web page with the following features using HTML5, JavaScript and JQuery
   a. Displaying of images with Custom animated effects
   b. Playing of selected video from the list of videos
   c. Showing the animated text in increasing and decreasing font size
   d. Changing the size of the area in a web page using DIV tag
   e. Hiding and Showing elements in a web page.

6. Design a web page with the following features using Bootstrap and Media Query.
   a. Components
   b. Responsive tables
   c. Responsive images and videos
   d. Toolbars, Buttons and Lists

7. a. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.
   b. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.

8. Change a Content of webpage using AJAX. Perform Different Operations using JQUERY Selectors.

9. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.

10. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database.

## RESOURCES

### TEXT BOOKS:


1. Kogent Learning Solutions Inc, "*HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery*," Dreamtech Press, 2nd Edition, 2016.
2. W. Jason Gilmore, "*Beginning PHP and MySQL*, APress," 4th Edition, 2011.


### REFERENCE BOOKS:


1. Snig Bahumik, "*Bootstrap Essentials*," PACKT Publishing, 1st Edition, 2015. (e-book).
2. Thomas A. Powell, "*The Complete Reference: HTML and CSS,*" Tata McGraw Hill, 5th Edition, 2010.
3. Andrea Tarr, "*PHP and MySQL*," Willy India, 1st Edition, 2012.

**SOFTWARE/TOOLS:**

1. Editor: Notepad++
2. Programming Language: Javascript, JQuery, PHP

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=Q33KBiDriJY
2. https://www.coursera.org/learn/html-css-javascript-for-web-developers?=
3. https://www.edx.org/course/using-javascript-jquery-and-json-in-django
4. https://www.edx.org/course/building-web-applications-in-django
5. https://www.udemy.com/course/web-technology-for-entrepreneurs/
6. https://www.edx.org/course/html5-apps-and-games
7. https://www.classcentral.com/course/openhpi-web-technologies-3517
8. https://www.edx.org/course/css-basics

**WEB RESOURCES:**

1. https://www.w3schools.com/php/DEFAULT.asp
2. https://www.w3schools.com/js/
3. https://www.geeksforgeeks.org/web-technology/
4. https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/
5. https://css-tricks.com/
6. https://davidwalsh.name/css-optional
7. https://jquery.com/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202029** | **MERN STACK DEVELOPMENT** | 3 | - | 2 | - | 4 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on MERN Stack, Building a Webserver with ExpressJS, Building a Restful API, Building Web Applications with React, MongoDB, NodeJS and Managing state with Redux.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge on fundamentals of MongoDB and NodeJS.

**CO2.** Build web server using ExpressJS to configure and customize web applications.

**CO3.** Apply Restful API with ExpressJS and Mongoose.

**CO4.** Apply React to design enterprise web applications.

**CO5.** Develop web applications through MERN stack and Redux store as per societal needs.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO2** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO3** | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | - | 2 | - |
| **CO4** | 1 | 2 | 3 | - | 3 | - | - | 1 | - | - | - | - | 3 | - | 1 | - |
| **CO5** | 1 | 2 | 3 | - | - | 1 | 1 | - | - | - | - | - | 3 | - | 1 | - |
| **Course Correlation Mapping** | **2** | **3** | **3** | **2** | **3** | **1** | **1** | **1** | **3** | **3** | **-** | **-** | **3** | **-** | **2** | **-** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: MERN STACK (08 Periods)**

Introduction to MERN STACK, The Model View Controller (MVC) architectural pattern, Installing and configuring MongoDB, Installing Node.js and Installing npm packages.

**Module 2: BUILDING A WEB SERVER WITH EXPRESSJS (09 Periods)**

Routing in ExpressJS, Modular route handlers, Writing middleware functions, Writing configurable middleware functions, Writing router-level middleware functions, Writing error-handler middleware functions, Using ExpressJS' built-in middleware function for serving static as sets, Parsing the HTTP request body, Compressing HTTP responses, Using an HTTP request logger.

**Module 3: BUILDING A RESTFUL API (09 Periods)**

CRUD operations using ExpressJS' route methods, CRUD operations with Mongoose, Using Mongoose query builders, Defining document instance methods, Defining static model methods, Writing middleware functions for Mongoose, Writing custom validators for Mongoose's schemas, Building a RESTful API to manage users with ExpressJS and Mongoose.

**Module 4: BUILDING WEB APPLICATIONS WITH REACT (10 Periods)**

Understanding React elements and React components, Composing components, Stateful components and life cycle methods, Working with React.PureComponent, React event handlers, Conditional rendering of components, Rendering lists with React, Understanding refs and how to use them, Understanding React portals, Catching errors with error boundary components, Type checking properties with PropTypes.

**Module 5: MANAGING STATE WITH REDUX (09 Periods)**

Defining actions and action creators, Defining reducer functions, Creating a Redux store, Binding action creators to the dispatch method, Splitting and combining reducers, Writing Redux store enhancers, Time traveling with Redux, Understanding Redux middleware, Dealing with asynchronous data flow.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

**Front-end Web Application Library**

1. Installing Node.js framework and configuring Visual Studio (VS) Code Integrated Development Environment (IDE), and its dependencies.
2. Create and Run —Hello World‖ Application in VS Code.
3. Build two mini applications using Router that will be served in two different sub-domains virtual domains through ExpressJS and Virtual domains.
4. Develop the code for Securing an ExpressJS web application with Helmet.
5. Create a React application that includes simple functional components.
6. Create a React application that includes simple class components.

7. Develop a React application to insert and access props (properties) and state of components.
8. Create a React application to demonstrate event handling.
9. Develop a React application for list rendering.
10. Implement a React application for form handling.

**Hosting Web Applications**

1. Choosing a hosting server and selecting a plan for web hosting.
2. Choosing and configuring DNS address.
3. Uploading, configuring and running the website over the internet.

## RESOURCES

**TEXT BOOKS:**


1. Eddy Wilson IriarteKoroliova, MERN Quick Start Guide: Build Web Applications with MongoDB, Express.js, React, and Node, Packt, May 2018.
2. Greg Lim, BeginningMERN Stack Development, First Edition, June 2021.


**REFERENCE BOOKS:**


1. Brad Dayley, Node.js, MongoDB and Angular Web Development, Pearson, 2nd Edition,2017.
2. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML,XHTML, AJAX, PHP and JQuery, Dreamtech Press, Second Edition, 2016.


**SOFTWARE/TOOLS:**

1. Software: Node.js, MongoDB and Visual Studio Code; Express and React modules.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=E-GA9GKJWuE
2. https://www.youtube.com/watch?v=Oe421EPjeBE
3. https://www.youtube.com/watch?v=KNZZZ3pbqco
4. https://www.youtube.com/watch?v=bbkBuqC1rU4

**WEB RESOURCES:**

1. Node.js Tutorial - https://www.w3schools.com/nodejs/
2. Express.js Tutorial - https://www.javatpoint.com/expressjs-tutorial
3. MongoDB Tutorial - https://www.tutorialspoint.com/mongodb/index.htm
4. Learn ReactJS Tutorial - https://www.javatpoint.com/reactjs-tutorial
5. Redux Tutorial - https://www.tutorialspoint.com/redux/index.htm

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA202023 | GO JAVA FULL STACK WITH SPRING BOOT AND REACT | 3 | - | 2 | - | 4 |

**Pre-Requisite** Full Stack Web Development

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Basics of Go programming language, Introduction to RESTful architecture, Java and Spring Boot, Building Backend with Spring Boot, Introduction to React.

**COURSE OUTCOMES:** After successful completion of this course, the student will be able to:

**CO1.** Understand Go Programming Language Concepts.
**CO2.** Describe Restful application program interface with Go.
**CO3.** Apply OOP concepts and spring boot framework.
**CO4.** Create backend with spring boot.
**CO5.** Understand React library and its concepts.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| CO5 | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 2 | - | 3 | |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**Module 1 INTRODUCTION TO GO (09 periods)**

Basics of Go programming language, Variables, data types, and control flow in Go, Functions, packages, and error handling in Go, Structs, interfaces, and concurrency in Go.

**Module 2 BUILDING RESTFUL APIS WITH GO (09 periods)**

Introduction to RESTful architecture, Setting up a basic Go web server, Handling HTTP requests and responses in Go, CRUD operations with database integration (e.g., PostgreSQL, MySQL) using a Go database driver, Authentication and authorization with JWT (JSON Web Tokens)

**Module 3 INTRODUCTION TO JAVA AND SPRING BOOT (09 periods)**

Introduction to Java programming language, Variables, data types, and control flow in Java, Object-oriented programming (OOP) concepts in Java, Introduction to Spring Boot framework and its features Building RESTful APIs using Spring Boot and Spring Web

**Module 4 BUILDING BACKEND WITH SPRING BOOT (09 periods)**

Setting up a Spring Boot project, Defining data models with JPA (Java Persistence API) and Hibernate Implementing CRUD operations with Spring Data JPA, Securing APIs with Spring Security, Testing and debugging Spring Boot applications.

**Module 5 INTRODUCTION TO REACT (09 periods)**

Introduction to React library and its concepts (components, state, props), Setting up a React project using create-react-app, Building reusable components in React, Handling state management with React hooks, Working with React Router for client-side routing

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

I. Go Lab Programs:
   1. Setting up the Go development environment
   2. Writing a basic Go program with variables, functions, and control flow
   3. Building a command-line application in Go
   4. Creating and using Go packages
   5. Working with JSON data in Go

II. Java with Spring Boot Lab Programs:
   1. Setting up the Java development environment
   2. Creating a basic Java program with variables, functions, and control flow
   3. Building a simple Java application using object-oriented programming (OOP) concepts
   4. Implementing CRUD operations with Spring Boot and Spring Data JPA

III. React Lab Programs:
   1. Setting up the React development environment
   2. Creating a basic React application with components and state management
   3. Building a form-based application in React

## RESOURCES

### TEXT BOOKS:


1. Alan A. A. Donovan and Brian W. Kernighan, "The Go Programming Language", Addison-Wesley.
2. Craig Walls," Spring Boot in Action", Manning Publications.
3. "Learning React: Modern Patterns for Developing React Apps" by Alex Banks and Eve Porcello.


### REFERENCE BOOKS:


1. "Go in Action", William Kennedy with Brian Ketelsen and Erik St. Martin, Manning Publications.
2. Learning Spring Boot 2.0 - Second Edition: by Greg L. Turnquist.


### VIDEO Lectures:

1. https://www.youtube.com/watch?v=dP4goCkKxlw&list=PLGRDMO4rOGcNLnW1L2vgsExTBg-VPoZHr

### WEB RESOURCES:

1. Go: https://golang.org/doc/ss
2. Java (Spring Boot): https://spring.io/projects/spring-boot#learn
3. React: https://reactjs.org/docs/getting-started.html

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202024** | **FULL STACK CLOUD DEVELOPER** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Full Stack Web Development

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**
Introduction to Full Stack Development, Web Development Fundamentals, Back-End Development, Cloud Computing Basics, Cloud Infrastructure and Front-End Frameworks, Security, Performance Optimization and Scalability

**COURSE OUTCOMES:** After successful completion of this course, the student will be able to:
**CO1.** Understand full stack development**,** Role of a full stack developer.

**CO2.** Describe Database design and cloud computing platforms.

**CO3.** Understand Cloud Infrastructure and Services.

**CO4.** Create Back-End Frameworks and Tools.

**CO5.** Understand Security**,** Performance Optimization and Scalability.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 2 | - | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **2** | **-** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**Module 1 INTRODUCTION TO FULL STACK AND WEB DEVELOPMENT (09 periods)**

Introduction to Full Stack Development: Overview of full stack development, Role of a full stack developer, Understanding the cloud computing paradigm.

Web Development Fundamentals:HTML5, CSS3, and JavaScript, Introduction to front-end frameworks (e.g., React, Angular, or Vue.js), Responsive web design and mobile development

**Module 2 BACK-END DEVELOPMENT AND CLOUD COMPUTING BASICS (09 periods)**

Back-End Development: Introduction to server-side programming languages (e.g., Python, Node.js, or Ruby), Database design and management (e.g., SQL, NoSQL), RESTful API development, Authentication and authorization mechanisms Cloud Computing Basics: Introduction to cloud computing platforms (e.g., AWS, Azure, or Google Cloud), Virtualization and containerization (e.g., Docker, Kubernetes), Deployment and scaling strategies

**Module 3 CLOUD INFRASTRUCTURE AND FRONT-END FRAMEWORKS (09 periods)**

Cloud Infrastructure and Services: Cloud storage and file systems, Serverless computing (e.g., AWS Lambda, Azure Functions), Message queues and event-driven architectures, Load balancing and auto-scaling.

Front-End Frameworks and Tools: Advanced front-end frameworks (e.g., React, Angular, or Vue.js) Build tools (e.g., Webpack, Gulp), Package managers (e.g., npm, Yarn)

**Module 4 BACKEND TOOLS AND DATABASE (09 periods)**

Back-End F Book-end Frameworksand Tools: Popular server-side frameworks (e.g., Express.js, Django, or Ruby on Rails), Testing frameworks (e.g., Jest, Mocha), Logging and monitoring toolsDatabase and Data Storage:Relational databases (e.g., MySQL, PostgreSQL), NoSQLdatabases (e.g., MongoDB, Cassandra), Data Modeling and Optimization.

rameworks and Tools: Popular server-side frameworks (e.g., Express.js, Django, or Ruby on Rails), Testing frameworks (e.g., Jest, Mocha), Logging and monitoring tools

Database and Data Storage: Relational databases (e.g., MySQL, PostgreSQL), NoSQL databases (e.g., MongoDB, Cassandra), Data modeling and optimization.

**Module 5 PERFORMANCE OPTIMIZATION AND SCALABILITY SECURITY (09 periods)**

Security and DevOps: Web application security best practices, Continuous integration and deployment (CI/CD), Infrastructure as code (IaC) using tools like Terraform or CloudFormation, Monitoring and alerting systems.

Performance Optimization and Scalability: Caching strategies (e.g., Redis, Memcached) Performance profiling and optimization, Horizontal and vertical scaling techniques.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Build a Full Stack Web Application: Create a web application using a front-end framework like React, Angular, or Vue.js, and a back-end framework like Node.js, Django, or Ruby on Rails. Deploy your application to a cloud platform like AWS, Azure, or Google Cloud.
2. Implement User Authentication and Authorization: Add user authentication and authorization functionality to your web application. Use technologies like JSON Web Tokens (JWT) or OAuth to authenticate and authorize users. Store user information securely in a database.
3. Develop a RESTful API: Create a RESTful API using a back-end framework of your choice. Define endpoints for performing CRUD (Create, Read, Update, Delete) operations on a database. Test the API using tools like Postman or Insomnia.
4. Implement Serverless Functions: Use a serverless computing platform like AWS Lambda or Azure Functions to develop and deploy serverless functions. Create functions that perform specific tasks, such as image processing or data transformation.
5. Build a Real-time Chat Application: Create a real-time chat application using technologies like Socket.io or Firebase Realtime Database. Enable users to send and receive messages instantly and see real-time updates.
6. Deploy and Manage Containers: Use containerization technologies like Docker and container orchestration tools like Kubernetes to deploy and manage your application in a containerized environment. Explore concepts like scaling, load balancing, and service discovery.
7. Integrate with Cloud Services: Utilize cloud services like AWS S3 for file storage, AWS SES for email sending, or Google Cloud Vision API for image recognition. Integrate these services into your application to add additional functionality.
8. Implement Continuous Integration and Deployment (CI/CD): Set up a CI/CD pipeline using tools like Jenkins, CircleCI, or GitLab CI/CD. Automate the build, test, and deployment processes for your application.
9. Monitor and Analyze Application Performance: Use monitoring and logging tools like AWS CloudWatch, Azure Monitor, or ELK Stack to track the performance and availability of your application. Set up alerts and visualize metrics to gain insights into your application's behavior.
10. Secure Your Application: Implement security best practices in your application. Protect against common vulnerabilities like cross-site scripting (XSS) and SQL injection. Explore techniques like encryption, secure communication (HTTPS), and user input validation.

## RESOURCES

**TEXT BOOKS:**


1. "Full Stack Development with JHipster" by Deepu K Sasidharan and Sendil Kumar N
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011


**REFERENCE BOOKS:**


1. "Full Stack Development with React and Node: Modern Web Development with Universal React" by Tomasz Dyl and Adam Boduch.
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010

**ADDITIONAL LEARNING RESOURCES:**

1. MDN Web Docs: The MDN (Mozilla Developer Network) Web Docs is an excellent resource for learning web development fundamentals, including HTML, CSS, and JavaScript. It offers comprehensive documentation, tutorials, and guides: https://developer.mozilla.org/
2. W3Schools: W3Schools is a popular online learning platform that provides tutorials and references for web development technologies. It covers HTML, CSS, JavaScript, and various frameworks like React, Angular, and Vue.js: https://www.w3schools.com/
3. Stack Overflow: Stack Overflow is a community-driven question and answer platform that covers a wide range of programming topics, including full stack development. It can be a valuable resource for troubleshooting and finding solutions to specific development challenges: https://stackoverflow.com/
4. AWS Documentation: If you're interested in cloud development with Amazon Web Services (AWS), their official documentation is an invaluable resource. It provides detailed information, tutorials, and guides on various AWS services and features: https://docs.aws.amazon.com/
5. Microsoft Azure Documentation: Microsoft Azure offers comprehensive documentation for developers looking to work with their cloud platform. It covers various Azure services, deployment options, and development tools: https://docs.microsoft.com/azure/

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=Ow_q1qR9jTw

2. https://www.youtube.com/watch?v=_wiFwn-H39Y

**WEB RESOURCES:**

1. https://www.executivelevels.com/full-stack-developer-vs-cloud-computing-full-comparison/

2. https://www.bing.com/search?q=full+stack+cloud+developer&cvid=82c58938f8174bf6affdcc6735b2e56c&gs_lcrp=EgZjaHJvbWUqBggCEAAYQDIGCAAQRRg5MgYIARAAGEAyBggCEAAYQDIGCAMQABhAMgYIBBAAGEAyBggFEAAYQDIGCAYQABhAMgYIBxAAGEAyBggIEAAYQNIBCDY0MzZqMGo0qAIIsAIB&FORM=ANAB01&PC=U531

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22CA202025 | DEVOPS AND SOFTWARE ENGINEERING | 3 | - | 2 | - | 4 |

**Pre-Requisite** software engineering and cloud computing

**Anti-Requisite** -

**Co-Requisite** -

**Course Description:**
This course is designed to: Adapt the software Engineering practices that combine Software Development and IT operations for Quality Software. Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.

**COURSE OUTCOMES:** At the end of the course, student will be able to Explain how DevOps will balance the needs throughout the SDLC Demonstrate how DevOps improves the collaboration and productivity by automation. Adapt DevOps in realtime projects. Illustrate the continuous integration tools and monitoring tools

**CO1.** Analyze SDLC phases, the Values and principles of agile software development

**CO2.** Understand the Fundamentals of DevOps for Deployment pipelines and operations to create the Instance of applications

**CO3.** Demonstrate the Technology aspects and Agile capabilities using Devops.

**CO4.** Design automate application build with Continuous Integration and Continuous Delivery Using Jenkins.

**CO5.** Learn to perform various operations using tools that simplify application deployment and facilitate continuous integration and learn to work with Docker.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO3 | 3 | 3 | - | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO4 | 2 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | 3 | - |
| CO5 | - | - | - | - | - | - | - | - | 3 | - | 3 | - | - | 3 | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **-** | - | - | **3** | **-** | **3** | - | **-** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: PHASES OF SOFTWARE DEVELOPMENT LIFE CYCLE (07 Periods)**

Phases of Software Development life cycle: Advantages and Disadvantages of SDLCs, the best SDLC methodology, Values and principles of agile software development.

**Module 2: INTRODUCTION OF DEVOPS (09 Periods)**

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

**Module 3: DEVOPS ADOPTION IN PROJECTS (9 Periods)**

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes.

**Module 4: CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY (09 Periods)**

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment , Benefits of CI/CD, Metrics to track CICD practices.
The CI/CD principles, using a package manager, Using Jenkins, Using Azure Pipelines, Using GitLab CI.

**Module 5: CONTAINERIZING YOUR APPLICATION WITH DOCKER (11 Periods)**

Installing Docker, Registering on Docker Hub, Docker installation, An overview of Docker's elements, Creating a Docker file, Writing a Docker file, Docker file instructions overview, Building and running a container on a local machine, Building a Docker image, Instantiating a new container of an image, Testing a container locally, Pushing an image to Docker Hub, Deploying a container to ACI with a CI/CD pipeline, The Terraform code for ACI, Creating a CI/CD pipeline for the container.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Write code for a simple user registration form for an event.
2. Practice Source code management on GitHub. Experiment with the source code written in exercise 1.
3. Jenkins installation and setup, explore the environment.
4. Demonstrate continuous integration and development using Jenkins.
5. Explore Docker commands for content management.
6. Develop a simple containerized application using Docker
7. Automate the process of running containerized application developed in Jenkins with Docker.
8. Create a role to ec2 instance to automat build code pipe line using Jenkins.

## RESOURCES

### TEXT BOOKS:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, andSecurityinTechnology Organizations,GeneKim,JohnWillis,PatrickDubois,Jez Humb,1st Edition,O'Reillypublications,2016.

2. What is DevOps? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.

### REFERENCE BOOKS:

1. Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications, 2013.
2. The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipe line With Containerized Microservices, 1st Edition, Viktor Farcic, Create Space Independent Publishing Plat form publications, 2016.
3 Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, 1st Edition, Jez Humble and David Farley,2010.
4 Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and microservices, 1st Edition, Dave Harrison, KnoxLively, Apresspublications,2019

### SOFTWARE/TOOLS:

1. Git
2. Docker
3. Jenkins
4. Maven
5. Tomcat

### VIDEO LECTURES:

1. https://youtu.be/W7WhGi_JJgs
2. https://youtu.be/WjwEh15M5Rw

### WEB RESOURCES:

1. https://www.javatpoint.com/devops
2. https://github.com/nkatre/Free-DevOps-Books-1/blob

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202026** | **RESPONSIVE WEBSITE DEVELOPMENT AND DESIGN** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Full Stack Web Development

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:**

Scripting language's flexibility has allowed developers to create innovative software. Most engineering students were required to learn the scripting languages to promote their study and complex problem solving in order to keep up-to - date with the competition.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Ability to differentiate web and website and summarize the importance of web languages in the development of website.

**CO2.** Apply JavaScript, HTML and CSS3 effectively to create interactive and dynamic websites

**CO3.** Ability to build web applications using PHP and submit the form using GET or POST method.

**CO4.** Create layout in websites using Div tags and incorporate pre-designed elements into them.

**CO5.** Ability to develop server side code using PHP and able to connect and manipulate the MySQL database.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | - |
| **CO4** | 3 | 3 | 3 | 1 | 3 | 1 | - | 1 | - | - | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | | **-** | **3** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: INTRODUCTION TO WWW (09 Periods)**

Introduction to Network, Internet and Intranet, Application and Services, Internet Addressing – IP, DNS, URL. Elements of Web – Web Page, Web Site, Web Client & Server. Web Languages – HTML/DHTML, JavaScript, PHP, XML.

**Module 2: BUILDING WEB BASED APPLICATION USING HTML (09 Periods)**

Html Document Structure, Various HTML Tags – Document Tag, Text Formatting Tag, Link Tag, List Tag, Image Tag, Table Tag, Line Breaks, Frame, Frameset, HTML Forms.

**Module 3: CASCADING STYLE SHEET (09 Periods)**

Introduction to Style sheet, Types of Style sheet, concept of class & ID, Different CSS Property- .Background Property- Font property- Text -Dimensions Combinators- Borders-Margins-Padding-Box Model.

**Module 4: CLIENT-SIDE SCRIPTING LANGUAGE (09 Periods)**

Concept and types of Scripting language, Introduction to Java script, How to develop Java script, Operators, Conditional Structure & Looping Structure, Dialog Boxes, Arrays, User Define Function, Java script Function keyword, Function Expression, Constructor, Self Invoking Functions, Built-in Functions (String, Math, Date, Array), Built-in Object (window, screen ,location, history, Navigator),DOM, Forms, Objects and its events- Functional Programming.

**Module 5: PHP COMPONENTS (09 Periods)**

Introduction to PHP, Basic PHP syntax: PHP tags, PHP statements and whitespace, comments, Operators, Conditional and Looping Structure, User Define Functions, Arrays. GET and POST Methods. GD Library, Cookies, Session, Server Variables, Database Connectivity with MySQL, PHP My Admin, Regular Expression, PHP with OOP (Class, constructor, inheritance), PHP with AJAX – Introduction-Sending Email using PHP.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Design the static web page using frames, links and tables for any application.
2. Creation of HTML pages using ordered list, unordered list , definition list and hotspots
3. Create webpage to embed audio and video
4. Usage of internal and external CSS along with HTML pages
5. Develop web pages using Background property, Font property, Dimensions, Box model, Combinators and Borders in CSS
6. Developing online applications such as shopping, railway/air/bus, education using HTML, CSS, Java script and PHP
7. Develop programs using control structures and arrays in PHP
8. Any online application using PHP and submit the form using GET or POST method.

## RESOURCES

### TEXT BOOKS:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.

### REFERENCE BOOKS:

1. Beginning PHP5, Apache, Mysql Web Development, Wrox, Elizabeth Naramore, Michael K. Glass, 2005.
2. PHP Bible, Wiley Publication, Tim Converse, Joyce Park, 2002.
3. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005.
4. Beginning Ajax, Wrox, Chris Ullman, Lucinda Dykes, 2007.

### SOFTWARE/TOOLS:

1. https://getbootstrap.com/

2. https://codepen.io/

### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=zAfLvFHKUS0
2. https://www.youtube.com/watch?v=EqzUcMzfV1w
3. https://www.youtube.com/watch?v=3JluqTojuME

### WEB RESOURCES:

1. https://careerfoundry.com/en/tutorials/web-development-for-beginners/introduction-to-web-development/
2. https://www.w3schools.com/whatis/
3. https://www.edureka.co/blog/web-development-tutorial/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA204003** | **MODERN APPLICATION DEVELOPMENT WITH NODE.JS ON AWS** | 2 | - | 2 | 4 | 4 |

**Pre-Requisite:** Cloud Computing
**Anti-Requisite:** **-**
**Co-Requisite:** **-**

**COURSE DESCRIPTION:** This Course provides a detailed discussion on Application Programming Interfaces(APIs), AWS SDK Exploration, AWS Toolkit, Amazon API Gateway authentication and authorization mechanisms, Amazon Cognito, Serverless Computing, AWS Lambda, creating a lambda function using AWS CLI, AWS Step Functions, Step Functions API exploration, Step Function Service Integrations, Call back patterns, Standard vs Express Step functions, Observability, Amazon X-Ray, API Gateway and Lambda Using the AWS X-Ray SDK with (Node), API Gateway and Lambda Logs, Amazon Cloud Watch Logs integration with API Gateway.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the concepts of Application Programming Interfaces (APIs) and Amazon Web Services Command Line Interface (CLI).

**CO2.** Analyze the Amazon API Gateway terminology for authentication and authorization of various resources and Amazon Cognito to sign in and call the APIs.

**CO3.** Design and develop applications using AWS Lambda permissions and functions using AWS Toolkit.

**CO4.** Create serverless workflows using Step functions for the integration and call back patterns.

**CO5.** Adhere to ethics and adapt observability using X-Ray and Configuring Cloud Watch Logs in API Gateway.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO3 |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 | 2 | 2 |
| **CO2** | 1 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | 1 | |
| **CO3** | - | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 2 |
| **CO4** | - | 2 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 1 | 3 |
| **CO5** | - | - | - | - | - | 3 | 2 | - | - | - | 2 | - | 2 | - | 2 | 2 |
| **Course Correlation Mapping** | **2** | **3** | **3** | **3** | **3** | **3** | **2** | - | - | **-** | **2** | - | **3** | **3** | **3** | **3** |

**Correlation Levels:** **3: High;** **2: Medium;** **1: Low**

## COURSE CONTENT

**Module 1: APPLICATION PROGRAMMING INTERFACES (APIs) (07 Periods)**

Architecting for the Cloud What we are building? AWS Cloud9, AWS Command Line Interface (CLI) and Application Programming Interfaces (APIs), APIs AWS CLI, AWS SDK Exploration (Node), AWS Credentials in Cloud9, Introduction to the Serverless Application Model (SAM), AWS Toolkit for (Cloud9/IntelliJ/PyCharm).

**Module 2: AMAZON API GATEWAY TERMINOLOGY (6 Periods)**

API Driven Design, API driven development, what is Amazon API Gateway? Amazon API Gateway terminology, Section Readings, Models and Mapping, Creating an API with Mock integration, Using Mappings, Using Models, Section Readings, Publish API, Using Postman to create requests, API Authentication, Amazon API Gateway authentication, Amazon API Gateway access controls, Amazon API Gateway authentication and authorization mechanisms, Amazon Cognito, Amazon Cognito, Using Amazon Cognito to sign in and call Amazon API Gateway.

**Module 3: AWS LAMBDA (6 Periods)**

Serverless Computing and AWS Lambda, AWS Lambda Execution, AWS Lambda permissions, Section Readings, Triggers, Push, Pull model. AWS Lambda execution context and reuse, AWS Lambda Compliance, Asynchronous vs Synchronous Responses, Versions and Aliases, creating a lambda function using the AWS CLI, Creating and Debugging an AWS Lambda Function using the AWS Toolkit.

**Module 4: AWS STEP FUNCTIONS (6 Periods)**

Orchestration, Creating a serverless workflow, AWS Step Functions, Step Functions API exploration, Step Function State types, Step Function Service Integrations, Amazon API Gateway and Step function Integration, Call back patterns, Step Function Activities, Standard vs Express Step functions.

**Module 5: OBSERVABILITY AND API GATEWAY (5 Periods)**

Observability, Amazon X-Ray, API Gateway and Lambda, Using the AWS X-Ray SDK with (Node), API Gateway and Lambda Logs, Amazon Cloud Watch Logs integration with API Gateway, Step Functions and Lambda Configuring, Cloud Watch Logs in API Gateway, Step Functions and Lambda.

***Total Periods: 30***

## EXPERIENTIAL LEARNING

1. Setting Up and Exploring the SDK
2. Amazon API Gateway
3. Amazon Cognito Authentication
4. Create a static website in Amazon S3
5. API
6. AWS Lambda Functions
7. AWS Step Functions
8. Optimizing an Application

## RESOURCES

### TEXT BOOKS:

1. Nader Dabit *"Full Stack Serverless: Modern Application Development with React, AWS, and GraphQL"*, 1st Edition, O'Reilly Publications, November 2020.

### REFERENCE BOOKS:

1. Saurabh Shrivastava, Neelanjali Srivastav and Artasanchez *"AWS for Solutions Architects: The definitive guide to AWS Solutions Architecture for migrating to, building, scaling, and succeeding in the cloud,"* 2nd Edition, Packt Publishing Limited, April 2023.

### SOFTWARE/TOOLS:

1. Cloud9 Toolkit
2. SDK

### VIDEO LECTURES:

1. https://youtu.be/9PfCvI6xI0E
2. https://youtu.be/iFMLyMgCUTs
3. https://youtu.be/clSWroo2snY

### WEB RESOURCES:

1. https://docs.aws.amazon.com/ec2/index.html?nc2=h_ql_doc_ec2
2. https://docs.aws.amazon.com/AWSEC2/latest/APIReference/Welcome.html

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202027** | **EXTREME WEB DEVELOPMENT** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Web Technologies

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Introduction to Basics of Web and Mobile application development, Responsive Web design, Native Web App, Basics of React Native, Native Components, JSX, State, Props, Cross-platform App, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:
**CO1.** Develop Native applications with GUI Components.
**CO2.** Develop hybrid applications with basic event handling.
**CO3.** Implement cross-platform applications with location and data storage capabilities.
**CO4.** Implement cross platform applications with basic GUI and event handling.
**CO5.** Develop web applications with cloud database access.

### CO-PO-PSO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 2 | 3 | 3 |
| **CO4** | 1 | 3 | 3 | 1 | 3 | 1 | - | 1 | - | - | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 1 | 3 | 3 | 2 | 2 | 2 | - | 3 | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **2** | **-** | **3** | **-** | **-** | **2** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3- High 2-Medium 1- Low**

### COURSE CONTENT:

**Module 1: FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT (9 periods)**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

**Module 2: NATIVE APP DEVELOPMENT USING JAVA (9 periods)**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

**Module 3: HYBRID APP DEVELOPMENT (9 periods)**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

**Module 4: CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE (9 periods)**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

**Module 5: NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS (9 periods)**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system ( km to miles, kg to pounds etc.,)
4. Design and develop a cross platform application for day to day task (to-do) management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases. For a simple library application. For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

## RESOURCES

### TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

**REFERENCES**

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras
4. Apache Cordova 4 Programming, John M Wargo, 2015 5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=JNz_aWGhAtM&list=PLpLBSl8eY8jRx0Tdqia7o3LGMewswU5XP
2. https://www.youtube.com/watch?v=l1EssrLxt7E&list=PLfqMhTWNBTe3H6c9OGXb5_6wcc1Mca52n

**WEB RESOURCES:**

1. https://www.udemy.com/course/the-extreme-web-development-course/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202028** | **ENTERPRISE APP & API DEVELOPMENT WITH ANGULARJS AND SAILS** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Full Stack Web Development

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Angular JS, Single-Page Application (SPA), AJAX requests and RESTful APIs in AngularJS, Sails JS, Restful APIs, Configuration and Integration of Angular Js and Sails.Js, Testing frameworks and methodologies, Continuous integration and deployment strategies, Performance optimization techniques, Internationalization and localization, third-party libraries and plugins in the apps.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1:** Understand the concepts of Angular JS and Sails JS for building applications and APIs.

**CO2:** Analyze the specifications of SPAs, routing and navigation, data binding for handling AJAX requests and RESTful APIs in Angular JS and Sails JS.

**CO3:** Design applications and APIs by configuring and integrating Angular JS and Sails JS.

**CO4:** Solve complex problems by practicing testing frameworks, continuous integration and deployment strategies.

**CO5:** Make use of custom directives, performance optimization techniques, third-party libraries and plugins in the development of applications and APIs.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - | 3 |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 |
| **CO3** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | 2 | |
| **CO4** | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | - | - | - | 3 | 3 |
| **CO5** | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| **Course Correlation Mapping** | **2** | **2** | **2** | **2** | **1** | **-** | **1** | **-** | - | **-** | **1** | **-** | **2** | 1 | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

**COURSE CONTENT**

**Module 1: INTRODUCTION TO ANGULAR JS AND BUILDING A SINGLE-PAGE APPLICATION (SPA) WITH ANGULAR JS (09 Periods)**

**Introduction to AngularJS:** Angular JS and its features, Setting up an Angular JS development environment, Angular JS expressions, directives, and modules, Controllers and scopes in Angular JS, Services and dependency injection in Angular JS.

**Building a Single-Page Application (SPA) With Angular JS:** Introduction to Single-Page Applications (SPAs), AngularJS routing and navigation, Templating and data binding in AngularJS, Working with forms and form validation in AngularJS, Handling AJAX requests and RESTful APIs in AngularJS

**Module 2: INTRODUCTION TO SAILS JS AND BUILDING RESTFUL API s WITH SAILS JS (09 Periods)**

**Introduction to Sails JS :** Sails.js and its features, Setting up a Sails.js development environment, Sails.js project structure and configuration, Defining models, controllers, and routes in Sails.js, Handling database operations with Sails.js using Waterline ORM.

**Building Restful APIs with Sails JS:**

RESTful API design principles, Creating RESTful routes in Sails.js, Implementing CRUD operations with Sails.js, Authentication and authorization in Sails.js, Error handling and validation in Sails.js.

**Module 3 INTEGRATING ANGULAR JS AND SAILS.JS (09 Periods)**

**Configuration and Integration of Angular Js and Sails.Js:** Setting up AngularJS and Sails.js integration, Consuming Sails.js APIs from AngularJS, Authentication and session management in the integrated app, Real-time communication with WebSockets in Sails.js and AngularJS, Optimizing performance and handling security in the integrated app.

**Module 4 TESTING AND DEPLOYMENT (09 Periods)**

**Testing And Deployment:** Testing frameworks and methodologies, Unit testing AngularJS components with Karma and Jasmine, End-to-end testing with Protractor, Continuous integration and deployment strategies, Best practices for deploying AngularJS and Sails.js apps.

**Module 5 ADVANCED TOPICS ON ANGULAR JS AND SAILS JS (09 Periods)**

**Advanced Topics on Angular JS and Sails JS:** Building custom directives in AngularJS, Performance optimization techniques for AngularJS and Sails.js, Internationalization and localization in AngularJS and Sails.js, Using third-party libraries and plugins in the app, Exploring advanced features and updates in AngularJS and Sails.js.

**Total Periods: 45**

**EXPERIENTIAL LEARNING**

**Lab 1: Setting up the Development Environment**

1. Install Node.js and npm (Node Package Manager).
2. Set up a code editor (e.g., Visual Studio Code).
3. Install AngularJS and Sails.js globally.
4. Create a new AngularJS project and a Sails.js project.

**Lab 2: Building a Basic AngularJS Application**

1. Create a simple AngularJS application with a few components.
2. Implement data binding and display dynamic content.
3. Add form controls and handle user input.
4. Perform basic validation on form inputs.
5. Implement basic routing and navigation between pages.

**Lab 3: Building a RESTful API with Sails.js**

1. Create models and configure the database connection.
2. Generate API endpoints for CRUD operations.
3. Implement validation and error handling in API endpoints.
4. Test API endpoints using tools like Postman or cURL.
5. Integrate authentication and authorization into API endpoints.

**Lab 4: Integrating AngularJS with Sails.js API**

1. Create AngularJS services to consume the Sails.js API.
2. Implement HTTP requests (GET, POST, PUT, DELETE) to interact with the API.
3. Handle responses and display data in the AngularJS application.
4. Implement authentication and session management in the integrated app.
5. Test API integration and ensure proper data flow between AngularJS and Sails.js.

**Lab 5: Building Real-Time Features with WebSockets**

1. Configure Sails.js to use WebSockets for real-time communication.
2. Implement real-time updates in the AngularJS application.
3. Use WebSockets for bidirectional communication between client and server.
4. Test and validate real-time features in the integrated app.

**Lab 6: Testing and Debugging**

1. Write unit tests for AngularJS components using frameworks like Jasmine.
2. Set up test runners like Karma for running AngularJS tests.
3. Use debugging tools and techniques to identify and fix issues in the application.
4. Perform end-to-end testing using tools like Protractor.
5. Analyze and troubleshoot common issues during testing and debugging.

**Lab 7: Deployment and Optimization**

1. Prepare the AngularJS and Sails.js application for deployment.
2. Deploy the application to a hosting environment (e.g., Heroku, AWS, or Azure).
3. Optimize the application's performance by minifying and bundling assets.
4. Implement caching strategies to improve the application's speed.
5. Monitor and analyze the application's performance using tools like Google Analytics or New Relic.

**Lab 8: Advanced Topics**

1. Explore advanced AngularJS concepts like custom directives or reactive programming.
2. Implement advanced features in Sails.js, such as policies or custom hooks.
3. Integrate third-party libraries or plugins into the application.

## RESOURCES

### TEXT BOOKS:


1. Shyam Seshadri and Brad Green "AngularJS: Up and Running" , O'Reilly Media, 2nd Edition, 2014.

2. Josh Kurz "Mastering AngularJS Directives" , Packt Publishing, 2014.Mike McNeil and Irl Nathan "Sails.js in Action", Manning Publisher, 1st Edition, 2017.


### REFERENCE BOOKS:


1. Adam Freeman "Pro AngularJS", Apress Publisher, 1st Edition, 2014.

2. Ken Williamson "Learning AngularJS: A Guide to AngularJS Development", O'Reilly Media, 1st Edition, 2015.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=AmjiDC_JUt4

2. https://www.youtube.com/watch?v=eqc7sYOpWg0&list=PLF8BRFFRWv9VkafkA4JtgY0I5NIzX2ZI9

### WEB RESOURCES:

1. https://sailsjs.com/documentation
2. https://docs.angularjs.org/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202030** | **MACHINE LEARNING** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Data mining /Python Programming

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks, Ensemble learning.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.

**CO2.** Analyze the underlying mathematical models within machine learning algorithms and learning tasks.

**CO3.** Design and implement machine learning solutions for classification, regression, and clustering problems.

**CO4.** Design and implement efficient neural architectures to model patterns for a given learning problem.

**CO5.** Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

**CO6.** Work Independently to solve problems with effective communication.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | 3 | 3 | 1 | | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | 1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO6** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **3** | **3** | **-** | **-** | **-** | **-** | **3** | **-** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

### Module 1: INTRODUCTION TO MACHINE LEARNING *(09 Periods)*

**Machine Learning:** Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning.

**Preparing to Model:** Machine learning activities, Types of data, Exploring structure of data, Data quality and remediation.

### Module 2: MODELING AND EVALUATION, BAYESIAN CONCEPT LEARNING *(09 Periods)*

**Modeling and Evaluation**: Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

**Feature Engineering:** Feature transformation, Feature subset Selection.

**Bayesian Concept Learning:** Introduction, Importance, Bayes' theorem, Bayes' theorem and concept learning, Bayesian belief network.

### Module 3: SUPERVISED LEARNING *(10 Periods)*

**Classification:** Classification model, Classification learning steps, K-Nearest Neighbor, Support vector machines, Decision Tree - Decision tree representation, Problems for decision tree learning, Decision tree learning algorithm, Hypothesis space search, Inductive bias in decision tree learning, Issues in decision tree learning.

**Regression**: Introduction, Simple linear regression, Improving accuracy of the linear regression model, Multiple linear regression, Assumptions and problems in regression analysis, Polynomial regression model, Logistic regression.

### Module 4: UNSUPERVISED LEARNING *(07 Periods)*

Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN.

### Module 5: ARTIFICIAL NEURAL NETWORKS, ENSEMBLE LEARNING *(10 Periods)*

**Artificial Neural Networks:** Neural network representations, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Back propagation algorithm, Convergence and local minima, Representational power of feed forward networks, Hypothesis space search and inductive bias, Hidden layer representations, Generalization, Overfitting, Stopping criterion.

**Ensemble Learning:** Bagging, Boosting, Gradient boosting.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

### LIST OF EXERCISES:

2. Introduction to Python machine learning libraries.
3. Use Naïve Bayes classifier to solve the credit card fraud detection problem.
4. Implement K-Nearest Neighbor algorithm to solve classification problem.
5. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Explore the problem of overfitting in decision tree and develop solution using pruning technique.
6. Perform Exploratory Data Analysis on the given dataset. Implement CART algorithm for decision tree learning. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
7. Train an SVM Classifier with Linear Kernel. Use an appropriate data set for building the SVM Classifier and apply this knowledge to classify a new sample.
8. Build linear regression and multiple regression models to predict the price of the house (Boston House Prices Dataset).
9. Build a polynomial regression model for predicting the salary of the employees.
10. Build a neural network that will read the image of a digit and correctly identify the number.
11. Solve classification problem by constructing a feedforward neural network using Backpropagation algorithm. (Wheat Seed Data)

## RESOURCES

### TEXT BOOKS:


1. Tom M. Mitchell, Machine Learning, McGraw Hill, 1997.
2. Saikat Dutt, Subramanian Chandramouli, Amit kumar das, Machine Learning, Pearson, 2019.


### REFERENCE BOOKS:


1. Manaranjan Pradhan, U Dinesh Kumar, Machine Learning Using Python, Packt Publishing, 2019.
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly, 2019.
3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition, 2020.
4. Shai Shalev Shwartz, Shai Ben David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.


### SOFTWARE/TOOLS:

1. Python
2. Scikit-learn/Keras/TensorFlow

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106106202/
2. https://www.coursera.org/learn/machine-learning
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
4. https://onlinecourses.nptel.ac.in/noc23_cs87/preview
5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview
6. https://www.coursera.org/learn/ntumlone-algorithmicfoundations
7. https://www.coursera.org/specializations/machine-learning-introduction
8. http://ndl.iitkgp.ac.in/document/YkxlRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhOWhlVXBhUVVWaXZlNDNyZUVldU9LdlYvd20wbkQ4MC92UQ
9. https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning

**WEB RESOURCES:**

1. https://www.ibm.com/topics/machine-learning
2. https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning
3. https://www.w3schools.com/python/python_ml_getting_started.asp
4. https://developers.google.com/machine-learning/crash-course
5. https://www.greenteapress.com/thinkstats/
6. https://info.deeplearning.ai/machine-learning-yearning-book
7. https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners
8. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202031** | **DATA HANDLING AND VISUALIZATION** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Data Analytics

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Introduction to data Visualization, Methodology, Data Presentation, design objectives, Seven stages of data visualization, Data representation methods, Acquiring data, Parsing data, data processing, Drawing with data, Port scan visualization, Attacking and defending visualization systems.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Understand the fundamentals of representing complex and voluminous data.

**CO2** Design and use various methodologies in visualization.

**CO3** Understanding the various process and tools used for visualization.

**CO4** Using interactive visualization to make inference.

**CO5** Discuss the process involved and security issues present in visualization.

### CO-PO-PSO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 3 | - | - | - | 2 | 3 | - | - | - | - | 3 | - | - | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | - | 2 | 2 | 3 | - | - | - | - | 2 | 2 | 3 |
| **CO3** | 1 | 3 | 3 | - | - | - | - | 3 | - | - | - | - | 2 | 2 | 3 | 3 |
| **CO4** | 1 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | 2 | - | |
| **CO5** | - | 3 | 3 | - | - | - | - | 2 | 2 | - | - | - | - | - | - | 3 |
| **Course Correlation Mapping** | **2** | **3** | **3** | **3** | **3** | **-** | **3** | **-** | **3** | **-** | **-** | **-** | **3** | **2** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT:

**Module 1 INTRODUCTION (9 Periods)**

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

**Module 2 VISUALIZING DATA METHODS (9 Periods)**

Mapping - Time series - Connections and correlations – Indicator-Area chart-Pivot table-Scatter charts, Scatter maps - Tree maps, Space filling and non-space filling methods-Hierarchies and Recursion - Networks and Graphs-Displaying Arbitrary Graphs-node link graph-Matrix representation for graphs- Info graphics

**Module 3 VISUALIZING DATA PROCESS (9 Periods)**

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

**Module 4 INTERACTIVE DATA VISUALIZATION (9 Periods)**

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3, .js, tablo.

**Module 5 SECURITY DATA VISUALIZATION (9 Periods)**

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems – Creating security visualization system.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.

## RESOURCES

### TEXT BOOKS:


1. Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013.
2. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007.
3. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", NoStarch Press Inc, 200


### REFERENCE BOOKS:


1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015..


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jLfo9uqgKFk&list=PL7yAVmu-X0Mm5cjTlDBZRvL8i7bFsWsce

2. https://www.youtube.com/watch?v=MiiANxRHSv4&t=176s

### WEB RESOURCES:

1. https://www.geeksforgeeks.org/data-handling/

2. https://www.tableau.com/learn/articles/data-visualization

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201018** | **DEEP LEARNING** | 3 | - | - | - | 3 |

**Pre-Requisite** Machine Learning

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Basics of Machine Learning, Neural Networks, Classifications, Classifiers, learning models, Back propagation algorithm, Feed Forward algorithm, Convolution and Recurrent Neural Networks, Auto encoder Architectures.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the concepts of classifications, neural networks, classifiers and learning models for the development of applications.

**CO2.** Select appropriate algorithms for solving the real time problems.

**CO3.** Analyze the working of Feed Forward Neural Networks and their modifications.

**CO4.** Apply Convolution & Recurrent Neural Networks to solve problems.

**CO5.** Commit to ethics in the use of algorithms in the development of applications.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO2** | 1 | 3 | 2 | - | 2 | - | 2 | - | - | - | - | 2 | 3 | - | 3 | 3 |
| **CO3** | 1 | 3 | - | 2 | - | - | - | - | - | - | 2 | - | 3 | 3 | 2 | 3 |
| **CO4** | 1 | 2 | 3 | 2 | - | - | - | 2 | - | - | - | - | 3 | 3 | - | - |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | - | - | 3 | 3 |
| **Course Correlation Mapping** | **2** | **3** | **2** | **1** | **1** | **-** | **1** | **1** | **1** | **1** | **1** | **1** | **3** | **2** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: BASICS OF MACHINE LEARNING (10 Periods)**

Beginnings of ANN, XOR Problem, From Cognitive Science to Deep Learning, NNs and their importance. Elementary classification problem, evaluating classification results, Simple Classifier – Naïve Bayesian Classifier, Simple NN: Logistic Regression, Learning without Labels, Learning alternative representation of data – PCA.

**Module 2: FEED FORWARD NEURAL NETWORKS (09 Periods)**

Basic concept and terminology, Representing networks, Perceptron rule, Delta rule, From logistic regression to Back propagation, Back propagation, Complete Feed forward NNs.

**Module 3 MODIFICATIONS & EXTENSIONS OF FF NEURAL NETS (09 Periods)**

Regularization, L1 & L2 regularization, Learning Rate, Momentum and Dropout, Stochastic Gradient Descent and Online Learning, Problems with multiple hidden layers, Vanishing and exploding gradients.

**Module 4 CONVOLUTION & RECURRENT NEURAL NETWORKS (09 Periods)**

Introduction, Feature maps and Pooling, Building a complete convolutional neural network. Recurrent Neural Networks – Sequences of unequal length, Settings for learning with recurrent neural networks, Adding feedback loops and Unfolding neural networks, Elman Networks, LSTM.

**Module 5 AUTO ENCODERS (08 Periods)**

Learning Representations, Different Auto encoder Architectures, Stacking Auto encoders.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. Deep Learning Methods for Object Detection.
2. Understanding YOLO Algorithm.
3. Transfer Learning and its applications.

## RESOURCES

**TEXT BOOK:**

1. Skansi S., "Introduction to Deep Learning - From Logical Calculus to Artificial Intelligence," Springer International Publishing, 1st Edition, 2018.

**REFERENCE BOOKS:**

1. Buduma N., "Fundamentals of Deep Learning," O Reilly Media, 1st Edition, 2016.
2. Seth Weidman, "Deep Learning from Scratch: Building with Python from First Principles,"
O'REILLY Media.

**VIDEO LECTURES:**

1. https://www.coursera.org/specializations/deep-learning

**WEB RESOURCES:**

1. https://www.mltut.com/best-resources-to-learn-deep-learning/
2. https://github.com/ChristosChristofidis/awesome-deep-learning

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201019** | **REINFORCEMENT LEARNING** | **3** | **-** | **-** | **-** | **3** |

**Pre-Requisite** Machine learning

**Anti-Requisite** **-**

**Co-Requisite** **-**

**COURSE DESCRIPTION:** Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Understand basics of RL.

**CO2** Understand RL Framework and Markov Decision Process.

**CO3** Analyzing through the use of Dynamic Programming and Monte Carlo

**CO4** Understand TD(0) algorithm, TD(λ) algorithm

**CO5** Analyzing geometric view problems

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO5** | - | - | - | - | - | - | - | - | 3 | 3 | - | - | 3 | - | 3 | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **3** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **3** | **-** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: BASICS OF PROBABILITY AND LINEAR ALGEBRA (09 Periods)**

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sublinear regret, UCB algorithm, KL-UCB, Thompson Sampling.

**Module 2: DECISION PROBLEM AND VALUE FUNCTION (09 Periods)**

Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration.

**Module 3: REINFORCEMENT LEARNING PROBLEM (09 Periods)**

The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation

**Module 4: BOOTSTRAPPING (09 Periods)**

Bootstrapping, TD (0) algorithm, Convergence of Monte Carlo and batch TD(0) algorithms, Model-free control: Q-learning, Sarsa, Expected Sarsa.

**Module 5: GEOMETRIC VIEW (09 Periods)**

N-step returns, TD (λ) algorithm, Need for generalization in practice, Linear function approximation and geometric view, Linear TD (λ). Tile coding, Control with function approximation, Policy search, Policy gradient methods, Experience replay, Fitted Q Iteration, Case studies.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Design and execute a simulation project to compare the performance of the UCB algorithm, KL-UCB, and Thompson Sampling on a set of stochastic multi-armed bandit problems
2. Organize a study group to dive deep into the mathematical underpinnings of the UCB algorithm.

## RESOURCES

**TEXT BOOKS:**


1. "Reinforcement learning: An introduction," First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. "Statistical reinforcement learning: modern machine learning approaches," First Edition, Sugiyama, Masashi. CRC Press 2015.

**REFERENCE BOOKS:**


1. "Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. "Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.


**VIDEO LECTURES:**

1. https://www.youtube.com/live/DB06M7ZA0Gs?feature=share
2. https://youtu.be/BAetsPIojg4

**WEB RESOURCES:**

1. https://users.cs.duke.edu/~cynthia/CourseNotes/MABNotes.pdf ·
2. https://bair.berkeley.edu/blog/2019/12/12/mbpo
3. https://arxiv.org/pdf/1705.07445v2.pdf

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201020** | **PREDICTIVE ANALYTICS** | **3** | **-** | **-** | **-** | **3** |

**Pre-Requisite** Data mining /Python Programming

**Anti-Requisite** **-**

**Co-Requisite** **-**

**COURSE DESCRIPTION:** The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Understand prediction-related principles, theories and approaches.

**CO2** Learn model assessment and validation.

**CO3** Understand the basics of predictive techniques and statistical approaches.

**CO4** Analyze supervised and unsupervised algorithms.

**CO5** Analyze unsupervised algorithms.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | - | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 | |
| **CO4** | 3 | 3 | 3 | - | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | - | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **3** | **-** | **3** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: LINEAR METHODS FOR REGRESSION AND CLASSIFICATION (09 Periods)**

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

**Module 2: MODEL ASSESSMENT AND SELECTION (09 Periods)**

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.

**Module 3: ADDITIVE MODELS, TREES, AND BOOSTING** (09 Periods)

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

**Module 4: NEURAL NETWORKS (NN), SUPPORT VECTOR MACHINES (SVM), AND K-NEAREST NEIGHBOR (09 Periods)**

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

**Module 5: UNSUPERVISED LEARNING AND RANDOM FORESTS (09 Periods)**

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

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Lead a project to apply unsupervised learning techniques (e.g., cluster analysis, principal components analysis) to a large, unlabeled dataset (e.g., customer data from a retail store).

2. Host a comparative analysis workshop on SVM for classification and regression tasks. Select two datasets: one for classification (e.g., digit recognition) and another for regression (e.g., stock price prediction).

## RESOURCES

**TEXT BOOKS:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

2. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.

**REFERENCE BOOKS:**

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.

2. L. Wasserman-All of statistics

**VIDEO LECTURES:**

1. https://www.investopedia.com/terms/p/predictive-analytics.asp
2. https://online.hbs.edu/blog/post/predictive-analytics

**WEB RESOURCES:**

1. https://www.javatpoint.com/predictive-analytics-vs-data-mining
2. https://www.geeksforgeeks.org/data-analytics-and-its-type/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201021** | **ARTIFICIAL INTELLIGENCE** | **3** | **-** | **-** | **-** | **3** |

**Pre-Requisite** Computational Statistics

**Anti-Requisite** **-**

**Co-Requisite** **-**

**COURSE DESCRIPTION:** Introduction to artificial intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Probabilistic reasoning, Represent knowledge and reason under uncertainty, Robotics, Ethics and safety in AI.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Architect intelligent agents using artificial intelligence techniques and principles.

**CO2.** Analyze and interpret the problem, identify suitable solutions using heuristic functions, optimization algorithms and search algorithms.

**CO3.** Select and apply appropriate knowledge representation to build Bayesian network models to reason under uncertainty.

**CO4.** Investigate robot hardware and frameworks for intelligent robotic perception.

**CO5.** Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

### CO-PO-PSO Mapping Table:

| Course Outcome | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | - | - | - | - | - | 1 | - | 2 | - | - | - | - | - | - | 3 | - |
| **Course Correlation Mapping** | **3** | **2** | **2** | **-** | **-** | **1** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |

***Correlation Level: 3-High; 2-Medium; 1-Low***

## COURSE CONTENT:

**Module 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE (10 Periods)**

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

**Module 2 PROBLEM SOLVING BY SEARCHING (9 Periods)**

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

**Module 3 SEARCH IN COMPLEX ENVIRONMENTS (9 Periods)**

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

**Module 4 PROBABILISTIC REASONING (9 Periods)**

Representing Knowledge in an uncertain domain, Semantics of Bayesian networks, Probabilistic reasoning over time – Time and uncertainty, Inference in temporal models, Hidden Markov models, Kalman Filter.

**Module 5 ROBOTICS, ETHICS AND SAFETY IN AI (8 Periods)**

Robotics: Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Ethics and Safety in AI: Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Solve the travelling sales man problem using Hill Climbing search algorithm.
2. Design and implement solution for 8-puzzle problem using Greedy Best First Search.

## RESOURCES

### TEXT BOOK(S):


1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 4th Edition, 2020.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education, 2017.
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.


### REFERENCE BOOKS:


1. Stephen Lucci , Danny Kopec, Artificial Intelligence in the 21st Century, Mercury Learning and Information, 3rd Edition,2018.
2. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.


### VIDEO LECTURES:

1. https://www.coursera.org/courses?query=artificial%20intelligence

**WEB RESOURCES:**

1. https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence
2. http://aima.cs.berkeley.edu/
3. https://ai.google/education/
4. https://www.edureka.co/blog/artificial-intelligence-with-python/

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA202032** | **AI FOR HEALTHCARE** | 3 | - | 2 | - | 4 |

**Pre-Requisite** Artificial Intelligence

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Understand the fundamental concepts of AI in Healthcare sector.

**CO2** Analyze the present state and future of AI in Healthcare specialties for different Scenarios.

**CO3** Apply design concepts and metrics for AI in Healthcare.

**CO4** Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.

**CO5** Develop AI applications through AI techniques for healthcare.

### CO-PO-PSO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - | |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | 3 | - | - | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | - | - | 3 | 3 | 3 | 3 | - | 3 |
| **Course Correlation Mapping** | **3** | **3** | **3** | **-** | **3** | **3** | **-** | **3** | **-** | **3** | **3** | **3** | **3** | **3** | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

### COURSE CONTENT

**Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE (09 Periods)**

Introduction to AI in Healthcare, Benefits and Risks, AI in the health sector, AI versus Human Intelligence, The future of AI in health sector, AI and Neural networks.

**Module 2: THE PRESENT STATE AND FUTURE OF AI IN HEALTHCARE SPECIALTIES (09 Periods)**

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

**Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE (09 Periods)**

IBM Watson, The role of Google and Deep mind in AI in Healthcare, Baidu, Facebook and AI in Healthcare, Microsoft and AI in Healthcare.

**Module 4: FUTURE OF HEALTHCARE IN AI (09 Periods)**

Evidence-based medicine, personalized medicine, Connected medicine, Disease and Condition Management, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Education, Incentivized Wellness, Artificial Intelligence, Block chain, Robots.

**Module 5: APPLICATIONS OF AI IN HEALTHCARE (09 Periods)**

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering a Scalable and Engaging Digital Therapy.

Total Periods: 45

## EXPERIENTIAL LEARNING

1. Study of PROLOG Programming Language and its Functions.
2. Write simple fact for the statements using PROLOG.
3. Write a Prolog program for the usage of all arithmetic Operators.
4. Write a Prolog program for solving the Towers of Hanoi problem
5. Write a Prolog program to solve Monkey and banana problem.
6. Write a Prolog program for depicting and inferring from the given Family relationship.
7. Write a Prolog program for implementing the solution for 8-Puzzle problem.

## RESOURCES

### TEXT BOOKS:


1. Dr. Parag Mahajan, Artificial Intelligence in Healthcare, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, Machine Learning and AI for Healthcare Big Data for Improved Health, Apress Publications, 2019.


### REFERENCE BOOKS:


1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril, National Academy

of Medicine Publication, First Edition, 2019.

**VIDEO LECTURES:**

1. https://www.udacity.com/course/ai-for-healthcare-nanodegree--nd320 (AI for Healthcare)

**WEB REFERENCES:**

1. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare (Surgical robots, new medicines and better care: 32 examples of AI in healthcare)
2. https://healthtechmagazine.net/article/2020/02/future-artificial-intelligence- healthcare (Future of Artificial Intelligence in Healthcare)

# SPECIALIZATION ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CA201022** | **DIGITAL IMAGE PROCESSING** | 3 | - | - | - | 3 |

**Pre-Requisite** Machine Learning

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Image Fundamentals, Image Transforms, Image enhancement in spatial and frequency domains, Restoration of images corrupted by noise, Image Compression models with coding, Segmenting images based on properties and Color image processing.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

**CO1.** Apply various transformations on images by analyzing basic operations on images.

**CO2.** Apply various image enhancement techniques in spatial and frequency domains.

**CO3.** Apply restoration techniques based on noise models and degradation function to restore the images, pertaining to health and societal applications.

**CO4.** Analyze various coding techniques for compression to reduce redundancies in images.

**CO5.** Analyze various segmentation techniques on images for societal applications.

**CO6.** Analyze various color models for different types of images.

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO3** | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO4** | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO5** | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **Course Correlation Mapping** | **2** | **2** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **-** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: IMAGE FUNDAMENTALS (10 Periods)**

Fundamental steps in Image Processing, Image sampling & quantization, some basic relationships between pixels, Arithmetic operations, Logical operations, Spatial operations.

Image Transforms: 2D-DFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar-Transform, Slant Transform and KL Transform, properties of image transforms.

**Module 2: IMAGE ENHANCEMENT (11 Periods)**

Basic Intensity transformation functions, Histogram processing, Fundamentals of Spatial Filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial Enhancement methods.

Basics of filtering in frequency domain, Correspondence between filtering in the spatial and frequency domains, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters, Homomorphic filtering.

**Module 3: IMAGE RESTORATION (07 Periods)**

Image degradation/Restoration model, Noise models, Restoration in the presence of Noise only-spatial filtering - mean, order- statistic and adaptive filters. Estimating the degradation function, Inverse filtering, Weiner filtering, Constrained least squares filtering.

**Module 4: IMAGE COMPRESSION (8 Periods)**

Classification of redundancy in Images, Image Compression models, Run length coding, Arithmetic coding, Dictionary based compression, bit-plane coding, Transform based coding, Fidelity Criteria, JPEG 2000.

**Module 5: IMAGE SEGMENTATION AND COLOR IMAGE PROCESSING (09 Periods)**

Detection of discontinuities- Point, line and edge Detection. Thresholding- global thresholding, adaptive thresholding. Region based Segmentation. Color image fundamentals - RGB, HSI models, conversions, Pseudo Color Image Processing, Color transformations.

**Total Periods: 45**

## EXPERIENTIAL LEARNING:

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image

**TEXT BOOKS**:


1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, Pearson Education,4th Edition, 2018.
2. Anil K. Jain, Fundamentals of Digital Image processing, Prentice Hall, 2007.

**REFERENCE BOOKS**:

1. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, Tata McGraw Hill Education, Second Edition, 2020.
2. Vipula Singh, Digital Image Processing with MATLAB & LabVIEW, Elsevier, 2019.

**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=1I6kfkY4GyQ
2. https://www.youtube.com/watch?v=RKE_w0F16ZA

**WEB RESOURCES:**

1. https://www.geeksforgeeks.org/digital-image-processing-basics/

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22AI201701** | **BUSINESS ANALYTICS** | 3 | - | - | - | 3 |

**Pre-Requisite**

**Anti-Requisite**

**Co-Requisite**

**COURSE DESCRIPTION:** This course emphasizes on the basic concepts of Business Analytics. It covers the basic excel skills, Excel look up functions for database queries in business analytics. By the end of this course students will acquire basic knowledge to implement statistical methods for performing descriptive, predictive and prescriptive analytics.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

| | |
|---|---|
| **CO1** | Understand the basic concepts and models of Business Analytics |
| **CO2** | Select Suitable basic excel function to perform analytics on spread sheets. |
| **CO3** | Apply different statistical methods and tools for data summarization and visualization. |
| **CO4** | Develop user-friendly Excel applications by using statistical models for effectiveness decision making. |
| **CO5** | Understand different optimization models used in prescriptive analytics. |

**CO-PO-PSO Mapping Table:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | - | - | - | 1 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO2** | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO3** | 3 | 2 | - | 2 | 2 | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO4** | 3 | - | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **CO5** | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | 3 | - | 3 | 3 |
| **Course Correlation Mapping** | **3** | **2.3** | **2.5** | **2** | **1.6** | - | - | - | - | - | - | - | **3** | - | **3** | **3** |

**Correlation Levels: 3: High; 2: Medium; 1: Low**

## COURSE CONTENT

**Module 1: FOUNDATIONS OF BUSINESS ANALYTICS (9 Periods)**

Introduction, What is Business Analytics, Evolution of Business Analytics, Scope of Business Analytics, Data for Business Analytics, Models in Business Analytics, Problem Solving with Analytics.

**Module 2: ANALYTICS ON SPREADSHEETS (9 Periods)**

Basic Excel Skills, Excel Functions, Using Excel Lookup Functions for Database Queries, Spreadsheet Add-Ins for Business Analytics.

**Module 3 DESCRIPTIVE ANALYTICS (9 Periods)**

Data Visualization, Creating Charts In Microsoft Excel, Other Excel Data Visualization, Statistical Methods For Summarizing Data, Exploring Data Using Pivot tables

**Module 4 PREDICTIVE ANALYTICS (9 Periods)**

Trend lines And Regression Analysis, Modeling Relationships And Trends In Data, Simple Linear Regression, Multiple Linear Regression, Building Good Regression Models,

Strategies for predictive decision modeling, implementing models on spreadsheets, spreadsheet applications in business analytics, developing user-friendly excel applications, analyzing uncertainty and model assumptions, model analysis using analytic solver platform

**Module 5 PRESCRIPTIVE ANALYTICS (9 Periods)**

Building Linear Models, Implementing Linear Optimization Models On Spreadsheets, Graphical Interpretation Of Linear Optimization, Formulating Decision Problems, Decision Strategies Without Outcome Probabilities, Decision Trees With Outcome Probabilities, Decision Trees.

**Total Periods: 45**

## RESOURCES

**TEXT BOOK:**

1. James Evans, "Business Analytics," Pearson Education ,2nd Edition, 2017.

**REFERENCE BOOKS:**

1. Marc J.Schniederjans, "Business Analytics," Pearson Education,2015
2. Camm,Cochran, "Essentials of Business Analytics," cenage learning,2015

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/110105089
2. https://archive.nptel.ac.in/courses/110/107/110107092/
3. https://nptel.ac.in/courses/110106050

**WEB RESOURCES:**

1. https://www.proschoolonline.com/certification-business-analytics-course/what-is-ba
2. https://michael.hahsler.net/SMU/EMIS3309/slides/Evans_Analytics2e_ppt_01.pdf
3. https://www.guru99.com/business-analyst-tutorial-course.html

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22EC101701** | **AI IN HEALTHCARE** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Understand the fundamental concepts of AI in Healthcare sector.

**CO2** Analyse the present state and future of AI in Healthcare specialties for different scenarios.

**CO3** Apply design concepts and metrics for AI in Healthcare.

**CO4** Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.

**CO5** Develop AI applications through AI techniques for healthcare

## CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 3 | - | 2 | - | 2 | 2 | - | - | - | - | - |
| **CO3** | 2 | - | 2 | 2 | - | - | - | - | - | - | - | - |
| **CO4** | 2 | - | - | - | 2 | 2 | - | - | - | - | - | - |
| **CO5** | - | - | 3 | - | - | - | - | - | - | - | - | - |
| **Course Correlation Mapping** | **2** | **-** | **3** | **2** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE** ***(08 Periods)***

Introduction to AI in Healthcare, Benefits & Risks, AI in the health sector, AI versus human intelligence, The future of AI in health sector, AI & Neural networks.

**Module 2: THE PRESENT STATE & FUTURE OF AI IN HEALTHCARE SPECIALTIES** ***(10 Periods)***

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

**Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE** ***(08 Periods)***

IBM Watson, The role of Google & Deep mind in AI in Healthcare, Baidu, Facebook & AI in Healthcare, Microsoft & AI in Healthcare.

**Module 4: FUTURE OF HEALTHCARE IN AI** ***(10 Periods)***

Evidence-based medicine, personalized medicine, Connected medicine, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Incentivized Wellness, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals.

**Module 5: APPLICATIONS OF AI IN HEALTHCARE** ***(09 Periods)***

**Case Study 1**: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

**Case Study 2**: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

**Case Study 3:** Delivering A Scalable and Engaging Digital Therapy.

**Case Study 4:** Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy.

**Case Study 5:** Big Data, Big Impact, Big Ethics: Diagnosing Disease Risk from Patient Data.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Analyze how the artificial intelligence is used to predict the disease result and Prognosis Assessment of a patient.
2. How does drug discovery happen and how does AI is helping in drug discovery and Labs.
3. Justify that artificial intelligence provide engineering solutions for early detection and Diagnosis of diseases.
4. Demonstrate the prediction of bladder volume of a patient.

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

### TEXT BOOKS:


1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare*, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, *Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.


### REFERENCE BOOKS:


1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, First Edition 2019.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=-aHBwTQQyNU
2. https://intellipaat.com/blog/artificial-intelligence-in-healthcare/

### WEB RESOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/
2. https://www.ibm.com/topics/artificial-intelligence-healthcare
3. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CB101701** | **CYBER LAWS AND SECURITY** | 3 | - | - | - | 3 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing ad Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber
Crime and Terrorism; Cyber Crime Illustrations

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge in Cyber security, Cybercrimes and its related laws in Indian and Global Act.
**CO2.** Analyze the legal perspectives and laws related to cybercrimes in Indian context.
**CO3.** Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.
**CO4.** Solve Cyber security issues using privacy policies and Use antivirus tools to minimize the impact of cyber threats.
**CO5.** Apply security standards for the implementation of Cyber Security and laws.

## CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION TO CYBER CRIMES AND OFFENSES** ***(09 Periods)***

**Cyber Crimes:** Introduction, Definition, Origin, Cybercrime and information security, Cyber criminals, Classifications of cybercrimes, The legal perspectives and Indian perspective, Cybercrime and Indian ITA 2000, Global perspective on cybercrimes.

**Cyber Offenses:** Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

**Module 2: TOOLS AND METHODS USED IN CYBER CRIME AND PHISHING AND IDENTITY THEFT** *(09 Periods)*

Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.

**Phishing and Identity Theft:** Introduction, Phishing, Identity Theft (ID Theft).

**Module 3 CYBER CRIMES AND CYBER SECURITY-LEGAL PERSPECTIVES** *(08 Periods)*

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cybercrime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber law, Technology and Students in India scenario.

**Module 4 CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS** *(10 Periods)*

Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

**Module 5 CYBER CRIME AND TERRORISMAND ILLUSTRATIONS** *(09 Periods)*

**Cyber Crime & Terrorism:** Introduction, Intellectual property in the cyber space, The ethical dimension of cybercrimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.

**Cyber Crime Illustrations:** Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. The Cyber Security Risks on Social Media – Learn from Case Studies: https://www.rswebsols.com/tutorials/internet/cyber-security-risks-social-media
2. SIX automates key cybersecurity tasks to actively protect itself against social media threats: https://www.hootsuite.com/resources/six-group-case-study
3. Important Cyber Law Case Studies : https://www.cyberralegalservices.com/detail-casestudies.php

*(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)*

## RESOURCES

**TEXT BOOKS:**

1. Nina Gobole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.

**REFERENCE BOOKS:**

1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.
2. Alfred Basta and et al, *Cyber Security and Cyber Laws*, Cengage Learning India 2018

**VIDEO LECTURES:**

1. Learn Cyber Security | Cyber Security Training: https://www.youtube.com/watch?v=PlHnamdwGmw

2. Cyber Security For Beginners: https://www.youtube.com/watch?v=4RE4d23tDFw

**WEB RESOURCES:**

1. https://study.com/academy/course/computer-science-110-introduction-to-cybersecurity.html
2. https://www.pandasecurity.com/en/mediacenter/panda-security/types-of-cybercrime/
3. https://mediasmarts.ca/digital-media-literacy/digital-issues/cyber-security/cyber-security-spam-scams-frauds-identity-theft

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| 22MG101701 | ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** To understand the setting up and management of MSMEs and initiatives of Government and other institutions support for growth and development of MSMEs

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Understand the basic of SME and challenges of MSMEs

**CO2.** Explain the opportunities to Set-Up SSI/SME Units and role of rural & women entrepreneurship.

**CO3.** Illustrate roles of various institutions supporting MSMEs.

**CO4.** Understand Management of MSME, NPA & sickness units

**CO5.** Evaluate role of Government in Promoting Entrepreneurship

## CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - |
| CO2 | 1 | 1 | 2 | - | - | | 2 | | 1 | | | - |
| CO3 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | 2 | |
| CO4 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO5 | 2 | 2 | 1 | - | - | 1 | - | - | - | - | - | 1 |
| **Course Correlation Mapping** | **2** | **2** | **2** | **2** | **1** | **1** | **2** | **1** | 1 | **-** | **2** | **2** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION2** ***(07 Periods)***

Concept & Definition, Role of Business in the modern Indian Economy SMEs in India, Employment and export opportunities in MSMEs. Issues and challenges of MSMEs

**Module 2: MSME SETTING** ***(09 Periods)***

Identifying the Business opportunity, Business opportunities in various sectors, formalities for setting up an enterprise - Location of Enterprise – steps in setting up an enterprise –

Environmental aspects in setting up, Incentives and subsidies.

**Module 3: MSMES SUPPORTING INSTITUTIONS** ***(09 Periods)***

Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions, Central level institutions, State level institutions, Other agencies, Commercial Bank – Appraisal of Bank for loans

**Module 4: MANAGEMENT OF MSME** ***(10 Periods)***

Management of Product Line; Communication with clients – Credit Monitoring System - Management of NPAs - Restructuring, Revival and Rehabilitation of MSME, Problems of entrepreneurs – sickness in SMI – Reasons and remedies –– Evaluating entrepreneurial performance

**Module 5: ENTREPRENEURSHIP PROMOTION** ***(10 Periods)***

MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB)

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Present a case study on MSMEs Business Strategies.
2. Collect the data about nearby MSMEs and Present their structures in a PPT
3. Discuss in the group MSMEs opportunities in terms of Orientation and Develop mentation.

*(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)*

## RESOURCES

### TEXT BOOKS:


1. Vasant Desai, *Small Scale Industries and Entrepreneurship*, Himalaya Publishing House, 2003..
2. Poornima M Charanthimath, *Entrepreneurship Development Small Business Enterprises*, Pearson, 2006.


### REFERENCE BOOKS:


1. Suman Kalyan Chaudhury, *Micro Small and Medium Enterprises in India Hardcover*, Raj Publications, 2013.
2. Aneet Monika Agarwal, *Small and medium enterprises in transitional economies, challenges and opportunities*, DEEP and DEEP Publications
3. Paul Burns & Jim Dew Hunt, *Small Business Entrepreneurship*, Palgrave Macmillan publishers, 2010.


### VIDEO LECTURES:

1. https://sdgs.un.org/topics/capacity-development/msmes
2. https://blog.tatanexarc.com/msme/msme-schemes-in-india-for-new-entrepreneurs-and-start-ups/

### WEB RESOURCES:

1. ncert.nic.in/textbook/pdf/kebs109.pdf
2. https://www.jetir.org/papers/JETIR1805251.pdf

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22CB101703** | **FORENSIC SCIENCE** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed discussion on Concepts of Forensic Science, Tools and Techniques in Forensic Science, Forensic Photography, Crime Scene Management, Crime Scene Management Laws and Forensic Science.

**COURSE OUTCOMES:** *After successful completion of the course, students will be able to*:

**CO1** Understand the basic concepts of Forensic science.

**CO2** Apply various tools and techniques in forensic science for crime investigation.

**CO3** Understand Forensic Photography fundamentals.

**CO4** Perform Crime scene investigation, scene reconstruction and prepare reports.

**CO5** Understand Legal aspects of Forensic Science.

### CO-PO Mapping Table:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - |
| **Course Correlation Mapping** | **3** | **3** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

**Module 1: INTRODUCTION** ***(09 Periods)***

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

**Module 2: TOOLS AND TECHNIQUES IN FORENSIC SCIENCE** ***(09 Periods)***

Basic principles of microscopy, spectroscopy, chromatography, Electrophoresis, Enzyme_Linked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies; Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance. Analysis of variance, Correlation and Regression.

**Module 3: FORENSIC PHOTOGRAPHY** ***(8 Periods)***

Basic principles of Photography, Techniques of black & white and color photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

**Module 4: CRIME SCENE MANAGEMENT** ***(11 Periods)***

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences, Chain of custody and Reconstruction of scene of crime. Report writing.

**Module 5: LAW AND FORENSIC SCIENCE** ***(8 Periods)***

**Legal aspects of Forensic Science**: Forensic Science in the Criminal Justice System, The Criminal Investigation Process, Production of Evidence: The Subpoena, The Rules of Evidence, Authentication of Evidence: The Chain of Custody, The Admissibility of Evidence, Laboratory Reports, Examples of Analysis and Reports, Expert Testimony, Getting into Court, Testifying, Being a Witness and an Expert, Considerations for Testimony.

***Total Periods: 45***

## EXPERIENCIAL LEARNING

1. Study of Computer Forensics and different tools used for forensic investigation
2. Identify and list the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt

*(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)*

## RESOURCES

### TEXT BOOKS:


1. Houck M.M and Siegel J.A, *Fundamentals of Forensic Science*, Elsevier, 2nd edition, 2010.
2. Sharma B.R, *Forensic Science in Criminal Investigation and Trials*, Universal Publishing Co., New Delhi, 2003.


### REFERENCE BOOKS:


1. Nanda B.B and Tewari, R.K, *Forensic Science in India- A vision for the Twenty First Century*, Select Publisher, New Delhi, 2001.
2. James, S.H and Nordby, J.J, *Forensic Science- An Introduction to Scientific and Investigative Techniques*, CRC Press, USA, 2003.

3. Saferstein, Criminalistics, *An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
4. Barry, A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, NewYork, 7th edition, 2003.

**VIDEO LECTURES:**

1. https://nptel.ac.in/courses/106106178
2. https://www.youtube.com/watch?v=X5fo1H7bc0g

**WEB RESOURCES:**

1. https://www.nist.gov/forensic-science
2. https://www.coursera.org/learn/forensic-science

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22SS101702** | **GENDER AND ENVIRONMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Gender and the environment relationship, Gendered Roles in the Family & Community, Gender and sustainable development, Gender in environmental justice, Gender & Environmental Security.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Apply the knowledge of gender & environmental connections by analyzing key issues and topics within global environmental politics in environmental decision-making.

**CO2** Demonstrate knowledge of the concepts of gender and sustainable development through debates and policy documents.

**CO3** Analyze the concept of environmental security and justice by identifying the sources of insecurity.

### CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 1 | - | - | - | 3 | 3 | - | - | - | - | - |
| **CO2** | 3 | - | - | - | - | 2 | 3 | 1 | - | 2 | - | - |
| **CO3** | 3 | 1 | - | - | - | 3 | 3 | - | - | - | - | 2 |
| **Course Correlation Mapping** | **3** | **1** | **-** | **-** | **-** | **3** | **3** | **1** | **-** | **2** | **-** | **2** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

### COURSE CONTENT

**Module 1: GENDER AND ENVIRONMENT RELATIONSHIP** ***(09 Periods)***

Introduction – Gender and Environment – Development of gender roles – Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism – Cultural eco-feminism – Social eco-feminism – Feminist political ecology

**Module 2: GENDERED ROLES IN THE FAMILY & COMMUNITY** ***(09 Periods)***

Organization of the household – Domestic division of labour – Food: growing, harvesting, shopping, preparing, and cooking

Gender & Power – Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

**Module 3: GENDER AND SUSTAINABLE DEVELOPMENT** ***(09 Periods)***

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development

**Module 4: GENDER IN ENVIRONMENTAL JUSTICE** ***(09 Periods)***

Normative Concerns ( Fairness, Inequality & Justice) –Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender &Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

**Module 5: GENDER AND ENVIRONMENTAL SECURITY** ***(09 Periods)***

Connections between security & the environment – **Gender, environment & security:** Sustainability as security – poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security - **Case Study** – The impacts of natural disasters

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on the family setup of different countries and their peculiar customs.
3. Prepare poster presentation on "Ancient hominin walked like a human but climbed like an ape."
4. Find out the problems of present society and being part of future generations how you may help to strengthen environmental security.

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

### TEXT BOOKS:


1. Nicole Detraz, *Gender and the Environment,* Polity Press, Cambridge, UK. 2017
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London. 2000

**REFERENCE BOOKS:**


1. Promillakapur ed., *Empowering Indian Women*, Publication Division, Government of India, New Delhi. 2000.
2. Ronnie Vernooy, Ed., *Social and Gender Analysis Natural Resource Management: Learning Studies and Lessons from Asia,* Sage, New Delhi. 2006
3. Swarup Hemlata and Rajput, Pam, *Gender Dimensions of Environmental and Development Debate: The Indian Experience,* In Sturat S. Nagel, (ed). *India's Development and Public Policy*. Ashgate, Burlington. 2000

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22ME101704** | **MANAGING INNOVATION AND ENTERPRENEURSHIP** | 3 | - | - | - | 3 |

**Pre-Requisite** -
**Anti-Requisite** -
**Co-Requisite** -

**COURSE DESCRIPTION:**
Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation & Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate the principles of innovation process for establishing Industrial ventures.
**CO2.** Identify and analyze the gaps in an organization for innovation in the context of developed economies
**CO3.** Develop a comprehensive and well-planned business structure for a new venture.
**CO4.** Demonstrate knowledge on intellectual property rights, patents, trademarks, copyrights, trade secrets and commercialization of intellectual property.
**CO5.** Apply ethics in constructive innovation framework and problem solving.

## CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 1 | 1 | - | 1 | 1 | 1 | 1 | - | - | 1 | - |
| **CO2** | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | - |
| **CO3** | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | - |
| **CO4** | 3 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - |
| **CO5** | 3 | 3 | 3 | 1 | 1 | 1 | - | | - | - | 2 | - |
| **Course Correlation Mapping** | **3** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | - | - | **1** | - |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: CREATIVITY AND INNOVATION** ***(09 Periods)***

Introduction, Levels of innovation, Purposeful innovation and the sources of innovative opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

**Module 2: PARADIGMS OF INNOVATION** ***(09 Periods)***

Systems approach to innovation, Innovation in the context of developed economies and Emerging economies, Examining reverse innovation and its application, Performance gap, Infra structure gap, Sustainability gap, Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

**Module 3: SOUCES OF FINANCE AND VENTURE CAPITAL** ***(09 Periods)***

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

**Module 4: INTELLECTUAL PROPERTY INNOVATION AND ENTREPRENEURSHIP** ***(09 Periods)***

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

**Module 5: OPEN INNOVATION FRAME WORK & PROBLEM SOLVING** ***(09 Periods)***

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and Opportunities of open innovation frame work, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification

**Total Periods:45**

## EXPERIENTIAL LEARNING

1. Identify the Innovative Marketing Strategies for Startups
2. Identify the Coca-cola Company Intellectual Property Rights

*(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)*

## CASE STUDIES/ARTICELS:

Contemporary relevant case studies/ Articles will be provided by the course instructor at the beginning.

1. Tesla Inc.: Disrupting the Automobile Industry
   This case study examines how Tesla Inc. disrupted the traditional automobile industry through its innovative electric vehicles and sustainable energy solutions. It discusses the sources of innovative opportunity that Tesla leverages, the ideation and creativity dynamics involved in new product development, and the strategies that the company uses to introduce and market its innovations.
2. Google Inc.: Innovation in Developed Economies
   This case study explores how Google Inc. became a global leader in the technology industry through its innovative search engine, advertising, and cloud computing solutions. It highlights the performance gap that Google addressed, the regulatory and sustainability gaps that it leveraged, and the impact of its innovation strategies on the company's growth and profitability.

3. Flipkart: From Startup to Unicorn
   This case study examines how Flipkart, an Indian e-commerce company, secured venture capital funding to become one of the largest online marketplaces in India. It discusses the importance of finance in entrepreneurship, the advantages and disadvantages of venture capital, and the strategies that Flipkart used to attract venture funding.

4. Patanjali Ayurved: Building a Brand through Intellectual Property
   This case study explores how Patanjali Ayurved, an Indian consumer goods company, built a strong brand through its intellectual property strategies. It discusses the forms of IP that Patanjali leverages, the patent process in India, and the impact of IP on the company's growth and profitability.

5. Procter & Gamble: Innovation through Open Innovation
   This case study analyzes how Procter & Gamble, a global consumer goods company, leveraged open innovation to achieve unprecedented success in product development and marketing. It discusses the difference between open and cloud innovation approaches, the limitations and opportunities of open innovation, and the role of strategic alliances in global innovation.

## RESOURCES

### TEXT BOOKS:


1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.
2. Drucker, P.F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.


### REFERENCE BOOKS:


1. Robert D Hisrich, Claudine Kearney, *Managing Innovation and Entrepreneurship,* Sage Publications, 1st Edition, 2014.
2. V.K. Narayanan, *Managing Technology and Innovation for Competitive Advantage,* Pearson India, 1st Edition, 2002.


### VIDEO LECTURES:

1. https://www.youtube.com/watch?v=wWsl48VLfVY
2. https://www.youtube.com/watch?v=dDpQ9ALKX0U
3. https://www.youtube.com/watch?v=Eu_hkxkJGTg

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22LG101702** | **PERSONALITY DEVELOPMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION**: This course gives awareness to students about the various dynamics of personality development.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Demonstrate knowledge in Self-Management and Planning Career

**CO2.** Analyze the functional knowledge in attitudes and thinking strategies

**CO3.** Learn and apply soft skills for professional success.

**CO4.** Function effectively as an individual and as a member in diverse teams

**CO5**. Communicate effectively in public speaking in formal and informal situations.

## CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 2 | - | - | 3 | - | - | - | - | 2 | - | - |
| **CO4** | 1 | 1 | - | - | - | - | - | - | 3 | 3 | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **Course Correlation Mapping** | **2** | **2** | **3** | **-** | **3** | **-** | **-** | **-** | **3** | **3** | **-** | **-** |

***Correlation Levels:*** ***3: High;*** ***2: Medium;*** ***1: Low***

## COURSE CONTENT

**Module 1: SELF-ESTEEM & SELF-IMPROVEMENT** ***(09 Periods)***

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself- Exercises- case studies

**Module 2: DEVELOPING POSITIVE ATTITUDES** ***(09 Periods)***

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies

**Module 3 SELF-MOTIVATION & SELF-MANAGEMENT** ***(09 Periods)***

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

**Module 4 GETTING ALONG WITH THE SUPERVISOR** ***(09 Periods)***

Know your Supervisor – Communicating with your Supervisor – Special Communication with your Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expe

of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

**Module 5 WORKPLACE SUCCESS** ***(09 Periods)***

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Exercises-

case studies

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. List out the self-improvements in you on the charts and explain in detail.
2. Discuss different famous personalities and their attitudes.
3. Describe different personalities with respect to self-motivation and self-management.
4. Imagine you are a supervisor and illustrate different special communications.
5. Assume and Interpret different experiences on the first day of your job.

*(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)*

## RESOURCES

**TEXTBOOK:**


1. Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)
2. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

**REFERENCE BOOKS:**


1. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014


**VIDEO LECTURES:**

1. https://www.youtube.com/watch?v=6Y5VWBLi1es
2. https://www.youtube.com/watch?v=H9qA3inVMrA

**WEB RESOURCES:**

1. https://www.universalclass.com/.../the-process-of-perso...
2. https://www.ncbi.nlm.nih.gov/pubmed/25545842
3. https://www.youtube.com/watch?v=Tuw8hxrFBH8

# UNIVERSITY ELECTIVE

| Course Code | Course Title | L | T | P | S | C |
|---|---|---|---|---|---|---|
| **22SS101706** | **WOMEN EMPOWERMENT** | 3 | - | - | - | 3 |

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** Concept & Framework, Status of Women, Women's Right to Work, International Women's Decade, and Women Entrepreneurship.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1** Demonstrate the knowledge of the characteristics and achievements of empowered women and women's empowerment techniques by analyzing women's legal and political status.

**CO2** Apply the knowledge of women's rights by analyzing various societal issues and obstacles in different fields, including science and technology.

**CO3** Demonstrate the knowledge of the significance of women's participation in policy debates, National conferences, and common forums for equality and development by identifying and analyzing issues.

**CO4** Analyze the concept of women's entrepreneurship, government schemes, and entrepreneurial challenges and opportunities.

### CO-PO Mapping Table

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 1 | - | - | 1 | 3 | - | 1 | – | – | - | - |
| **CO2** | 3 | 1 | - | - | - | 2 | - | - | - | – | - | - |
| **CO3** | 3 | 1 | - | - | - | 2 | - | - | - | 3 | - | - |
| **CO4** | 3 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| **Course Correlation Mapping** | **3** | **1** | **-** | **-** | **1** | **3** | **-** | **1** | **–** | **3** | **2** | **-** |

***Correlation Levels: 3: High; 2: Medium; 1: Low***

## COURSE CONTENT

### Module 1: CONCEPT & FRAMEWORK *(09 Periods)*

Introduction– Empowered Women's Characteristics – Achievements of Women's Empowerment **Concept of Empowerment:** Meaning & Concept – Generalizations about Empowerment – Empowerment Propositions – Choices women can make for empowerment – Women's participation in decision making, development process & in Governance. **Framework for Empowerment** – Five levels of equality – Tenets of Empowerment– Elements – Phases and aspects – Techniques – Categories and Models – Approaches.

### Module 2: STATUS OF WOMEN *(09 Periods)*

Legal Status: Present Scenario – Call for Social Change – Significant Trends – Legal & Schemes – Personal Law – Joint Family – Criminal Law – Shift towards Dowry – Deterrent Punishment – Criminal Law (II Amendment) – Discrimination in Employment.

Political Status: Present Scenario – Political Participation & its NatureSocio–economic Characteristics – Political Mobilization: Mass Media – Campaign Exposure – Group Orientation – Awareness of issues and participation – Progress & Future Thrust.

### Module 3: WOMEN'S RIGHT TO WORK *(09 Periods)*

Introduction – Present Scenario – Changes in Policy & Programme – National Plan of Action– Women's Cells and Bureau – Increase in the work participation rate – Discrimination in the labour market – Women in unorganized sector – Issues and Obstacles– Women in Education – Women in Science & Technology – Case Study: Linking Education to Women's Access to resources.

### Module 4: WOMEN'S PARTICIPATORY DEVELOPMENT *(09 Periods)*

Dynamics of social change – conscious participation – Information Explosion – Organized Articulation – National Conference – Common Forums – Participatory Development – New Issues Identified – Role of other Institutions.

### Module 5: WOMEN ENTREPRENEURSHIP *(09 Periods)*

Introduction – Definition – Concept – Traits of women Entrepreneurs – Role of Women Entrepreneurs in India – Reasons for Women Entrepreneurship – Government schemes & Financial Institutions to develop Women Entrepreneurs – Key policy recommendations – Project Planning – Suggestions and measures to strengthen women entrepreneurship – Growth & Future challenges – Training and Opportunities – Case Study: Training Women as Hand–pump Mechanics– Case Study: Literacy for Empowering Craftswomen

***Total Periods: 45***

## EXPERIENTIAL LEARNING

1. Prepare poster presentation on "impact of women's self-help groups on their empowerment and socio-economic development."
2. Prepare a comparative analysis chart on the status of women in various countries.
3. Prepare a presentation on women and cultural responsibilities in different societies.
4. Prepare a presentation on the women of the past, present and future in terms of responsibilities and duties.
5. Prepare a presentation on the great women entrepreneurs of India.

*(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)*

## RESOURCES

### TEXT BOOKS:


1. SahaySushama, *Women and Empowerment,* Discovery Publishing House, New Delhi, 2013.
2. NayakSarojini, Jeevan Nair, *Women's Empowerment in India*, Pointer Publishers, Jaipur, 2017.


### REFERENCE BOOKS:


1. Baluchamy. S, *Women's Empowerment of Women*, Pointer Publishers, Jaipur, 2010.
2. Khobragade Grishma, *Women's Empowerment: Challenges and Strategies Empowering Indian Women*, Booksclinic Publishing, Chhattisgarh, 2020.


### WEB RESOURCES:

1. https://www.economicsdiscussion.net/entrepreneurship/women–entrepreneurs–in–india
2. https://www.businessmanagementideas.com/entrepreneurship–2/women entrepreneurs