

# **BANGALORE UNIVERSITY**

## **SCHEME AND SYLLABUS**

**For the course**

### **BACHELOR OF COMPUTER APPLICATIONS (BCA)**

**NEP2021 Scheme**

**Academic Year 2021-22 and onwards**

Department of Computer Science and Applications  
**BANGALORE UNIVERSITY, BANGALORE**

**BANGALORE UNIVERSITY**

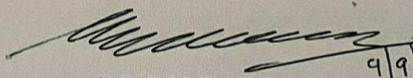
**PROCEEDINGS OF THE MEETING OF THE BOARD OF STUDIES IN  
COMPUTER SCIENCE (UG AND PG), BANGALORE UNIVERSITY HELD ON  
09-09-2023 THROUGH ONLINE MODE AT 6:30 PM**

The Following Members were present:

1. Dr. Aziz Makandar, Department of Computer Science, Karnataka State Akkamahadevi Women's University, Vijayapura
2. Dr.. H.L. Shashi Rekha, Department of Computer Science, Mangalore University
3. Dr. Shivashankar S, Department of Computer Science, Karnatak University, Dharwad
4. Ms. L. Hamsaveni, Department of Computer Science, University of Mysore
5. Dr. Hanumanthappa M, Department of Computer Science, Bangalore University
6. Dr. Somashekara. M.T, Department of Computer Science, Bangalore University
7. Mr. Prakasha K Renukappa, Software Quality Principal Engineer, Dell Technologies, Bangalore
8. Mr. Dodde Gowda, Sales force, Torrey Pines, Bangalore
9. Ms. Suneetha V, MCA Department, Dayananda Sagar College of Arts, Science and Commerce, Bangalore
10. Dr.P.Felcy Judith, Computer Applications, T John College, Bangalore
11. Ms. B Nazia Hassan, Department of Computer Science, Government First Grade College, Vijayanagar ,Bengaluru
12. Mr. Chandrashekar, Department of Computer Science, Government First Grade College, Nelamangala
13. Mr. Sreenivasa H V, Department of Information Technology AIMS, Peenya , Bangalore
14. Dr. Muralidhara B L, Department of Computer Science, Bangalore University

The chairperson presented the syllabus of the V and VI semester BCA (NEP), and B.Sc Computer Science (NEP) to the Committee. The Committee discussed the syllabus in detail, and approved the same.

The Chairperson thanked all members for their active participation.

  
(MURALIDHARA B. L)  
Chairperson, BoS in Computer Science

**BANGALORE UNIVERSITY**  
**BCA SYLLABUS (NEP)**  
**[Based on I-C. Model of Karnataka State Higher Education Council]**

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
<b>I</b>	CA-C1T	Discrete Structure	3	OE1: Open Elective	3	26
	CA-C2T	Problem solving Techniques	3	Language L1	3	
	CA-C3T	Data Structure	3	Language L2	3	
	CA-C4L	Problem solving Lab	2	SEC I : Office Management Tools	2	
	CA-C5L	Data Structure Lab	2	Physical Education	1	
				Health & Wellness	1	
<b>II</b>	CA-C6T	Computer Architecture	3	OE2: Open Elective	3	26
	CA-C7T	Object Oriented Programming using Java	3	Language L1	3	
	CA-C8T	Database Management System	3	Language L2	3	
	CA-C9L	Java Lab	2	Environmental studies	2	
	CA-C10L	Database Management System Lab	2	Physical Education	1	
				NCC/NSS/CL/R&R	1	
<b>III</b>	CA-C11T	Operating Systems	3	OE3: Open Elective	3	26
	CA-C12T	Computer Networks	3	Language L1	3	
	CA-C13T	Python Programming	3	Language L2	3	
	CA-C14L	Computer Networks Lab	2	SEC II : Computer Assembly and Repair	2	
	CA-C15L	Python Programming Lab	2	Physical Education	1	
				NCC/NSS/CL/R&R	1	
<b>IV</b>	CA-C16T	Software Engineering	3	OE4: Open Elective	3	26
	CA-C17T	Design and Analysis of Algorithm	3	Language L1	3	
	CA-C18T	Internet Technologies	3	Language L2	3	
	CA-C19L	Design and Analysis of Algorithm Lab	2	The Constitution of India	2	
	CA-C20L	Internet Technologies Lab	2	Physical Education	1	
				NCC/NSS/CL/R&R	1	

Semester	Course Code	Title of the Paper	Credits	Languages, Skill Enhancement (SEC), and Ability Enhancement Courses (AECC)	Credits	Total Credits
<b>V</b>	CA-C21T	Artificial Intelligence	4	CA-V1 Vocation Course I : Quantitative Techniques	3	25
	CA-C22T	Data Analytics	4	CA-E1 Elective I : a. Data Mining b. Computer Graphics	3	
	CA-C23T	Web Programming	4	SEC III : Cyber Crime, Cyber Law, and Intellectual Property Right	3	
	CA-C24L	Data Analytics Lab	2			
	CA-C25L	Web Programming Lab	2			
<b>VI</b>	CA-C26P	Project Work	4	CA-V2 Vocation Course II : Electronic Content Design	3	24
	CA-C27T	Machine Learning	4	CA-E2 Elective II : a. Operations Research b. Software Testing	3	
	CA-C28T	Mobile Application Development	4	Internship	2	
	CA-C29L	Machine Learning Lab	2			
	CA-C30L	Mobile Application Development Lab	2			

## CA-C21T: ARTIFICIAL INTELLIGENCE

Total Teaching Hours: 60

No. of Hours / Week: 04

### Course Outcomes:

- CO 1. Understand the various characteristics of problem solving agents and apply problem solving through search for AI applications.
- CO 2. Appreciate the concepts of knowledge representation using Propositional logic and Predicate calculus and apply them for inference/reasoning.
- CO 3. Obtain insights about Planning and handling uncertainty through probabilistic reasoning and fuzzy systems.
- CO 4. Understand basics of computer vision and Natural Language Processing and understand their relevance in AI applications.
- CO 5. Obtain insights about machine learning, neural networks, deep learning networks and their significance.

### **UNIT I :** [15 Hours]

Introduction to AI: What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of the environment, the structure of agents; Problem-solving: Problem-solving agents; Uninformed search strategies: DFS, BFS; Informed Search: Best First Search, A\* search, AO\* search, Means End Analysis. Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning.

### **UNIT - II** [15 Hours]

Knowledge-based Agents, The Wumpus world as an example world, Logic, Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting, Forward chaining, Backward chaining, Resolution, Truth maintenance systems. Knowledge in Learning, What is learning? Types of Learning, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

### **UNIT - III** [15 Hours]

Introduction to Planning: Blocks World problem, Strips; Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Fuzzy logic; Robotics: Fundamentals of Robotics, Robot Kinematics; Computer Vision: Introduction to image processing and classification, object detection.

### **UNIT - IV** [15 Hours]

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing; Expert Systems: Architecture and role of expert systems, two case studies of Expert Systems; Introduction to Machine learning: Supervised learning, unsupervised learning, reinforcement learning; Neural Networks: Introduction, basics of ANN, Deep Learning with basics of CNN, RNN, LSTM and their applications.

### **Text Book/References**

1. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
2. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Dan W Patterson, "Introduction to Artificial Intelligence & Expert Systems", PHI Learning 2010.

# CA-C22T: DATA ANALYTICS

Total Teaching Hours: 60

No. of Hours / Week: 04

## Course Description:

Almost every company and organization collect data about their operations to better understand how to make internal improvements, the collection of large quantities of data to discover behavior patterns and better understand their internal processes. Data analytics provide strong foundation for the learners to understand the underlying core concepts and emerging technologies in data analytics.

## Learning outcomes:

- Explore the fundamental concepts of data analytics
- Recognize and conduct statistical inference to solve engineering problems.
- Appreciate the science of statistics and the scope of its potential applications
- Summarize and present data in meaningful ways
- Select the appropriate statistical analysis depending on the research question at hand
- Form testable hypotheses that can be evaluated using common statistical analyses

Effectively and clearly communicate results from analyses performed to others

## UNIT: 1 Introduction to Data Analytics

[15 hours]

Evolution of Data Analytics, Data Analytics Overview, Types of Data Analytics -Descriptive Analytics -Diagnostic Analytics -Predictive Analytics -Prescriptive Analytics, Importance and Benefits of Data Analytics. Different Applications of Analytics in Business, Text Analytics and Web Analytics, Skills for Business Analytics.

## UNIT: 2 Probability and Statistical Methods

[15 hours]

Sample Space, Types of Events, Measures of probability, conditional probability, Bayes' theorem, Random variable, Probability Distributions- Binomial, Poisson and Normal, Sampling Distributions, Estimation and Hypothesis Testing- t-test, Analysis of variance (ANOVA) and Chi-square test, Correlation Analysis-Simple Correlation coefficient, Interpretation, Scatter plot. Linear Regression-Simple and Multiple, Polynomial Regression, Logistic Regression- with one variable and with multiple variables, Logistic Regression vs. Linear Regression.

## UNIT: 3 Data Visualization

[15 hours]

Introduction to data visualization, Visualization foundations, Introduction to Power BI, Power BI – Advantages and Scalable Options, Power BI Architecture and Data Access, Visualization Techniques for Spatial Data, Geospatial Data, Time-Oriented Data, Multivariate Data, Trees, Graphs, and Networks, Text and Document Visualization, Power Query & M Language.

## UNIT: 4 Case Study

[15 hours]

Importance and types of case studies: case study of Amazon, Twitter, Netflix, Uber, COVID-19: for understanding business scenarios and how they applied the analytics to improve their decision making, cost reduction, logistics planning and other benefits.

#### **Text Books:**

1. Kumar, U.D. :Business Analytics – The Science of Data – Driven Decision Making, Wiley.
2. Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
3. Johnson, R.A., Miller, I. and Freund, . :Probability and Statistics for Engineers, Pearson.

#### **Reference Books:**

1. Gert, H.N., Thorlund, L. and Thorlund, J :Business Analytics for Managers – Taking Business Intelligence Beyond Reporting, Wiley.
2. Data Analytics: Principles, Tools, and Practices: A Complete Guide for Advanced Data Analytics Using the Latest Trends, Tools, and Technologies by Dr. Gaurav Aroraa (Author), Chitra Lele (Author),
3. Dr. Munish Jindal (Author)
4. How to Find a Job in Data Analytics author Michael Dillon

## **CA-C23T: WEB PROGRAMMING**

Total Teaching Hours: 60

No of Hours/ Week: 04

### **Course Objective**

- CO1:** Understand the basics of Web Programming concepts
- CO2:** To build dynamic web pages with validation using JavaScript objects and by applying different event-handling mechanisms.
- CO3:** Analyze various PHP library functions that manipulate files and directories.
- CO4:** To develop modern interactive web applications using PHP and XML

### **UNIT – 1**

[15 Hours]

**Fundamentals of Web:** Internet – World Wide Web - Web Browsers - Web Servers – URLs – MIME – Internet Security - The Web Programmers Toolbox. **Java Script and HTML Documents:** The JavaScript execution environment - The Document Object Model - Element access in JavaScript - Events and event handling - Handling events from the Body elements, Button elements, Text box and Password elements - The DOM 2 event model - The navigator object - DOM tree traversal and modification.

### **UNIT – II**

[15 Hours]

**Dynamic Documents with JavaScript:** Introduction to dynamic documents - Positioning elements - Moving elements - Element visibility - Changing colours and fonts - Dynamic content - Stacking elements - Locating the mouse cursor - Reacting to a mouse click - Slow movement of elements - Dragging and dropping elements. **XML:** Introduction – Syntax - Document structure - Document Type definitions - Namespaces - XML schemas - Displaying raw XML documents - Displaying XML documents with CSS - XSLT style sheets - XML Processors - Web services.

### **UNIT – III**

[15 Hours]

**Introduction to PHP:** The Structure of PHP-Using Comments -Basic Syntax -Variables Operators -Variable Assignment -Multiple-Line Commands -Variable Typing -Constants Predefined Constants -The Difference Between the echo and print Commands -Functions Variable Scope, Expressions and Control Flow in **PHP:** Operators -Operator Precedence - Associativity Relational Operators - **Conditionals:** The if Statement -The else Statement - The elseif Statement -The switch Statement - The ? Operator - **Looping:** while Loops - do...while Loops for Loops -Breaking Out of a Loop-The continue Statement.

## UNIT – IV

[15 Hours]

**PHP Functions and Objects:** PHP Functions - Defining a Function - Returning a Value Returning an Array - Do Not Pass Arguments by Reference - Returning Global Variables. **PHP Arrays:** Numerically Indexed Arrays - Associative Arrays - Assignment Using the array Keyword - The foreach...as Loop -Multidimensional Arrays - Using Array Functions-Date and Time Functions. **File Handling:** Checking Whether a File Exists - Creating a File - Reading from Files - Copying Files - Moving a File - Deleting a File - Updating Files - Locking Files for - Multiple Accesses Reading an Entire File - Uploading Files. Exception Handling, Cookies and connecting to database

## TEXT BOOK

1. Robert W Sebesta, “Programming the World Wide Web”, 4th Edition, Pearson Education, 2008.
2. Learning PHP, MySQL & JavaScript With jQuery, CSS & HTML5 by Robin Nixon, Published by O’Reilly 2015.

## Reference Books

1. M.Deitel, P.J.Deitel, A.B.Goldberg, “Internet & World Wide Web How to program”, 3rd Edition, Pearson Education / PHI, 2004.
2. Chris Bates, “Web Programming Building Internet Applications”, 3rd Edition, Wiley India, 2006.
3. Xue Bai et al, “The Web Warrior Guide to Web Programming”, Thomson, 2003.
4. PHP A Beginner’s Guide by VikramVaswani, by The McGraw-Hill, 2009

## CA-C24L: Data Analytics Lab

### Part- A: Spreadsheet (Excel)

Data preprocessing, interpretation and analytical functions

Note: Download the sample data file from the open sources (Kaggle.com, etc.) to apply & practice all these functions.

1. CONDITIONAL FORMATTING, IF, COUNTIF, SUMIF, AVERAGE, CONCAT
2. INDEX, MATCH, UNIQUE, IFS, COUNTIFS, SUMIFS, AVERAGEIFS
3. VLOOKUP, HLOOKUP, XLOOKUP, COUNT, COUNTA
4. LEFT, MID, RIGHT, LEN, SUBSTITUTE, SEARCH, ISNUMBER



5. TODAY, NOW, YEAR, MONTH, NETWORKDAYS, EOMONTH
6. OFFSET, CHOOSE, LET, MAX, SORT, SORTBY, RANK
7. FILTER, FRQUENCY, SEQUENCE, RANDARRAY, IFERROR
8. PIVOT TABLES, WHAT-IF ANALYSIS, DATA VALIDATION, SUBTOTALS WITH RANGES
9. Develop an interactive dashboard for the Financial Sample Excel workbook (<https://learn.microsoft.com/en-us/power-bi/create-reports/sample-financial-download>) or Sample-Superstore Excel data

### **Part- B: Data Analysis using Python**

Note: Download the sample data file from the open sources (Kaggle.com, etc.,) or from prescribed study materials to apply & practice all these methods using Python.

1. Probability
  - a. Calculating the simple probabilities
  - b. Applications of Probability distributions to real life problems
2. Test of significance
  - a. T-Test: one sample, two independent samples and paired
  - b. ANOVA & Chi-Square Test
3. Correlation and Regression analysis
  - a. Scattered diagram, calculating of correlation coefficient
  - b. Linear regression: fitting, testing model adequacy and prediction (simple and multiple)
  - c. Fitting of logistic regression

### **Part- C: Power BI**

1. Introduction to Power BI- Get Started with Power BI - Sign up for Power BI - Overview: Power BI data sources - Connect to a SaaS solution - Upload a local CSV file - Connect to Excel data that can be refreshed - Create a Report with Visualizations
2. Using visualizations - Create a new report - Create and arrange visualizations - Format a visualization - Use text, map, and gauge visualizations and save a report - Use a slicer to filter visualizations - Sort, copy, and paste visualizations
3. Modify and Print a Report - Rename and delete report pages - Add a filter to a page or report Set visualization interactions - Send a report to PowerPoint
4. Create a Dashboard - Create and manage dashboards - Pin a report tile to a dashboard - Pin a live report page to a dashboard - Pin a tile from another dashboard - Pin an Excel element to a dashboard - Add a tile to a dashboard

## CA-C25L: WEB PROGRAMMING LAB

1. Create a form with the elements of Textboxes, Radio buttons, Checkboxes, and so on. Write JavaScript code to validate the format in email, and mobile number in 10 characters, If a textbox has been left empty, popup an alert indicating when email, mobile number and textbox has been left empty.
2. Develop an HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluate the expression and Display the result.
3. Create a page with dynamic effects. Write the code to include layers and basic animation.
4. Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)
5. Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.
6. Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.
7. Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.
8. Write a program in PHP to change background color based on day of the week using if else if statements and using arrays .
9. Write a simple program in PHP for i) generating Prime number ii) generate Fibonacci series.
10. Write a PHP program to remove duplicates from a sorted list.

11. Write a PHP Script to print the following pattern on the Screen:

```
*****  
****  
***  
**  
*
```

12. Write a simple program in PHP for Searching of data by different criteria
13. Write a function in PHP to generate captcha code
14. Write a Program to store and read image from Database.
15. Write a program in PHP to read and write file using form control.
16. Write a program in PHP to add, update and delete using student database.

17. Write a program in PHP to Validate Input
18. Write a program in PHP for setting and retrieving a cookie
19. Write a PHP program to Create a simple webpage of a college.
20. Write a program in PHP for exception handling for i) divide by zero ii) checking date format.

## **CA-V1: QUANTITATIVE TECHNIQUES**

Total Teaching Hours: 48

No. of Hours / Week: 03

### **UNIT – I** [12 Hours]

Numbers Property – Simplification – Divisibility – HCF and LCM – Decimal Fractions – Square roots and Cube Roots – Logarithms – Antilogarithms - Surds and indices - Permutation and Combination – Probability – Odd man out series - Number series - letter series – codes – Relationships – classification.

### **UNIT – II** [12 Hours]

Time and work – Problems on Ages – Calendar – Clock – Pipes and Cistern – Time and Distance – Problems of Train – Boats and Streams. Area – Volume and surface Areas – Heights and Distances – Data Interpretation: Tabulation – Bar Graphs – Pie Charts – Line Graphs. Data Interpretation - Sources, acquisition and interpretation of data; Quantitative and qualitative data; Graphical representation and mapping of data.

### **UNIT – III** [12 Hours]

Simple Interest – Compound Interest – Stocks and Shares – True Discount – Banker's discount. Averages – Percentage – Profit and Loss - Ratio and Proposition – Partnership – Allegation and mixture – Chain rule. Understanding the structure of arguments; Evaluating and distinguishing deductive and inductive reasoning; Verbal analogies: Word analogy Applied analogy; Verbal classification; Reasoning Logical Diagrams: Simple diagrammatic relationship, multi diagrammatic relationship; Venn diagram; Analytical Reasoning.

### **UNIT – IV** [12 Hours]

Teaching: Nature, objectives, characteristics and basic requirements; Learner's characteristics; Factors affecting teaching; Methods of teaching; Teaching aids; Evaluation systems. Research Aptitude: Meaning, characteristics and types; Steps of research; Methods of research; Research Ethics; Paper, article, workshop, seminar, conference and symposium; Thesis writing: its characteristics and format. Reading Comprehension: A passage to be set with questions to be answered. Communication: Nature, characteristics, types, barriers and effective classroom communication.

### **Reference**

1. R.S. Aggarwal, Quantitative Aptitude, S. Chand & Company, New Delhi, 2012
2. Govind Prasad Singh and Rakesh Kumar, Text Book of Quickest Mathematics (for all Competitive Examinations), Kiran Prakashan, 2012.
3. R.S. Aggarwal, Objective Arithmetic, S. Chand & Company, New Delhi, 2005.
4. Dr. Lal, Jain, Dr. K. C. Vashistha, "U.G.C.- NET/JRF/SET Teaching & Research Aptitude", Upkar Prakashan, 2010.
5. "UGC NET/SLET: Teaching & Research Aptitude", Bright Publications, 2010.

# CA-E1: DATA MINING

Total Teaching Hours: 48

No. of Hours / Week: 03

## UNIT-I INTRODUCTION

[12 Hours]

**Basic Data Mining Tasks:** [Some things on data warehousing , ETL Tools] Classification – Regression - Time Series Analysis- Prediction - Clustering – Summarization - Association Rules - Sequence Discovery.

Data Mining Versus Knowledge Discovery in Databases - The Development of Data Mining - Data Mining Issues - Data Mining Metrics - Social Implications of Data Mining - Data Mining from a Database Perspective.

**Data Mining Techniques:** Statistical Perspective on Data Mining - Similarity Measures - Decision Trees.

## UNIT-II CLASSIFICATION

[12 Hours]

Introduction - Statistical-Based Algorithms: Regression – Bayesian Classification. Distance-Based Algorithms: Simple Approach - K Nearest Neighbors. Decision Tree-Based Algorithms: ID3 – C4.5 - CART - Scalable DT techniques.

## UNIT-III CLUSTERING

[12 Hours]

**Introduction** - Similarity and Distance Measures – Outliers. Hierarchical Algorithms: Agglomerative Algorithms - Divisive Clustering. Partitional Algorithms: Minimum Spanning Tree - Squared Error Clustering Algorithm - K -Means Clustering - Nearest Neighbor Algorithm

## UNIT-IV ASSOCIATION RULES

[12 Hours]

**Introduction** – Large Itemsets – Basic Algorithms : Apriori Algorithm – Sampling algorithm – Partitioning. Parallel and Distributed algorithms (be specific): Data Parallelism – Task Parallelism. Comparing approaches – Incremental rules

### Text Book:

1.Margaret H Dunham, “Data Mining Introductory and Advanced Topics”, Pearson Education, 2012

### References:

1.Jiawei Han and Micheline Kamber, “Data Mining - Concepts and Techniques”, Third Edition, Elsevier, 2012

2.Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison Wesley, Second edition, 2018.

## COMPUTER GRAPHICS

**UNIT 1: Graphics Systems and Output Primitives**

[12 Hours]

Application of computer graphics; Graphic software; Video display devices- Raster scan and random scan displays; CRT functioning - Factors affecting CRT; Raster scan system; Color CRT monitors - Display processor with raster system; Raster co-ordinate system; Color mapping - Instruction set and raster system applications;

Line drawing methods-Direct, DDA and Bresenham's, line attributes, Circle drawing – Direct and midpoint circle drawing – ellipse drawing-Bresenham's ellipse algorithm-Area filling-scanline area filling and character attributes

**UNIT 2: 2D-Transformation , Windowing and Clipping**

[12 Hours]

Geometric transformation; Translation; Rotation; Scaling; Reflection and shear matrix representations; Homogeneous co-ordinates - Composite transformation - Raster methods for geometric transformations;

Window and viewport; Clipping process - Point clipping, Line clipping, Text clipping, Line clipping techniques - Cohen Sutherland line clipping algorithm,

Midpoint subdivision algorithm; Area clipping - Sutherland and Hodgman polygon clipping algorithm, Window to view port transformation

**UNIT 3: 3D Graphics**

[12 Hours]

3D-Coordinate system; 3D-Display techniques; parallel projections, Perspective projections, Orthogonal projections: 3D-Transformations; Translation, Scaling, Rotation, Reflection; polygon surfaces, polygon tables; Octrees; Hidden surface removal; Depth buffer and scan line method Introduction to segments, functions for segmenting, display file, segment attributes, display file compilation;

**UNIT 4: Graphical Input Devices and Techniques**

[12 Hours]

Input Devices: Keyboard, Mouse, Joystick, Touch panels, Track ball, Light pen, Graphic tablets. Positioning techniques, Grid, Constraints, Dynamic manipulation, Gravity field, Rubber band, Dragging, Selection technique, Menu, Pointing and selection by naming. Tablet; Data glove; Digitizers; Voice systems.

**Text Book:**

1. Pearson, Donald Hearn & M. Pauline Baker Computer Graphics OpenGL (3rd ed.).. (2013) .
2. Steven Harrington, Computer Graphics, McGH ,
3. Newman & Sproull, Computer Graphics, McGH , Principles of Interactive.
4. Yeshwant P. Kanetkar, Graphics under C, BPB publication
5. Pearson, Edward Angel Interactive Computer Graphics A Top-Down Approach Using OpenGL (5th ed.)..(2013)
6. James D. Foley, Andries Van Dam, Steven K. Feiner & F Hughes John.(2013). Roger T. Stevens. Computer Graphics Principles & Practice in C (2nd ed.). Pearson, Graphics Programming in C. BPB Publications. (1993).

7. Advanced Graphics Programming Using OpenGL. Elsevier Publications Tom McReynolds, David Blythe. (2005)..
8. Interactive Computer Graphics.Tata McGrawHill. William M. Newman & Robert F. Sproull.(1997).

## **SEC III: Cyber Crimes, Cyber Laws and Intellectual Property Rights**

### **Program Outcomes**

At the end of this course student will be able to:

- Understand cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
- Recognize various privacy and security concerns on Social media and e-commerce platforms.
- Use basic tools and technologies to protect their devices.
- Understand digital environment and IPR issues

### **Cybercrime & laws**

- Identify types of cyber crimes
- Prepare checklist for reporting cyber-crime at Cybercrime Police Station.
- Prepare checklist for reporting cyber-crime online.
- Identify phishing emails
- Analyze cybercrime cases and identify section applicable ( as per IT Act)
- Discuss Data protection laws in India

### **Social Media and E-commerce Security**

- Basic checklist, privacy and security settings for popular social media platforms.
- Reporting and redressal mechanism for violations and misuse of social media platforms.
- Configure security settings in Mobile Wallets and UPIs.
- Prepare checklist for secure net banking

### **Digital Devices Security, Tools and Technologies for Cyber Security**

- Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
- Setting and configuring two factor authentication in the Mobile phone.
- Security patch management and updates in Computers and Mobiles.
- Managing Application permissions in Mobile phone.
- Installation and configuration of computer Anti-virus.
- Wi-Fi security management in computer and mobile.

### **IPR**

- IPR issues in Cyber Space
- Identify liabilities in case of infringement of copyrights/trademarks/patents using Cases
- Procedure for registration of patents, copyrights, trademarks and GI
- Recognize Geographical Indicators and their significance
- Traditional knowledge and IPR

- Discuss Landmark judgements on trademark and domain names issues

## **References**

1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Pre ss. ISBN: 9789351194736, 2015
3. Duggal Pavan, Legal Framework on Electronic Commerce and Intellectual Property Rights in Cyberspace Hardcover – 2014

# SIXTH SEMESTER

## CA-C27T: Machine Learning

Total Teaching Hours: 60

No of Hours / Week: 04

### Course Outcome

1. Learn the basics of machine learning, understanding its uses, challenges, and various applications.
2. Build practical data skills, covering data collection, analysis, visualization, and preparation.
3. Become skilled in using classification and regression algorithms, including selecting, training, and evaluating models.
4. Dive into advanced clustering and specialized applications, using methods like K-Means, DBSCAN, and others.

### UNIT 1: Fundamentals of Machine Learning

[12 hours]

**Introduction to Machine Learning:** What is Machine Learning? Why Use Machine Learning? , Types of Machine Learning Systems, Main Challenges of Machine Learning, Applications of Machine Learning. Why Python, scikit-learn, Essential Libraries and Tools.

### UNIT 2: Data Preparation

[12 hours]

Working with Real Data, look at the Big Picture, Get the Data, Discover and Visualize the Data to Gain Insights, Prepare the Data for Machine Learning Algorithms, Select and Train a Model.

### UNIT 3: Supervised Learning

[12 hours]

Classification and Regression, Some Sample Datasets, k-Nearest Neighbours, Linear Models, Naive Bayes Classifiers, Decision Trees.

### UNIT 4: Unsupervised Learning

[12 hours]

Clustering, K-Means, Limits of K-Means, using clustering for image segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Other Clustering Algorithms.

### Textbook:

1. Andreas . C. Müller and S. Guido, "Introduction to Machine Learning with Python," O'Reilly, 2017 (Unit-1)
2. Amanda . Casari and Alice . Zheng, "Feature Engineering for Machine Learning," O'Reilly Media, Inc., 2018, p. 218. (Unit-2)
3. A. Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow," O'Reilly Media, Inc., 2022.
4. Ian Goodfellow, Yoshua. Bengio, and Aaron. Courville, "Deep Learning," MIT Press, 2016. (Unit-4)

### Reference Books



1. S. Rashka and V. Mirdzhalili, "Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2," Packt, Birmingham and Mumbai, 2020.
2. S. Shalev-Shwartz and S. Ben-David, "Understanding Machine Learning: From Theory to Algorithms," Cambridge University Press, 2014.

### Online Machine Learning Tutorial

1. Kaggle: Kaggle offers interactive machine learning courses and competitions.  
URL: <https://www.kaggle.com/learn>
2. LinkedIn Learning (formerly Lynda.com):  
Offers a wide range of courses on machine learning and artificial intelligence.  
URL: <https://www.linkedin.com/learning/machine-learning-with-python-foundations>
3. Github [https://github.com/amueller/introduction to ml with python/blob/master/01-introduction.ipynb](https://github.com/amueller/introduction%20to%20ml%20with%20python/blob/master/01-introduction.ipynb) )

## CA-C28T: Mobile Application Development

Total Teaching Hours: 60

No. of Hours / Week: 04

### Course Objective

This course examines the principles of mobile application design and covers the necessary concepts which are required to understand mobile based application and develop Android based application in particular. After completing the course the students can build varieties of real-time Apps using Android.

### COURSE OUTCOMES:

**CO1:** Understand the basic concepts of Mobile application development

**CO2:** Design and develop user interfaces for the Android platforms

**CO3:** Apply Java programming concepts to Android application development and create an application using database

### UNIT – I

[15 Hours]

**Introduction** : Brief History of mobile technologies, Different mobile technologies

Key Mobile Application Services-Introducing Android, The Android Application Components, Exploring the Development Environment, -Obtaining the Required Tools-Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application

**Using Activities** - Fragments and Intents in Android : Working with activities, Using Intents, Fragments, Using the Intent Object to Invoke Built-in Application

**Working with the User Interface Using views**

Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes to Screen Orientation- Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notification

**Using Basic Views**-Using Picker Views -Using List Views to Display Long Lists- Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with Views Using WebView- Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases.

**UNIT – III****[15 Hours]**

**Designing User interface** Designing by declaration, creating the opening screen, using alternate resources, implementing an about box, applying a theme, adding a menu, adding settings, debugging with log messages, debugging with debugger

**UNIT – IV****[15 Hours]**

**Creating Your Own Content Providers** -Using the Content Provider, SMS Messaging - Sending Email-Displaying Maps- Getting Location Data- Monitoring a Location

**Putting SQL to work** Introducing SQLite, In and Out of SQLite, Hello Database, Data Binding, using content provider, implementing content provider.

Reading/writing local data, Accessing the Internal File system, Accessing the SD card. Preparing app for publishing, Deploying APK files, uploading in Market , Consuming Web Services Using HTTP-Consuming JSON Services- Creating Your Own Services Binding Activities to Services -Understanding Threading

**Text Books:**

- 1..Wei-Meng Lee, Beginning android 4 application Development, John Wiley & sons, Inc, 2012.
2. Jerome DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition

**Reference Books:**

- 1.Grant Allen, Beginning Android 4, Apress,2012.
- 2.Pradeep Kothari, “Android Application Development (With Kitkat Support)”, Black Book 2014

**Web Reference**

<https://developer.android.com/guide>  
<https://flutter.dev/> <http://ai2.appinventor.mit.edu>  
<https://aws.amazon.com/mobile/mobile-application-development>  
[https://www.tutorialspoint.com/android/android\\_advanced\\_tutorial.pdf](https://www.tutorialspoint.com/android/android_advanced_tutorial.pdf)

**Outcome:**

1. Achieve proficiency in setting up Python, installing vital libraries, and configuring essential tools.
2. Demonstrate competence in data manipulation, dataset loading, and the creation of insightful visualizations.
3. Exhibit the ability to preprocess data, address missing values, perform categorical encoding, and implement fundamental machine learning algorithms.
4. Develop an understanding of clustering techniques, create cluster visualizations, and interpret decision tree splits.

**List of Programs**

1. Install and set up Python and essential libraries like NumPy and pandas.
2. Introduce scikit-learn as a machine learning library.
3. Install and set up scikit-learn and other necessary tools.
4. Write a program to Load and explore the dataset of .CSV and excel files using pandas.
5. Write a program to Visualize the dataset to gain insights using Matplotlib or Seaborn by plotting scatter plots, bar charts.
6. Write a program to Handle missing data, encode categorical variables, and perform feature scaling.
7. Write a program to implement a k-Nearest Neighbours (k-NN) classifier using scikit-learn and Train the classifier on the dataset and evaluate its performance.
8. Write a program to implement a linear regression model for regression tasks and Train the model on a dataset with continuous target variables.
9. Write a program to implement a decision tree classifier using scikit-learn and visualize the decision tree and understand its splits.
10. Write a program to Implement K-Means clustering and Visualize clusters.

**Datasets Link:**

1. Classification Problem: <https://archive.ics.uci.edu/dataset/53/iris>
2. Regression Problem: <https://archive.ics.uci.edu/dataset/186/wine+quality>
3. Clustering Problem: <https://archive.ics.uci.edu/dataset/352/online+retail>

**CA-C30L: Mobile Application Development Lab**

- 1 Creating “Hello world” Application.
- 2 Creating an application that displays message based on the screen orientation.

- 3 Create an application to develop Login window using UI controls.
- 4 Create an application to implement new activity using explicit intent, implicit intent and content provider.
- 5 Create an application that displays custom designed Opening Screen.
- 6 Create an UI with all views.
- 8 Create menu in Application
- 9 Read/ write the Local data.
- 10 Create / Read / Write data with database (SQLite).
- 11 Create an application to send SMS and receive SMS
- 12 Create an application to send an e-mail.
- 13 Display Map based on the Current/given location.
- 14 Create a sample application with login module(check user name and password) On successful login change Textview “Login Successful”. On login fail alert using Toast “login fail”
- 15 Learn to deploy Android applications.

## **CA-V2: Electronic Content Design**

Total Teaching Hours: 48

No. of Hours / Week: 03

### **Course Description:**

This course explores the principles and practices of designing electronic content for various digital platforms. Students will learn to create engaging and effective digital content, including websites, multimedia presentations, and social media graphics.

### **Course Outcome:**

- To deliver the content via various media such as radio, television, computer etc.
- To increase students’ concentration on particular subject matter in depth learning
- To feel emotionally good with joyful learning and active learning involvement of students during the content delivery
- To reuse many time the content to various group of same class without hesitate and unchanging.
- To handle easy to the facilitators during the content delivery.
- To modify the content with present time needs.

### **UNIT I:**

[12 Hours]

Introduction to E-learning- Definition, history, benefits and drawbacks of online learning, best practices of online learning, future of e learning. Overview of LMS. Technologies used in e -learning, Online course, tools to create an online course, need of the millennial learners, 21st century skills and E-learning trends.

### **UNIT 2:**

[12 Hours]

E-content. Designing and Development of E-content. Standards of E-content. Learning Objects and Re-usability of E-content. Phases of e-content development, various instructional models-ADDIE and ASSURE instructional model. An overview of Content Authoring Tools.

**UNIT 3:** [12 Hours]

Principles of Visual Design- Visual hierarchy, typography, and colour theory, User Experience (UX) Design-UX principles, wireframing, and prototyping, Graphic Design for Digital Media-Image editing, resolution, and file formats.

**UNIT 4:** [12 Hours]

HTML and CSS basics, designing for different screen sizes and devices, Multimedia Content Creation- Creating multimedia elements (images, audio, video), Social media platforms and content planning, Develop a social media content calendar, Content Management Systems (CMS), introduction to CMS platforms (e.g., WordPress), search Engine Optimization (SEO), SEO basics and best practices, Copyright and Ethics in Digital Content, Copyright laws, fair use, and ethical considerations, Content Evaluation and Feedback, Usability testing and feedback collection

**Books and References**

1 Diane Elkins et al , E-Learning Fundamentals: A PRACTICAL GUIDE, . (2015). ISBN: 9781562869472, Pages: 176.

**CA-E2-Elective II: OPERATION RESEARCH**

Total Teaching Hours: 48

No of Hours / Week: 03

**Course Outcomes:**

- Formulation of optimization model and applying appropriate optimization techniques for decision making.
- Solve linear programming problems using appropriate optimization techniques.
- Finding the optimal strategy for Minimization of Cost of shipping of products from source to Destination.
- Optimizing the allocation of resources to Demand points in the best possible way.

**UNIT - I : Introduction to OR and Linear Programming** [12 Hours]

**Introduction to OR:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operation Research.

**Linear Programming:** Linear Programming Problem Formulation –Graphical solution – Simplex method –Artificial variables technique -Big-M method.

**UNIT - II Transportation and Assignment Problems** [12 Hours]

**Transportation Problem:** definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Unbalanced problems and Degeneracy in transportation, Modified Distribution method.

**Assignment Problem :** Formulation, Solutions to assignment problems by Hungarian method, unbalanced, Maximization assignment problems.

**UNIT - III Sequencing and Game Theory** [12 Hours]

**Sequencing:** Basic assumptions, sequencing- n jobs through two machines model – n jobs through three machines model.

**Game Theory:** Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method.

#### **UNIT - IV Network Problems and Project Management-**

[12 Hours]

**Network Problems:** Shortest Path problem, Minimum spanning tree problem.

**Project Management:** Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of a project.

#### **Text Books:**

1. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
2. Introductory Operations Research , S C Sharma, Discovery Publishing House DPH, 2018

#### **References :**

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016.
2. Operations Research, Paneerselvan, PHI

## **CA-E2: SOFTWARE TESTING**

Total Teaching Hours: 48

No. of Hours/Week: 03

#### **Course Outcomes:**

This course will enable students to

- Differentiate the various testing techniques
- Derive Test Cases for any given problem.
- Classify the problem into suitable testing models.
- Apply a wide-variety of testing techniques in an effective and efficient manner.
- Explain the need for planning and monitoring a process

## **UNIT-I**

[12 Hours]

Introduction: Basic definitions, A testing life cycle, Test Cases, Fundamental approaches to apply Test Cases, Levels of Testing, Examples: The NextDate function, Triangle problem and The Commission Problem and The SATM (Simple Automatic Teller Machine) problem. Boundary Value Testing: Generalizing Boundary Value Analysis, Limitations of Boundary Value Analysis, Robustness Testing, Worst-Case Testing, Special Value Testing, Test cases for the Triangle problem, Test cases for the NextDate function, Test cases for the Commission Problem, Random Testing and Guidelines for Boundary Value Testing.

## **UNIT-II**

[12 Hours]

Equivalence Class Testing: Equivalence Classes, Weak Normal Vs Strong Normal Equivalence Class Testing, Weak Robust Vs Strong Robust Equivalence Class Testing, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the Next Date Function and Equivalence Class Test Cases for the Commission Problem, Guidelines for Equivalence Class Testing. Decision Table Based Testing: Decision tables, Test cases for the triangle problem, Test cases for the Next Date function, Test cases for the commission problem, Guidelines and observations. Data flow Testing: Definition Use Testing, Example- The Commission Problem, Slice-Based Testing, Guidelines and Observations.

## **UNIT-III**

[12 Hours]

Levels of Testing: The SATM System, Structural and Behavioural Insights. Integration Testing: A Closer Look at the SATM System, Decomposition-Based Integration, Top-Down Vs Bottom-Up Integration, Sandwich Integration, Call Graph-Based Integration, Pair wise Integration, Neighborhood Integration, Path-Based Integration. System Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, Interaction Testing: A Taxonomy of Interactions, Static Interaction in a Single Processor, Static Interaction in Multiple Processors, Dynamic Interaction in a Single Processor, Dynamic Interaction in Multiple Processors, Client-Server Testing.

## **UNIT-IV**

[12 Hours]

Object Oriented Testing: Issues in Object Oriented Testing, Implication of Composition and Encapsulation, Implications of Inheritance, Implications of Polymorphism, GUI-Testing, Object-Oriented Integration Testing. Exploratory Testing: The context-driven school, Exploring exploratory testing, Exploring a familiar example, Exploratory and context-driven testing observations. Model-Based Testing: Testing based on models, Appropriate models, Use case-based testing, Commercial tool support for model-based testing. Test-Driven Development: Test-then-code cycles, Automated test execution, Java and JUnit example, Remaining questions, Pros, cons, and open questions of TDD, Retrospective on MDD versus TDD, Software Testing Excellence: Craftsmanship, Best practice of software testing, Top 10 best practices for software testing excellence.

### **Text Book**

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, 2013.

**Reference Books**

1. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, 1st edition, John Wiley & Sons, 2011.
2. Brian Marrick: The Craft of Software Testing, 1st edition, Pearson, 2012.
3. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 1<sup>st</sup> Edition, Pearson, 2012.
4. Aditya P Mathur: Foundations of Software Testing, Pearson, 2008.