

**Bucket List for Minor Courses As Recommended by BoS in
Computer Science and Design**

Semester	Course Code	Name of Course	L	P	CA	MSE	ESE	CR
III	25AF1257MD306A	Computer Graphics	2	2	20	20	60	3
III	25AF1257MD306B	Python Programming	2	2	20	20	60	3
IV	25AF1257MD406A	Data Analytics	3	--	20	20	60	3
IV	25AF1257MD406B	Object-Oriented Modelling and Design	2	2	20	20	60	3

Second Year (Semester –III) Computer Graphics

25AF1257MD306A	Computer Graphics	MDM	2L-0T-2P	3 Credit
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Teaching Scheme	Examination Scheme
Lecture: 2 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

- To acquaint the learner with the basic concepts of Computer Graphics
- To learn the various algorithms for generating and rendering graphical figures
 - To get familiar with the 2D and 3D transformation techniques

	Course Outcomes
CO1	Explain basic concepts of computer graphics to generate line, circle and polygon
CO2	Use polygon filling and polygon clipping algorithms
CO3	Apply geometric transformations on 2D and 3D objects
CO4	Make use of color models and hidden surface removal algorithms for rendering 2D/3D objects
CO5	Develop graphical applications using Curves and Fractals

Unit I : Scan Conversion Algorithms and Display Files

Introduction: Graphics Primitives - Pixel, Resolution, Aspect ratio, Frame buffer, Display devices, Applications of computer graphics

Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: Bresenham, Midpoint

Display Files: Structure, Algorithms and Display file interpreter. Primitive operations on display file.

Segment: Segment table, Segment creation, closing, deleting and renaming, Visibility

Unit II : Polygons, Windowing and Clipping

Polygons: Introduction to polygon. Inside test: Even-Odd method, Winding number method

Polygon Filling: Seed fill, Scan line fill

Windowing and clipping: Introduction to windowing, 2-D clipping: Cohen – Sutherland line Clipping algorithm, Sutherland-Hodgeman Polygon clipping algorithm, Weiler-Atherton generalized Polygon Clipping algorithm

Unit-III : 2D, 3D Transformations and Projections

2-D transformations: Homogeneous Coordinates, Translation, scaling, rotation and shear, rotation about an arbitrary point

3-D transformations: Translation, scaling, rotation, rotation about an arbitrary axis Projections: Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective (Vanishing Points – 1 point, 2 point and 3 point).

Unit-IV : Color Models and Hidden Surface Removal

Colour models: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY

Hidden Surface Removal: Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock)

Unit-V : Curves and Fractals

Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve

Fractals: Introduction, Fractal generation: Koch curve, Hilbert curve, Applications.

Text Books

1. S. Harrington-Computer Graphics, —A Programming Approach, Second Edition, McGraw-Hill Publications, 1987, ISBN:0 – 07 – 100472 – 6
2. D. Rogers, —Procedural Elements for Computer Graphics, Second Edition, Tata McGraw-Hill Publication, 2001, ISBN:0 – 07 – 047371 – 4

Reference Books

1. D. Rogers, J. Adams, —Mathematical Elements for Computer Graphics, Second Edition, Tata McGrawHill Publication, 2002, ISBN:0 – 07 – 048677 – 8
2. J. Foley, V. Dam, S. Feiner, J. Hughes, —Computer Graphics Principles and Practicell, Second Edition, Pearson Education, 2003, ISBN:81 – 7808 – 038 – 9
3. D. Hearn, M. Baker, —Computer Graphics – C Version, Second Edition, Pearson Education, 2002, ISBN:81 – 7808 – 794 – 4

Second Year (Semester –III) Python Programming

25AF1257MD306B	Python Programming	MDM	2L-0T-2P	3 Credit
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Teaching Scheme	Examination Scheme
Lecture: 2 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1. Understand algorithms, data structures, and core programming concepts while setting up Python and running your first programs. Work with variables, operations, control flow, functions, strings, and file handling to create interactive and robust applications.
2. Apply object-oriented programming principles and efficiently use Python's built-in collections like lists, tuples, sets, and dictionaries.
3. Use SQLite and SQL queries to store, retrieve, and manage data, including practical projects like spidering Twitter and joining multiple tables

COURSE CONTENT

Unit-1 02 hrs

Informal introduction to programming, algorithms and data structures, downloading and installing Python, run a simple program on Python interpreter.

Unit-2 02 hrs

Variables, operations, control flow – assignments, conditionals, loops, functions: optional arguments, default values, passing functions as arguments, Statements, Expressions.
Strings: String processing. Exception handling, Basic input/output, handling files.

Unit-3 04 hrs

Class and Object, Data Structure: List, Tuple and Sequences, Set, Dictionaries.

Unit-4 04 hrs

Using Database and Structured Query Languages (SQL): SQLite manager, Spidering Twitter using a Database, Programming with multiple tables, JOIN to retrieve data.

Text/Reference Books:

1. Michael Urban and Joel Murach, Murach's Python Programming, Murach's Publication, 2016
2. Charles Severance, Python for Informatics: Exploring Information, University of Michigan, Version 2.7.0, 2014.
3. Dr. R. Nageswara Rao, Core Python Programming, Dreamtech Press, 1st Edition, 2016.
4. Mark Lutz, Learning Python, O'Reilly Media, 5th Edition, 2013.
5. Mark Pilgrim, Dive into Python 3, A press Publication, 2nd Edition, 2009.
6. Allen B. Downey, Think Python, O'Reilly Media, 2nd Edition, 2012.
7. Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson Education, 1st Edition, 2006.

Second Year (Semester –IV) Data Analytics

25AF1257MD406A	Data Analytics	MDM	3L-0T-0P	3 Credit
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Teaching Scheme	Examination Scheme
Lecture: 2 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1. Apply statistical concepts and methods for data collection, preparation, cleaning, and exploratory data analysis, addressing bias and errors.
2. Compute and interpret descriptive statistics, measures of central tendency, spread, and distribution shape to summarize datasets.
3. Perform data transformation and standardization techniques to prepare data for statistical modeling and hypothesis testing.
4. Conduct classical statistical tests, including Z-tests, t-tests, ANOVA, and non-parametric tests, to analyze and compare datasets.
5. Interpret the results of statistical analyses, assess significance, and evaluate model robustness and validity for data-driven decision-making.

COURSE CONTENT

Unit-1 : Statistical Data and Concepts

07 hrs

The statistical Methods, Misuse, Misinterpretation, and bias, Sampling and sampling size, Data preparation and cleaning, Missing data and data errors, Exploratory Data Analysis, Statistical error, Statistical Modeling, Computational Statistics, Inference, Bias, Confounding, Hypothesis testing, Types of error, Statistical significance, Confidence Interval, Power and robustness, Degrees of freedom, Non parametric analysis.

Unit-2 : Descriptive Statistics:

05 hrs

Counts and specific values, Measure of central tendency, Measure of spread, Measure of distribution shape, Statistical indices, Moments, Key functions, Measures of complexity and model selection.

Unit-3 : Data Transformation and Standardization

05 hrs

Box-Cox and power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transforms, Normal transform

Unit-4 : Classical Tests and Contingency Tables

07 hrs

Goodness of fit tests: Anderson-Darling, Chi-square test, Kolmogorov-Smirnov, Ryan-Joiner, Shapiro-Wilk, Jarque-Bera, Lilliefors.

Z-test: Test of single mean, standard deviation known, Test of the difference between two means, standard deviation known, test for proportions.

T-tests: Test of single mean, standard deviation not known, Test of the difference between two means, standard deviation not known, Test of regression coefficients

Unit-5 : Analysis of Variance and Covariance

07 hrs

Variance test: Chi square test of single variable, F-test of two variables, test of homogeneity; Wilcoxon rank-sum/Mann-Whitney U test; Sign test.

Contingency Tables: Chi-square contingency table test, G contingency table test, Fisher's exact test, Measures of association, McNemar's test.

ANOVA: Single factor or one way ANOVA, Two factor or two-way and higher-way ANOVA, MANOVA, ANCOVA; Non Parametric ANOVA: Kruskal Wallis ANOVA, Friedman ANOVA test, Mood's median.

Text/Reference Books:

1. Dr. Michael J de Smith, Statistical Analysis Handbook: A Comprehensive Guide to Statistical Concepts, Methods and Tools, The Winchelsea Press, Drumlin Security Ltd, Edinburgh, 2018 edition.
<https://www.statsref.com/HTML/index.html>
2. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Sixth Edition, Wiley, 2013.
3. Dr.J.Ravichandran, Probability And Statistics For Engineers, First Edition, Wiley, 2010.
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. V2.1, Cambridge University Press. 2014. (free online)
5. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020, 2013.
6. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
7. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline, O'Reilly. 2014.

Second Year (Semester –IV) Object Oriented Modelling

25AF1257MD406B	Object Oriented Modelling	MDM	3L-0T-0P	3 Credit
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Teaching Scheme	Examination Scheme
Lecture: 2 hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

- To Introduce various designing techniques and methods for object oriented
- Performance analysis with real time system
- Demonstrate a familiarity with object oriented data and system.
- To give clear idea on implementing design with UML diagram like state diagram , activity diagram , use case diagram etc.

	Course Outcomes
CO1	Explain the concepts of class and modeling
CO2	Identify and analyze system processes using use cases and scenario views.
CO3	Develop and refine system concepts through problem statements.
CO4	Apply object-oriented design principles to software development.
CO5	Learn to select and apply design patterns to solve design problems.

Unit-I : Introduction, Modelling Concepts and Class Modelling 7 hrs

What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages.

Unit-II : UseCase Modelling and Detailed Requirements 7 hrs

Overview; Detailed object oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.

Unit-III : Process Overview, System Conception and Domain Analysis 7 hrs

Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement.

Domain Analysis: Overview of analysis;

Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Unit-IV : Use case Realization

7 hrs

The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.

Unit-V : Design Patterns

7 hrs

Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Reference Books:

1. Oriented Modeling and Design with UML second edition by Michael Blaha and James Rumbaugh
2. Object-Oriented Analysis and Design with Applications, Second Edition by, Grady Booch