BCA(System Administration and Cyber Security)
Detailed Syllabus

Semester – IV
3SCS4-DE-002-T-03
Software Engineering
Pre-requisites: None

Course Category			
L	**T**	**P**	**C**
4	0	0	4

Course Objective:

- To understand different SDLC models and how they work.
- To analyze user needs and write clear software requirements.
- To apply design rules to build well-structured software.
- To create and run tests to find and fix software bugs.
- To evaluate software quality and check if it is reliable.

Course Outcomes:

Course Outcomes (COs)	**Level ***
CO1: Explain different SDLC models and their stages to choose the right process for a project.	L2
CO2: Analyze user needs to create clear and accurate software requirement documents.	L3
CO3:Apply basic design principles to build organized and easy-to-maintain software code.	L2
CO4: Develop and execute various test cases to find errors and ensure the software works correctly.	L3 & L4
CO5: Assess the final software to check its quality, reliability, and performance standards.	L5

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome.*

Articulation Matrix:-
(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	1	–	1	1	–	–	-	–	–	1	1	-
CO2	-	–	2		–	–	1	–	–	1	1	2
CO3	2	1	3		–	–	-	–	–	2	-	3
CO4	3	–	2	3	–	–	2	–	–	1	1	2
CO5	2	2	3	3	1	–	3	1	–	2	3	1

High-3 Medium-2 Low-1

Course Contents:

Unit-I: Introduction to Software Engineering

Software definition, software characteristics, software evolution, software myths, software crisis, software engineering layers, software process, umbrella activities, process framework, Software Development Life Cycle (SDLC), Classical Waterfall Model, Iterative Waterfall Model, Prototyping Model, Rapid Application Development (RAD) Model, Evolutionary Process Models, Spiral Model, Win-Win Spiral Model, Component-Based Development, Concurrent Development Model, Agile Process Models, Scrum, Extreme Programming (XP), Adaptive Software Development (ASD), Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development, Agile Manifesto, Comparison of various process models.

Unit-II: Requirements Engineering

Requirements engineering process, inception, elicitation, elaboration, negotiation, specification, validation, management, Functional Requirements, Non-functional Requirements, User Requirements, System Requirements, Interface Requirements, Software Requirement Specification (SRS) document, IEEE 830 standards, characteristics of a good SRS, requirement traceability, Analysis Modeling, Data Flow Diagrams (DFD), Level-0 DFD, Level-1 DFD, Level-2 DFD, Data Dictionary, Entity Relationship Diagram (ERD), State Transition Diagram (STD), Control Flow Diagram (CFD).

Unit-III: Software Design

Design process, design quality, design principles, Abstraction, Refinement, Modularity, Software Architecture, structural partitioning, information hiding, functional independence, Cohesion, functional cohesion, sequential cohesion, communicational cohesion, procedural cohesion, temporal cohesion, logical cohesion, coincidental cohesion, Coupling, data coupling, stamp coupling, control coupling, external coupling, common coupling, content coupling, Architectural Styles, call and return architecture, data-centered architecture, data-flow architecture, object-oriented architecture, layered architecture, User Interface Design, golden rules, interface analysis, human-computer interaction (HCI).

Unit-IV: Software Testing

Testing fundamentals, testing objectives, principles of testing, Verification vs Validation, test plan, test case design, White-Box Testing, basis path testing, flow graph notation, Cyclomatic Complexity, control structure testing, condition testing, data flow testing, loop testing,

Black-Box Testing, equivalence partitioning, Boundary Value Analysis (BVA), comparison testing, orthogonal array testing, Testing Strategies, unit testing, integration testing, top-down integration, bottom-up integration, regression testing, smoke testing, System Testing, recovery testing, security testing, stress testing, performance testing, Acceptance Testing, alpha testing, beta testing, debugging process.

Unit-V: Software Project Management

Project management spectrum, people, product, process, project, Software Metrics, process metrics, project metrics, size-oriented metrics, function-oriented metrics, Function Point (FP) Analysis, Software Estimation, COCOMO Model, basic COCOMO, intermediate COCOMO, detailed COCOMO, software equation, project scheduling, Work Breakdown Structure (WBS), Gantt Charts, PERT/CPM Charts, Risk Management, risk identification, risk projection, risk refinement, RMMM plan, Software Quality Assurance (SQA), software reviews, formal technical reviews (FTR), ISO 9000 quality standards, CMMI levels, Software Maintenance, corrective maintenance, adaptive maintenance, perfective maintenance, preventive maintenance, Reverse Engineering, Software Re-engineering..

Examination Scheme: Total – 100 marks

Components	**Continuous Internal Assessment* (A, Assignment-I & II, Q, MST-I & II #)**	**External Assessment (EST #)**
Weightage (%)	40	60

*A-Attendance; Assignment I-V (Class Assignment/Home Assignments/Case Discussions/Term Papers/Mini Project); Q-Quiz (5 Quizzes), MST-I, MST-II, EST. (# MST-I & II conducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

List of Books:

Text Book:

1. Pankaj Jalote ,"An Integrated Approach to Software Engineering", Narosa Pub, 2005

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering" Second Edition, PHI Learning
2. R S. Pressman ,"Software Engineering: A Practitioner's Approach", Sixth edition2006, McGraw-Hill.
3. Sommerville,"Software Engineering",Pearson Education.

Important Websites:

1. https://www.w3schools.com/php/
2. https://www.geeksforgeeks.org/php-tutorial/

BCA (System Administration and Cyber Security)
Detailed Syllabus

Semester – IV
3SCS4-DE-002-T-02
Cloud Migration
Pre-requisites: None

Course Category			
L	**T**	**P**	**C**
4	0	0	4

Course Objective:

- To explain the move from local physical servers to flexible cloud environments using the 6 R's strategy.
- To design smart cloud setups by mapping app dependencies and choosing the right resource sizes.
- To implement automated tools and code-based setups to move data and apps without errors.
- To analyze how new 2026 cloud trends change the way we manage Edge and Hybrid services.
- To evaluate if the migration was successful by checking cost savings and system speed.

Course Outcomes:

Course Outcomes (COs)	**Level ***
CO1: Apply the 6 R's framework to select the most efficient migration path for any business application.	L2
CO2: Build a detailed migration roadmap that identifies risks and maps all technical dependencies.	L2
CO3: Execute the move of databases and servers to the cloud using automation and migration tools.	L3
CO4: **Optimize** cloud costs and performance by using **auto-scaling** and usage-based billing audits.	L4
CO5: **Optimize** cloud costs and performance by using **auto-scaling** and usage-based billing audits.	L4 & L5

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome..*

Articulation Matrix:-

(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	1	–	1	1	–	–	-	–	–	1	1	-
CO2	-	–	2		–	–	1	–	–	1	1	2
CO3	2	1	3		–	–	-	–	–	2	-	3
CO4	3	–	2	3	–	–	2	–	–	1	1	2
CO5	2	2	3	3	1	–	3	1	–	2	3	1

High-3 Medium-2 Low-1

Course Contents:

Unit 1: Fundamentals & Strategic Planning

Introduction to Cloud Computing (Public, Private, Hybrid), Defining Cloud Migration (On-premise to Cloud), Building a Business Case (ROI, TCO), The 6 R's Strategy (Rehost, Replatform, Refactor, Rearchitect, Retire, Retain), Organizational Change Management (Cultural, Structural), Compliance & Legal Assessment (GDPR, HIPAA, SOC2), Cloud Provider Selection (AWS, Azure, GCP), Project Scoping (Timeline, Budget, Goals), Inventory Discovery (Hardware, Software), Risk Mitigation Planning (Technical, Business), Migration Center of Excellence (Governance, Team Roles), Pilot Planning (PoC, Sandbox).

Unit 2: Infrastructure Assessment & Design

Automated Discovery Tools (Agent-based, Agentless), Application Dependency Mapping (Tiers, Connections), Resource Right-Sizing (CPU, RAM, IOPS), Network Architecture Design (VPC, Subnets, Gateways), Hybrid Connectivity (VPN, Direct Connect, SD-WAN), Identity and Access Management (RBAC, MFA, SSO), Storage Strategy (Block, Object, File), Database Assessment (Schema, Compatibility, Version), Legacy Systems Analysis (Mainframe, Monolithic), Security Perimeter Design (WAF, Firewall, NSG), Cost Forecasting (Calculators, Quotas), Migration Roadmap Development (Priority, Wave-based).

Unit 3: Migration Execution & Data Transfer

Rehosting Techniques (Lift & Shift, VM Import), Replatforming Strategies (Managed Services, PaaS), Large Scale Data Transfer (Online, Offline Appliances), Database Migration Services (CDC, Schema Conversion), Application Refactoring (Code Change, Microservices), Containerization in Migration (Docker, Kubernetes), Serverless Integration (Lambda, Event-driven), Continuous Integration/Deployment (CI/CD Pipelines), Handling Unstructured Data (Buckets, Sync), Data Consistency & Integrity (Checksums, Validation), Migration Automation Scripts (Python, Bash, PowerShell), Infrastructure as Code (Terraform, CloudFormation).

Unit 4: Post-Migration Testing & Security

Post-Migration Validation (UAT, Functional), Performance Benchmarking (Latency, Throughput), Security Hardening (Encryption, Key Management), User Acceptance Testing (Business, Technical), Connectivity Troubleshooting (Ping, Trace, DNS), Disaster Recovery

Setup (RTO, RPO), Cloud Monitoring Configuration (Logs, Metrics, Alerts), Log Management & Auditing (Centralized, SIEM), Vulnerability Scanning (DAST, SAST), High Availability Testing (Failover, Load Balancing), Incident Response Planning (Procedure, Escalation), Compliance Verification (Audit, Certification).

Unit 5: Optimization & Final Transition

Cost Optimization (On-demand, Spot, Savings Plans), Auto-Scaling Implementation (Horizontal, Vertical), Final Cutover Strategies (Blue-Green, Canary), DNS Switchover (TTL, Record Update), Legacy Decommissioning (Shredding, Archiving), Reserved Instances & Savings Plans (1-year, 3-year), Advanced Automation (AI-Ops, Auto-remediation), Knowledge Transfer (Documentation, Training), Post-Migration Review (Lessons Learned, KPIs), Modernization Roadmap (Evolutionary, Revolutionary), Operational Excellence (Patching, Maintenance), Course Recap & Certification Prep (Mock Exams, Case Studies).

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**
Weightage (%)	60	40

*A-Attendance; Assignment I-V (Class Assignment/Home Assignments/Case Discussions/Term Papers/Mini Project); Q-Quiz (5 Quizzes), MST-I, MST-II, EST. (# MST-I & IIconducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

List of Books:

Textbook:

1. **Cloud Security and Privacy**, Tim Mather and Subra Kumaraswamy, O'Reilly Media, 1st Edition, 2017.

Reference Books:

1. **Cloud Computing Security: Foundations and Challenges**, John R. Vacca, CRC Press, 2nd Edition, 2020.
2. **Practical Cloud Security: A Guide for Secure Cloud Design**, Chris Dotson, O'Reilly Media, 1st Edition, 2019.
3. **Virtualization Security: Protecting Virtualized Environments**, Dave Shackleford, John Wiley & Sons, 1st Edition, 2013.
4. **Serverless Architectures on AWS**, Peter Sbarski, Manning Publications, 2nd Edition, 2021.

Important Websites:

1. **Cloud Security Tutorial**, TutorialsPoint, https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm, 2026.
2. **Introduction to Cyber Security**, GeeksforGeeks, https://www.geeksforgeeks.org/cloud-computing-security-challenges/, 2026.
3. **Cloud Computing and Distributed Systems**, Prof. Rajiv Misra, NPTEL (IIT Patna), https://nptel.ac.in/courses/106104182, 2026.

4. **AWS Cloud Security Concepts**, AWS Training Video, https://explore.skillbuilder.aws/learn/course/external/view/elearning/1927/aws-security-fundamentals, 2026.
5. **Serverless Framework Documentation**, https://www.serverless.com/framework/docs, 2026.

BCA(System Administration and Cyber Security)

Detailed Syllabus

Semester – IV
3SCS4-DE-002-T-01
Cyber Crime & Law

Pre-requisites: Basic Knowledge of Computer

Course Category			
L	**T**	**P**	**C**
4	0	0	4

Course Objectives

- To introduce the cyber world and cyber law in general.
- To explain the various facets of cyber crimes.
- To enhance the understanding of problems arising out of online transactions and provoke them to find solutions.
- To clarify the Intellectual Property issues in cyberspace and the growth and development of the law in this regard.
- To educate about the regulation of cyber space at national and international levels.

Course Outcomes

Course Outcomes(COs)	**Level***
CO1 Define cyberspace, internet infrastructure, and the regulatory frameworks governing digital environments.	L2
CO2 Explain the Indian IT Act, GDPR, and data protection principles applicable to cybercrime and digital privacy.	L2
CO3 Identify and classify cybercrimes targeting computer systems including phishing, malware attacks, and emerging technology-based crimes.	L2 & L3
CO4 Recognize cybercrimes against persons including stalking and child exploitation, and apply ethical guidelines for online crime reporting.	L3
CO5 Analyze cyber terrorism, malware types, digital forensics, and international legal responses to global cybersecurity threats.	L4

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome.*

Articulation Matrix:-

(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	2	–	–	–	–	–	1	1	–	1	2	–
CO2	2	1	2	–	–	–	–	3	–	1	2	–
CO3	2	–	3	2	–	–	1	3	–	1	3	1
CO4	2	1	2	1	–	–	–	3	–	1	2	–
CO5	3	2	3	2	2	–	2	3	–	2	3	1

High-3 Medium-2 Low-1

Unit I: Introduction-Cyber Security

Introduction-Cyber Security, Issues and Challenges of Cyber Security, Architecture of Cyberspace, Intervention Strategies: Redundancy, Diversity and Autarchy, Cyberspace: Definition, Overview of Communication and Web Technology, Internet, World Wide Web, Advent of Internet, Nature of Internet, Internet Infrastructure for Data Transfer, Internet and Society, Need of cyber law, Regulation of Cyberspace, Key Regulatory issues in India, Regulation via Software, Regulation via Hardware, Application of Common Law Principles for Internet Regulation, Private Regulation, Human Rights in Cyberspace, Freedom of Expression, Privacy, Anonymity, Harassment and defamation, Economic Rights, IPR, Jurisdiction, Protecting Human Dignity in the Digital Age, Commercialization of the Internet.

Unit II: Legal Perspectives of Cybercrimes and Cyber security

Legal Perspectives of Cybercrimes and Cyber security, Origin and state of cybercrime, Cybercrime and the Legal Landscape around the World, Need Cyber laws, The Indian IT Act and its Amendments, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of IT Act, Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Cybercrime and Punishment, Data Privacy, Data Security, Big Data Security: issues and challenges, General Data Protection Regulations (GDPR), Personal Data Protection Bill and its Compliance, Data Protection Principles, Data Protection Officer, Incident Management and Business Continuity, Contract Act, Trademark Act, Copyright, Patents.

Unit III:Cybercrime Targeting Computer Systems

Cybercrime Targeting Computer Systems – Data Diddling, Attacks, Spy Ware, Logic Bombs, Email Scam and Phishing, Theft, Obscene Content, Cyber bullying, Cyber grooming, Online job fraud, Online sextortion, Vishing, Sexting, Smashing, Sim Swap scam, Debit/Credit card fraud, Impersonation and identity theft, Data breach, Denial of services /distributed dos, Website defacement, Cyber-squatting, Pharming, Cryptojacking (crypto Currency), Online Drug Trafficking, Espionage Act, Cyber Law in perspective Advanced Technology: IOT, AI, Machine Learning, BlockChain and Social Media & Social Defamation

Unit IV

Law for DarkNet,Cybercrime Against Persons- Child Pornography/ Child Sexually Abusive Material (CSAM), Cyber Stalking and Its Type, Phishing and Its Type, Ethics And Its Important, Legal Developments, Cyber Security In Society, Online Cyber Crime Reporting,

Unit V:Law for DarkNet,Cybercrime Against Persons

Cybercrime Targeting Countries – Cyber Terrorism, International Response to Cybercrime, Digital Evidence and Computer Forensics, Regulation and Jurisdiction for global Cyber security, Copy Right- Source of Risks, Pirates, Internet Infringement, Fair Use, Postings, Criminal Liability, Malware Analysis: -Spamming, SMSware, Malware, Adware, Ransomware, Virus, Worms & Trojans.

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**
Weightage (%)	60	40

*A-Attendance; Assignment I-V (Class Assignment/Home Assignments/Case Discussions/Term Papers/Mini Project); Q-Quiz (3 Quizzes), MST-I, MST-II, EST. (# MST-I & IIconducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

Reference Books:

Textbook:

1. Kumar K -Cyber Laws: Intellectual Property & E Commerce, Security, Dominant Publisher

Reference book:

2. Information Security Policy & Implementation Issues, NIIT, PHI
3. Marine R.C.- Cyber Crime Impact in the New Millennium, Author Press

Important Website:

1. https://nptel.ac.in/
2. https://www.coursera.org/

BCA (System Administration and Cyber Security)

Detailed Syllabus

Semester – IV
3CSC4-SE-004-T
Programming with Python
Pre-requisites: Basic Knowledge of Computer

Course Category			
L	**T**	**P**	**C**
2	0	0	2

Course Objectives

- To learn about Basics of Python programming.
- To know about Decision Making and Functions in Python.
- To learn about Object Oriented Programming using Python.
- To know about Files Handling in Python.
- To learn about GUI Programming and Database operations in Python.

Course Outcomes :

Course Outcomes(COs)	**Level***
CO1 Explain Python syntax including data types, control structures, and modules with basic programs.	L2
CO2 Develop Python programs using functions, lists, tuples, and dictionaries with appropriate methods.	L2 & L3
CO3 Implement object-oriented concepts including classes, inheritance, and exception handling in Python.	L2 & L3
CO4 Perform file and directory operations in Python through illustrative programs.	L2 & L3
CO5 Integrate GUI components using Tkinter and database operations using PyMySQL to build Python applications.	L4

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome..*

Articulation Matrix:-
(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	3	–	1	1	–	–	2	–	–	1	3	1
CO2	3	–	2	3	–	–	3	–	–	1	3	2
CO3	3	1	3	3	–	–	3	–	–	2	3	3
CO4	3	–	2	3	–	–	3	–	–	1	3	2
CO5	3	2	3	3	1	–	3	1	–	2	3	3

High-3 Medium-2 Low-1

Unit I

Introduction, Origin, Comparison, Comments, Operators, Variables and Assignment, Numbers, Strings, Lists and Tuples, Dictionaries, if Statement, while Loop, for Loop and the range(),String and regular expressions. Module: Importing Module, Math Module, The sys Module, Random Module, and Package.

Unit II

Functions: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Built-in functions, Lists and Tuple: Introduction to List and Tuple, Accessing List and Tuple, Operations, working with List and Tuple, Function and Methods. Dictionaries: Working with dictionaries, properties and functions.

Unit III

Object oriented programming and classes in Python - creating classes, instance objects, accessing members, Data hiding (the double underscore prefix), Built-in class attributes, Garbage collection: the constructor, Overloading methods and operators, Inheritance-implementing a subclass, overriding methods, Exceptions: try Statement, Exception Propagation, Except Clause, Try, Finally Clause, User Defined Exception, The raise statement.

Unit IV

Creating files, Operations on files (open, close, read, write), File object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing Files and Directories, Copying and Renaming Files, Splitting Path names, Creating and Moving to Directories, Traversing Directory Trees, Illustrative programs: word count, copy file.

Unit V

Tkinter module, widgets and basics, Component, layout options, Button, Label, Entry, Listbox, Radio button, Check button, Scrollbar, Container Widgets: Frame, Event handling, Keyboard events, Mouse events etc. Introduction to MySQL, PYMYSQL Connections, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, understanding exceptions in database connectivity.

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**

Weightage (%)	60	40

*A-Attendance; Assignment I-V (Class Assignment/Home Assignments/Case Discussions/Term Papers/Mini Project); Q-Quiz (5 Quizzes), MST-I, MST-II, EST. (# MST-I & IIconducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

Reference Books:

1. Python Essential by David M. Beazly.
2. Python Pocket by Mark Lutz.
3. Barry, Paul, Head First Python, 2nd Edition.
4. Python: The Complete Reference.

List of e-Learning Resources:

1. https://www.coursera.org/learn/python-programming-intro
2. https://www.codecademy.com/catalog/language/python
3. https://learn.microsoft.com/en-us/training/modules/intro-to-python/
4. https://developers.google.com/edu/python
5. https://www.python.org/about/gettingstarted/
6. https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/

Prepared By	**Academic Coordinator**	**HOD**	**Senior Faculty nominated by DOAA**

BCA (System Administration and Cyber Security)

Detailed Syllabus

Semester – IV
3CSC4-SE-004-P
Programming with Python Lab

Course Category			
L	**T**	**P**	**C**
2	0	0	2

Pre-requisites: Basic Knowledge of Computer

Course Objectives

- To learn about Basics of Python programming.
- To know about Decision Making and Functions in Python.
- To learn about Object Oriented Programming using Python.
- To know about Files Handling in Python.
- To learn about GUI Programming and Database operations in Python.

Course Outcomes :

Course Outcomes(COs)	**Level***
CO1 Explain Python syntax including data types, control structures, and modules with basic programs.	L2
CO2 Develop Python programs using functions, lists, tuples, and dictionaries with appropriate methods.	L2 & L3
CO3 Implement object-oriented concepts including classes, inheritance, and exception handling in Python.	L2 & L3
CO4 Perform file and directory operations in Python through illustrative programs.	L2 & L3
CO5 Integrate GUI components using Tkinter and database operations using PyMySQL to build Python applications.	L4

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome.*

Articulation Matrix :
(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

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CO1	3	–	1	1	–	–	2	–	–	1	3	1
CO2	3	–	2	3	–	–	3	–	–	1	3	2
CO3	3	1	3	3	–	–	3	–	–	2	3	3
CO4	3	–	2	3	–	–	3	–	–	1	3	2
CO5	3	2	3	3	1	–	3	1	–	2	3	3

High-3 Medium-2 Low-1

Unit I : Fundamentals of Python Programming
Introduction to Python, Writing a simple Python program, Variables, data types, and input/output, Control structures (if-else, loops), Functions and modular programming

Unit II : Python Data Structures and Methods
Lists and their methods, Tuples and their methods, Dictionaries and their functions, Sets and their operations

Unit III : Advanced Python Programming Concepts
Anonymous functions (lambda), Modules and packages, Object-Oriented Programming (OOP) concepts, Classes and objects, Inheritance and method overriding, Special (double underscore) methods

Unit IV : Exception Handling and File Operations in Python
Exception handling basics, User-defined exceptions, File operations (read, write, copy), Working with text and binary files

Unit V : Python GUI Development and Database Connectivity
Introduction to Tkinter for GUI development, Creating basic GUIs (Login form, Registration form), Connecting Python to databases, Performing CRUD operations on databases

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, LR, MST-I & II #)**
Weightage (%)	50	50

*A-Attendance; Lab Record Submission, MST-I, MST-II, EST. (# MST-I & IIconducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

List of Experiments

1. Write a program to convert temperature from Fahrenheit to Celsius depending upon user choice.

2. Write a program to use a dictionary and its functions in python.
3. Write a program to check whether given no is prime or not.
4. Write a program to implement a list and use its methods.
5. Write a program to implement tuple and use its methods.
6. Write a program to import modules and use it.
7. Write a user defined function to implement factorial of a given no.
8. Write a program to show the use of anonymous functions.
9. Write a program to calculate the area of rectangle and circle using class.
10. Write a program to implement single level inheritance.
11. Write a program to override methods.
12. Write a program to implement double underscore methods.
13. Write a program to implement Exception Handling.
14. Write a program for user defined exceptions.
15. Write a program to copy a file.
16. Write a program to count no. of words in a file.
17. Write a program to make Login GUI in Tkinter.
18. Write a program to make registration form GUI in Tkinter.
19. Write a program to connect with the database and perform insert operation.
20. Write a program to perform select operation on database.
21. Write a program to perform delete operations on databases.
22. Write a program to perform update operations on databases.

Reference Books:

1. Python Essential by David M. Beazly.
2. Python Pocket by Mark Lutz.
3. Barry, Paul, Head First Python, 2nd Edition.
4. Python: The Complete Reference.

List of e-Learning Resources:

1. https://www.coursera.org/learn/python-programming-intro
2. https://www.codecademy.com/catalog/language/python
3. https://learn.microsoft.com/en-us/training/modules/intro-to-python/
4. https://developers.google.com/edu/python
5. https://www.python.org/about/gettingstarted/
6. https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/

Prepared By	Academic Coordinator	HOD	Senior Faculty nominated by DOAA

BCA (System Administration and Cyber Security)

Semester –IV
3CSC4-DM-003-T
Principles of Virtualization
Pre-requisites: Basic Knowledge of Computer

Course Category			
L	**T**	**P**	**C**
4	0	0	4

Course Objectives:

- To know about various virtualization technologies, including server, storage, I/O, network, client, application, and desktop virtualization.
- To learn about Install and set up Windows Virtual PC on different platforms.
- To learn about Install and configure the RD Session Host Role Service on the server.
- To know about the Configure Remote Desktop Web Access and role-based application provisioning.
- To Learn about the HYPER-V role and create virtual machines.

Course Outcomes:

Course Outcomes(COs)	**Level***
CO1 Configure Remote Desktop Web Access, role-based application provisioning, and client settings to enable access to virtualized desktops and published applications.	L2
CO2 Install and configure Windows Virtual PC by creating virtual hard disks and managing network resources on host machines.	L3
CO3 Deploy remote applications by packaging them using RemoteApp and configuring the RD Session Host Role Service.	L3
CO4 Configure Remote Desktop Web Access, role-based provisioning, and client settings to access virtualized desktops.	L3
CO5 Compare VMware vSphere, Microsoft Hyper-V, and Citrix XenDesktop to select and manage appropriate virtualization solutions.	L4

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome.*

Articulation Matrix:-
(Program Articulation Matrix is formed by the strength of the correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO-1	3	1	1	–	–	–	2	–	–	1	3	1
CO-2	3	1	2	3	–	–	3	–	–	1	3	2
CO-3	3	1	2	3	–	–	3	–	–	1	3	2
CO-4	3	1	2	2	–	–	3	–	–	1	3	2
CO-5	3	2	3	3	1	–	3	–	–	2	3	3

High-3 Medium-2 Low-1

Unit-1: Exploring Virtualization Technologies
Understanding Virtualization, Need of Virtualization and Virtualization Technologies: Server Virtualization, Storage Virtualization, I/O Virtualization, Network Virtualization, Client Virtualization, Application virtualization, Desktop virtualization, Understanding Virtualization Uses: Studying Server Consolidation, Development and Test Environments, Helping with Disaster Recovery.

Unit-II: Hardware Virtualization and Windows Installation
Configure the BIOS to support hardware virtualization; Install and configure Windows Virtual PC: installing Windows Virtual PC on various platforms (32-bit, 64-bit), creating and managing virtual hard disks, configuring virtual machine resources including network resources, preparing host machines; create, deploy, and maintain images.

Unit-III: Remote App Deployment Management
Prepare and manage remote applications: configuring application sharing, package applications for deployment by using RemoteApp, installing and configuring the RD Session Host Role Service on the server.

Unit-IV: Application Access and Configuration
Access published applications: configuring Remote Desktop Web Access, configuring role based application provisioning, configuring Remote Desktop client connections. Configure client settings to access virtualized desktops: configuring client settings.

Unit-V: Exploring Virtualization Software Options
List of virtualization Software available. Vmware- introduction to Vsphere, ESXi, CenterServer and Vsphere client. Creating Virtual Machines. Introduction to HYPER-V role. Create Virtual Machines. Create Hyper-v virtual networking, Use virtual Machine Snapshots. Monitor the performance of a Hyper-v server, Citrix XENDesktop fundamentals

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**
Weightage (%)	60	40

*A-Attendance; Assignment I-V (Class Assignment/Home Assignments/Case Discussions/Term Papers/Mini Project); Q-Quiz (3 Quizzes), MST-I, MST-II, EST. (# MST-I

& IIconducted at Department Level & EST (External Assessment) will be conducted by the CoE office at MU).

Reference Books:

1. Virtualization with Microsoft Virtual Server 2005 by TwanGrotenhuis, RogierDittner, Aaron Tiensivu, Ken Majors, Geoffrey Green, David Rule, Andy Jones, Matthijs ten Seldam, Syngress Publications, 2006
2. Virtualization--the complete cornerstone guide to virtualization best practices, Ivanka Menken, Gerard Blokdijk, Lightning Source Incorporated, 2008
3. Virtualization: From the Desktop to the Enterprise, Chris Wolf, Erick M. Halter, EBook, 2005

List of e-Learning Resources:

1. https://www.udemy.com
2. https://www.edx.org
3. https://www.coursera.com/

Prepared By	Academic Coordinator	HOD	Senior Faculty nominated by DOAA

BCA (System Administration and Cyber Security)
Detailed Syllabus

Semester – IV	**Course Category**			
3CSC4-DC-001-T	**L**	**T**	**P**	**C**
Web App Pentesting	4	0	0	4

Pre-requisites: Basic Knowledge of Computer

Course Objectives

- Introduce Vulnerability Assessment and Penetration Testing
- To be familiar with the Penetration Testing and Tools
- To get an exposure to Metasploit exploitation tool, Linux exploit and Windows exploit
- To gain knowledge on Web Application Security Vulnerabilities, Vulnerability analysis and Malware analysis

Course Outcomes

Course Outcomes(COs)	**Level***
CO1: Explain the fundamentals of ethical hacking, penetration testing concepts, and social engineering attacks along with basic defense mechanisms.	L2
CO2: Apply knowledge of physical and insider attacks and use tools like Metasploit to identify and exploit system vulnerabilities.	L2 & L3
CO3: Demonstrate the planning, execution, and management of penetration testing, and analyze Linux and Windows exploit techniques.	L3 & L4
CO4: Analyze web application vulnerabilities such as SQL injection and XSS, and evaluate systems using vulnerability analysis techniques.	L3 & L4
CO5: Evaluate client-side and malware-based attacks and design appropriate mitigation and defense strategies.	L5

**Level of Learning: Level 1 (L1) - Remember ; Level 2 (L2) – Understand; Level 3 (L3) –Apply; Level 4 (L4) –Analyze; Level 5 (L5) -Evaluate;.Level 6 (L6) -Create. Mention the highest level that will be attained in the Course Outcome.*

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CO/PO/PSO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	1	–	1	2	–	–	-	–	–	1	1	-
CO2	-	–	2		–	–	1	–	–	1	1	2
CO3	1	1	-		–	–	-	–	–	-	-	3
CO4	3	–	2	3	–	–	2	–	–	1	1	2
CO5	2	2	3	3	1	–	3	1	–	2	3	1

High-3 Medium-2 Low-1

Course Contents:

Unit-I

Introduction to Ethics of Ethical Hacking: Why You Need to Understand Your Enemy's Tactics,Recognizing the Gray Areas in Security, Vulnerability Assessment and Penetration Testing.

Penetration Testing and Tools: Social Engineering Attacks: How a Social Engineering Attack Works, Conducting a Social Engineering Attack, Common Attacks Used in Penetration Testing, Preparing Yourself for Face-to-Face Attacks, Defending Against Social Engineering Attacks.

Unit-II

Physical Penetration Attacks: Need of Physical Penetration, Conducting a Physical Penetration, Common Ways into a Building, Defending Against Physical Penetrations.

Insider Attacks: Conducting an Insider Attack, Defending Against Insider Attacks.

Metasploit: The Big Picture, Getting Metasploit, Using the Metasploit Console to Launch Exploits,Exploiting Client-Side Vulnerabilities with Metasploit, Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, Going Further with Metasploit.

Unit-III

Managing a Penetration Test: Planning a Penetration Test, Structuring a Penetration Testing Agreement, Execution of a Penetration Test, Information Sharing During a Penetration Test, Reporting the Results of a Penetration Test.

Basic Linux Exploits: Stack Operations, Buffer Overflows, Local Buffer Overflow Exploits, Exploit Development Process.

Windows Exploits: Compiling and Debugging Windows Programs, Writing Windows Exploits, Understanding Structured Exception Handling (SEH), Understanding Windows Memory Protections (XP SP3, Vista 7 And Server 2008), Bypassing Windows Memory Protections.

Unit-IV

Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities, Injection Vulnerabilities, Cross-Site Scripting Vulnerabilities, The Rest of the OWASP Top Ten, SQL Injection Vulnerabilities, Cross-Site Scripting Vulnerabilities.

Vulnerability Analysis: Passive Analysis: Source Code Analysis, Binary Analysis.

Unit-V

Client-Side Browser Exploits: Why Client-Side Vulnerabilities are Interesting, Internet Explorer Security Concepts, History of Client- Side Exploits and Latest Trends, Finding New Browser-BasedVulnerabilities, Heap Spray to Exploit, Protecting Yourself from Client-Side Exploit.
Malware Analysis: Collecting Malware and Initial Analysis: Malware, Latest Trends in Honeynet Technology, Catching Malware: Setting the Trap, Initial Analysis of Malware.

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**
Weightage (%)	60	40

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Reference Books:

1. The Web Application Hacker’s Hand Book - Discovering and Exploiting Security flaws, Dafydd Suttard, Marcuspinto,1st Edition, Wiley Publishing.
2. Penetration Testing: Hands-on Introduction to Hacking, Georgia Weidman, 1st Edition, No Starch Press.
3. The Pen Tester Blueprint - Starting a Career as an Ethical Hacker, L. Wylie, Kim Crawly,1st Edition, Wiley Publications.

BCA (System Administration and Cyber Security)
Detailed Syllabus

Semester – IV	**Course Category**			
3CSC4-DC-001-P	**L**	**T**	**P**	**C**
Web App Pentesting Lab	0	0	4	2

Pre-requisites: Basic Knowledge of Computer

Course Objectives

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CO2	-	–	2		–	–	1	–	–	1	1	2
CO3	1	1	-		–	–	-	–	–	-	-	3
CO4	3	–	2	3	–	–	2	–	–	1	1	2
CO5	2	2	3	3	1	–	3	1	–	2	3	1

High-3 Medium-2 Low-1

List of Experiments

1. Monitoring Network Traffic

Objective: To analyze and capture network traffic to identify patterns, detect anomalies and assess overall network performance and security.

2. Host & Services Discovery using Nmap

Objective: To identify active hosts and the services they are running within a network using Nmap, enabling a comprehensive understanding of the network environment.

3. Vulnerability Scanning using OpenVAS

Objective: To perform a systematic assessment of networked systems using OpenVAS to identify potential vulnerabilities that could be exploited by attackers.

4. Internal Penetration Testing

a. Mapping
b. Scanning
c. Gaining Access through CVEs
d. Sniffing POP3/FTP/Telnet Passwords
e. ARP Poisoning
f. DNS Poisoning

Objective: To perform a thorough internal penetration test that systematically assesses the security of the organization's network infrastructure by mapping network resources, scanning for vulnerabilities, exploiting known weaknesses and demonstrating attack techniques, including credential sniffing and poisoning attacks, in order to identify and mitigate potential security risks effectively.

5. External Penetration Testing

a. Evaluating External Infrastructure
b. Creating Topological Map & Identifying IP Address of Target
c. Lookup Domain Registry for IP Information
d. Examining Use of IPv6 at Remote Location

Objective: To conduct a comprehensive external penetration test aimed at evaluating the security of the organization's external infrastructure by assessing vulnerabilities, mapping the network topology, gathering IP and domain registry information, and examining the implementation of

IPv6, ultimately identifying potential entry points and recommending measures to strengthen defenses against external threats.

6. Different Types of Vulnerability Scanning
Objective: To explore and compare various vulnerability scanning techniques and tools, assessing their effectiveness in identifying and prioritizing security risks.

7. Vulnerability Scanning with Nessus
Objective: To utilize Nessus for comprehensive vulnerability scanning, identifying security weaknesses in systems and providing recommendations for remediation.

8. Web Application Assessment with Nikto & Burp Suite
Objective: To evaluate web applications for security vulnerabilities using Nikto and Burp Suite, identifying issues such as misconfigurations and common vulnerabilities in web applications.

Examination Scheme: Total – 100 marks

Components Continuous Internal Assessment*	**External Assessment (EST #)**	**(A, Assignment I-V, Q, MST-I & II #)**
Weightage (%)	50	50

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