# Value-Added Course (VAC)

| | | | | | |
|---|---|---|---|---|---|
| Programme | BCA | | | | |
| Course Title | Introduction to Cyber Laws | | | | |
| Type of Course | VAC | | | | |
| Semester | IV | | | | |
| Academic Level | 100-199 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 3 | 3 | - | - | 45 |
| Pre-requisites | 1. Basic Computer Literacy<br>2. Familiarity with Online Platforms | | | | |
| Course Summary | Introduction to Cyber laws provides students with a foundational understanding of various concepts Cyber Crimes and Cyber laws against them. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | To understand the concept of Cyber Space, Cyber Crimes and cyber laws | U | C | Instructor-Create Exams or Quiz |
| CO2 | To understand details of cybercrimes and criminals | A | P | Discussions and Quizzes |
| CO3 | To examine various provisions in IT Act 2000 | U | F | Instructor created exams or home assignments |
| CO4 | To Identify Intellectual Property right and E-commerce related issues. | A, E | P | Discussions, Quizzes |
| CO5 | To get overall idea of cyber laws and its enforcement mechanisms in India | Ap | P | Viva Voce Observation of practical skills |
| CO6 | To get to know about Penalties and legal implications associated with cybercrimes under Indian law | U | M | Instructor Created - Exams, Assignments |

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

**Detailed Syllabus**

| Module | Unit | Content | Hrs (36+9) | Marks |
|---|---|---|---|---|
| I | | **Introduction to Cyber Space** | **9** | **12** |
| | 1 | Cyber Space- Fundamental definitions | 2 | |

| | | | | |
|---|---|---|---|---|
| | 2 | Jurisprudence and-Jurisdiction in Cyber Space | 2 | |
| | 3 | Need for IT act - Enforcement agencies | 3 | |
| | 4 | Introduction to cyber law and its relevance in the Indian context | 2 | |
| **II** | **Cyber Crimes and Criminals** | | **9** | **12** |
| | 5 | Cyber crimes | 2 | |
| | 6 | Cyber Criminals and their Objectives | 2 | |
| | 7 | Cyber stalking; cyber pornography | 2 | |
| | 8 | Forgery and fraud; crime related to IPRs; | 2 | |
| | 9 | Phishing and Identity Theft | 1 | |
| **III** | **Indian Cyber law** | | **9** | **14** |
| | 10 | Introduction to Indian Cyber Law | 2 | |
| | 11 | Cyber Crime vs Conventional Crime | 2 | |
| | 12 | Electronic Commerce and related issues | 2 | |
| | 13 | Overview of Intellectual Property rights | 2 | |
| | 14 | Computer Software and related IPR Issues | 1 | |
| **IV** | **Basics of IT law and its regulatory mechanisms** | | **9** | **12** |
| | 13 | Key provisions of the Information Technology Act, 2000 related to cybercrimes and offenses | 2 | |
| | 14 | Regulatory Mechanisms and Enforcement | 2 | |
| | 15 | Overview of the Cyber Crime Investigation Cell (CCIC) | 2 | |
| | 16 | Understanding the process of reporting cyber crimes | 2 | |
| | 17 | Penalties and legal implications associated with cybercrimes under Indian law (basics only) | 1 | |
| **V** | **Open Ended Module**<br>**Hands-on: Practical Applications, Case Study and Course Project** | | **9** | |
| | 1 | **S**ocial media based Cyber crimes | 2 | |
| | 2 | Discussion on Emerging issues | 2 | |
| | 3 | Recent trends in digital marketing | 3 | |
| | 4 | Demonstrate how to use google web masters Indexing Using API | 2 | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Practical Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ |
| CO 3 | ✓ | | | ✓ |
| CO 4 | ✓ | | | ✓ |
| CO 5 | | ✓ | | ✓ |
| CO6 | | | | ✓ |

**References:**


1. Cyber law –The Indian perspective by Pavan Duggal
2. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi
3. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi


| Programme | BCA | | | | |
|---|---|---|---|---|---|
| Course Title | Business Intelligence and Innovation | | | | |
| Type of Course | VAC | | | | |
| Semester | VI | | | | |
| Academic Level | 100-199 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 3 | 3 | - | - | 45 |
| Pre-requisites | 1. Basic Understanding of Business Operations.<br>2. Foundational Knowledge of Data Analysis.<br>3. Awareness of IT Infrastructure | | | | |
| Course Summary | This course offers a comprehensive exploration of Business Intelligence (BI), IT innovation, and startup culture. It covers fundamental concepts, tools, and strategies essential for navigating the modern business | | | | |

| | |
|---|---|
| | landscape. Students delve into the importance of data-driven decision-making and learn about data collection, analysis, and visualization techniques. Additionally, the course delves into the dynamics of innovation ecosystems, lean startup methodologies, and funding strategies for entrepreneurial ventures. |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | Acquire a comprehensive understanding of Business Intelligence and its applications | Ap | C | Instructor-Create Exams or Quiz |
| CO2 | Students can implement data-driven decision-making processes in various business contexts. | E | C | Discussions and Quizzes |
| CO3 | Develop customised Business Intelligence solutions tailored to specific organisational needs. | Ap | C | Instructor created exams or home assignments |
| CO4 | Evaluate emerging trends and technologies in IT for potential business impact. | Ap | C | Discussions, Quizzes |
| CO5 | Lead entrepreneurial initiatives by applying lean startup methodologies and securing funding. | Ap | C | Viva Voce Observation of practical skills |
| CO6 | Analyse case studies of successful IT innovations for practical insights and application. | Ap | C | Instructor Created -Exams, Assignments |

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

**Detailed Syllabus**

| Module | Unit | Content | Hrs (36+9) | Marks |
|---|---|---|---|---|
| I | | **Introduction to Business Intelligence (BI)** | **9** | **10** |
| | 1 | Overview of Business Intelligence concepts, Business Intelligence technologies | 2 | |
| | 2 | Importance of Business Intelligence in Decision-making Processes | 2 | |
| | 3 | Data-driven decision-making (Data Collection, Data Integration, Data Analysis, Data Visualisation, Decision Support), Benefits of Data-Driven Decision Making | 2 | |
| | 4 | Tools and techniques for data collection, processing, and analysis | 3 | |
| II | | **Exploring BI Tools and Applications** | **9** | **15** |
| | 5 | Application of Business Intelligence in different business domains | 2 | |
| | 6 | Business Intelligence tools for Performance Monitoring (Tableau, Power BI, Qlik Sense, IBM Cognos Analytics, Oracle BI) | 3 | |

| | | | | |
|---|---|---|---|---|
| | 7 | Use of Business Intelligence tools for performance monitoring | 2 | |
| | 8 | Data visualization techniques | 2 | |
| **III** | **IT Entrepreneurship and Startup Culture** | | **9** | **15** |
| | 9 | Innovation in IT and Startup Culture, Understanding Innovation Ecosystems | 2 | |
| | 10 | Startup culture and lean startup methodology, Identifying opportunities for innovation in IT | 2 | |
| | 11 | Funding for Startups and Entrepreneurial Ventures, Sources of funding for startups | 2 | |
| | 12 | Venture capital investment process, Bootstrapping strategies | 1 | |
| | 13 | Financial modelling and valuation techniques, Legal and regulatory considerations | 2 | |
| **IV** | **IT Innovation: Trends, Successes, and Challenges** | | **9** | **10** |
| | 14 | Innovations in IT, Entrepreneurial mindset and skills development | 2 | |
| | 15 | Emerging trends and technologies in IT | 2 | |
| | 16 | Case studies of successful IT innovations in India (Infosys, Tata Consultancy Services (TCS), Wipro Limited, HCL Technologies, Zoho Corporation) | 3 | |
| | 17 | Opportunities and challenges in adopting innovative technologies, Strategies for managing technological change. | 2 | |
| **V** | **Open Ended Module- Application Level** | | **9** | |
| | | Discuss from the following:<br>• Strategic Role of Business Intelligence.<br>• Next-generation Data Visualization Techniques and Tools.<br>• Understanding Innovation Ecosystems.<br>• Agile Methodologies and Lean Startup Principles for IT Innovation.<br>• Ethical Considerations in Data-driven Decision-making and Innovation<br>• Future Outlook: Anticipating Trends and Staying Ahead of the Curve | **9** | |

**Mapping of COs with PSOs and POs:**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 3 | 2 | 1 | - | - | | | | | | |
| CO 2 | 1 | 1 | 2 | 1 | - | - | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 3 | - | 3 | 1 | 1 | - | - | | | | | | |
| CO 4 | - | 3 | 3 | 2 | - | - | | | | | | |
| CO 5 | - | 1 | 3 | 3 | 1 | - | | | | | | |
| CO 6 | - | 1 | 3 | 3 | 1 | - | | | | | | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Practical Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | ✓ | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ |
| CO 3 | ✓ | ✓ | | ✓ |
| CO 4 | ✓ | ✓ | | ✓ |
| CO 5 | ✓ | ✓ | | ✓ |
| CO 6 | ✓ | ✓ | | ✓ |

**Reference:**


1. Business Intelligence Guidebook: From Data Integration to Analytics by Rick Sherman.
2. Business Intelligence: A Managerial Perspective on Analytics by Ramesh Sharda, Dursun Delen, and Efraim Turban.
3. Lean Analytics: Use Data to Build a Better Startup Faster" by Alistair Croll and Benjamin Yoskovitz.
4. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries.
5. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist" by Brad Feld and Jason Mendelson.
6. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company" by Steve Blank and Bob Dorf.

# Semester IV

| | | | | | |
|---|---|---|---|---|---|
| Programme | BCA | | | | |
| Course Title | Database Management System | | | | |
| Type of Course | Major | | | | |
| Semester | IV | | | | |
| Academic Level | 200 - 299 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | Discrete Mathematics, Data structures and Programming Basics | | | | |
| Course Summary | This course provides an introduction to database management systems. The topics covered include the concept of Database Management System, ER Model, Relational model, SQL, Database design, Transactions, concepts of other data model-NoSQL and practical session to implement Database Concepts. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | A comprehensive understanding of fundamental concepts in database management systems and its application | U | C | Instructor-created exams / Quiz |
| CO2 | Understand concepts of Relational Data Model | U | C | Instructor- |

| | | | | |
|---|---|---|---|---|
| | and Normalization Techniques | | | created exams / Quiz |
| CO3 | Apply principles of entity-relationship modeling and normalization techniques to design efficient and well-structured databases that meet specified requirements. | Ap | P | Practical Assignment / Observation of Practical Skills |
| CO4 | Acquire expertise in crafting and executing SQL queries for the retrieval, updating, and manipulation of data, showcasing adept skills in database querying and data manipulation | Ap | p | Practical Assignment / Observation of Practical Skills |
| CO5 | Comprehend and apply strategies for managing transactions and implementing mechanisms for controlling concurrency, ensuring the database's consistency and reliability in environments with multiple users. | Ap | P | Practical Assignment / Observation of Practical Skills |
| CO6 | Explore and analyze recent trends in database management systems, with a focus on unstructured databases, NoSQL technologies | An | P | Practical Assignment / Observation of Practical Skills |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus**

| Module | Unit | Content | Hrs (45+30) | Mark |
|---|---|---|---|---|
| **I** | | **Database System- Concept** | **10** | **15** |
| | 1 | Introduction, Characteristics of the Database Approach | 2 | |
| | 2 | Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, File system vs Database | 2 | |
| | 3 | Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence | 3 | |
| | 4 | Database Languages and Interfaces | 2 | |
| | 5 | Structured, Semi Structured and Unstructured Database | 1 | |
| **II** | | **Database Design** | **14** | **20** |
| | 6 | ER Model- Basic concepts, entity set & attributes, notations | 2 | |
| | 7 | Relationships and constraints, cardinality, participation, notations, weak entities | 2 | |
| | 8 | Relational Model Concepts-Domains, Attributes, Tuples, and Relations, Values and NULLs in the Tuple | 2 | |
| | 9 | Relational Model Constraints and Relational Database Schemas | 2 | |
| | 10 | Relational Database Design- Atomic Domain and Normalization- INF, 2NF,3NF, BCNF | 4 | |
| | 11 | 4NF,5NF | 2 | |
| **III** | | **Query Languages** | **11** | **20** |
| | 12 | SQL-, introduction to Structured Query Language (SQL) | 1 | |
| | 13 | Data Definition Language (DDL), Table definitions and operations | 2 | |
| | 14 | SQL DML (Data Manipulation Language) - SQL queries on | 4 | |

| | | | | |
|---|---|---|---|---|
| | | single and multiple tables | | |
| | 15 | Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types. | | |
| | 16 | Introduction to NoSQL Databases | 2 | |
| | 17 | Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB) | 2 | |
| **IV** | **Transaction Processing, Concurrency Control** | | **10** | **15** |
| | 18 | Transaction Processing: Introduction, Transaction and System Concepts | 3 | |
| | 19 | Desirable Properties of Transactions | 1 | |
| | 20 | Characterizing Schedules Based on Recoverability & Serializability | 2 | |
| | 21 | Transaction Support in SQL. | 1 | |
| | 22 | Introduction to Concurrency Control: Two-Phase Locking Techniques | 3 | |
| **V** | **DBMS LAB** | | **30** | |
| | 1 | Students should decide on a case study and formulate the problem statement. | 3 | |
| | 2 | Based on Identified problem Statement, Design ER Diagram (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher. | 3 | |
| | 3 | Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model. | 2 | |
| | 4 | Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form | 3 | |
| | 5 | Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables | 3 | |
| | 6 | Practicing DML commands-Insert, Select, Update, Delete | 2 | |
| | 7 | Experiment 7: Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc. | 2 | |
| | 8 | Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi). | 2 | |
| | 9 | Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping. | 4 | |
| | 10 | Install and Configure MongoDB to execute NoSQL Commands. | 6 | |

**Mapping of COs with PSOs and POs:**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 2 | - | - | - | - | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 2 | 2 | 2 | 1 | - | - | - | | | | | | |
| CO 3 | - | - | 2 | 3 | - | - | | | | | | |
| CO 4 | - | - | - | 3 | 3 | - | | | | | | |
| CO 5 | - | - | - | 3 | 3 | - | | | | | | |
| CO 6 | 2 | - | - | - | 2 | 3 | | | | | | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Project Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | | | ✓ |
| CO 2 | ✓ | | | ✓ |
| CO 3 | | ✓ | ✓ | ✓ |
| CO 4 | | ✓ | ✓ | ✓ |
| CO 5 | ✓ | ✓ | | ✓ |
| CO 6 | | ✓ | ✓ | ✓ |

**References:**

1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1.

2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8.

| | | | | | |
|---|---|---|---|---|---|
| Programme | BCA | | | | |
| Course Title | Python Programming | | | | |
| Type of Course | Major | | | | |
| Semester | IV | | | | |
| Academic Level | 200 - 299 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | Knowledge in Fundamentals of Programming | | | | |
| Course Summary | This course explores the versatility of Python language in programming and teaches the application of various data structures using Python. The course also introduces fundamental concepts of object-oriented programming and insights into leveraging Python packages. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | Understand the basic concepts of Python programming language. | U | C | Instructor-created exams / Quiz |
| CO2 | Apply problem-solving skills using the basic constructs in Python programming | Ap | P | Coding Assignments/ Code reading and review |
| CO3 | Apply modular programming using functions in Python | Ap | P | Coding Assignments/ Code reading and review |
| CO4 | Analyse the various data structures and operations on it using Python | An | C | Instructor-created exams / Case studies |
| CO5 | Apply various packages available in Python | Ap | P | Coding Assignments/ Case studies |
| CO6 | Apply visualization tools in Python | Ap | P | Coding Assignments/ Case studies |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus**

| Module | Unit | Content | Hrs (45+30) | Marks |
|---|---|---|---|---|
| **I** | | **Introduction to Python and Control Flow Statements** | **10** | **15** |

| | | | | |
|---|---|---|---|---|
| | 1 | Tokens in Python | 2 | |
| | 2 | Operators Precedence & Associativity & Type Conversion | 1 | |
| | 3 | Built-in functions | 1 | |
| | 4 | Decision-making Structures | 3 | |
| | 5 | Looping Structures | 3 | |
| **I** | **Introduction to Functions & Modules** | | **12** | **20** |
| **I** | 6 | Introduction to functions | 2 | |
| | 7 | Scope and lifetime of variables | 1 | |
| | 8 | Types of arguments | 3 | |
| | 9 | Types of functions – recursive, anonymous, returning more than onevalue | 3 | |
| | 10 | Introduction to Modules | 1 | |
| | 11 | User-defined modules and packages | 2 | |
| **III** | | | **12** | **20** |
| | 12 | Introduction to Strings and traversal | 2 | |
| | 13 | Slicing, splitting, and joining methods on Strings | 1 | |
| | 14 | Introduction to Lists and traversal | 1 | |
| | 15 | List methods | 2 | |
| | 16 | Introduction to Dictionaries and traversal | 1 | |
| | 17 | Dictionaries methods | 2 | |
| **IV** | **Introduction to Scientific Computing in Python** | | **11** | **15** |
| | 18 | Basics of NumPy Arrays | 2 | |
| | 19 | Computation on NumPy Arrays | 2 | |
| | 20 | Basics of Pandas objects | 3 | |
| | 21 | Basics of Matplotlib | 1 | |
| | 22 | Plotting in Matplotlib | 3 | |
| **V** | **Hands-on Data Structures: Practical Applications, Case Study and Course Project** | | **30** | |
| | 1 | **Introduction to Python**<br>• Running instructions in Interactive interpreter and a PythonScript.<br>• Generate output with print statements<br>• Read input, including casting that input to the appropriate type<br>• Perform calculations involving integers and floating point numbers using Python operators like +, -, *, /, //, %, and **<br>• Call functions residing in the math module | 20 | |
| | 2 | **If Statement**<br>• Make a decision with an if statement<br>• Select one of two alternatives with an if-else statement<br>• Select from one of several alternatives by using an if-elif or if-elif-else statement<br>Construct a complex condition for an if statement that includes theBoolean operators and, or and not | | |
| | 3 | **Loops**<br>• Iterate over a sequence using a for loop | | |

| | | | | |
|---|---|---|---|---|
| | | • Use the range () function in a form loop<br>• Create a while loop to repeat a block of code<br>• Use the break and continue statement<br>• Nested loops For loop with else clause<br>• While loop with else clause | | |
| | 4 | **Function**<br>• Define a function for later use<br>• Pass one or more values into a function<br>• Perform a complex calculation within a function<br>• Return one or more results from a function<br>• Call a function that you have defined previously | | |
| | 5 | **Strings**<br>• Create a string<br>• String Indexing<br>• Looping through a String<br>• String Slicing | | |
| | 6 | **Lists**<br>• Create a list<br>• List Indexing<br>• Looping through a list<br>• Adding items to a list<br>• Modifying items of a list<br>• Removing elements<br>• List Slicing | | |
| | 7 | **Tuples**<br>• Create a tuple<br>• Tuple Indexing<br>• Looping through a tuple<br>• Adding items to a tuple<br>• Tuple Slicing | | |
| | 8 | **Dictionary**<br>• Create a dictionary and access values with key<br>• Adding a key-value pair<br>• Adding to an empty dictionary<br>• Modifying values in a dictionary<br>• Removing key-value pair<br>• Looping through a dictionary- Looping through all key-valuepairs, Looping through all the keys, Looping through all the values | | |
| | 9 | **NumPy**<br>• Create NumPy(1 D, 2D, and 3D) arrays from a sequence<br>• Create NumPy Arrays using functions<br>• Arithmetic Computations using Universal Functions<br>• Broadcasting<br>• Fancy Logic | | |
| | 10 | **Pandas**<br>• Create a data frame from a dictionary<br>• Create an explicitly indexed series object from an array or list<br>• Create Index objects of various types | | |

| | | | | |
|---|---|---|---|---|
| | | • Perform set operations on Index objects | | |
| | 11 | **Matplotlib**<br>• Create and format a simple line plot<br>• Create and format a simple scatter plot<br>• Create and format a simple histogram<br>• Create and format a contour plot | | |
| | 12 | Case study | 3 | |
| | 13 | Capstone (/Course) Project: Build a practical application using any onepackage and implement the visualization tools | 7 | |

**Mapping of COs with PSOs and POs:**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | - | - | - | - | | | | | | |
| CO2 | 1 | - | 2 | - | 1 | - | | | | | | |
| CO3 | 1 | - | 2 | 1 | - | - | | | | | | |
| CO4 | 1 | - | 1 | - | - | - | | | | | | |
| CO5 | 3 | 2 | 2 | 2 | 2 | 2 | | | | | | |
| CO6 | 3 | 2 | 2 | - | 2 | 2 | | | | | | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Project Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | | | ✓ |
| CO 2 | ✓ | | | ✓ |
| CO 3 | ✓ | ✓ | | ✓ |

| | | | | |
|---|---|---|---|---|
| CO 4 | | ✓ | | ✓ |
| CO 5 | | ✓ | | ✓ |
| CO 6 | | | ✓ | |

**References:**


1. Jose, Jeeva. Taming Python by Programming. Khanna Book Publishing, 2017. Print.
2. S, Gowrishankar, and A, Veena. Introduction to Python Programming. Chapman & Hall/CRC Press, 2018.
3. Downey, Allen. Think Python. Green Tea Press, 2nd ed. 2009
4. VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. United States, O'Reilly Media, 2016.
5. Stephenson, Ben. The Python Workbook. SPRINGER INTERNATIONAL PU, 2016.


| | | | | | |
|---|---|---|---|---|---|
| Programme | Bachelor of Computer Applications (BCA) | | | | |
| Course Title | Software Engineering | | | | |
| Type of Course | Major | | | | |
| Semester | IV | | | | |
| Academic Level | 200-299 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 4 | - | - | 60 |
| Pre-requisites | 1. Understanding fundamental computer science concepts, data structures, and algorithms.<br>2. Basic knowledge of project planning and scheduling | | | | |
| Course Summary | After completing the course students may be engaged in practical exercises, projects, and teamwork to apply theoretical concepts to real-world scenarios. The goal is to equip students with the knowledge and skills needed to develop high-quality software solutions and contribute effectively to the software development lifecycle. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | To learn and understand the Concepts of Software Engineering | Ap | C | Practical Assignment / Instructor-created exams / Quiz |
| CO2 | To Learn and understand Software Development Life Cycle. Identify and apply appropriate SDLC models and methodologies. | Ap | P | Practical Assignment / Instructor-created exams / Quiz |

| | | | | |
|---|---|---|---|---|
| CO3 | To apply the project management and analysis principles to software project development. | Ap | C | Practical Assignment / Instructor-created exams / Quiz |
| CO4 | To apply principles of software design to create high-quality software architectures. Demonstrate proficiency in programming languages and coding standards. | Ap | P | Practical Assignment / Instructor-created exams / Quiz |
| CO5 | To apply testing techniques to ensure software quality and identify and perform different types of software maintenance activities. | Ap | P | Practical Assignment / Instructor-created exams / Quiz |
| CO6 | Prepare and deliver effective project presentations. | Ap | P | Practical Assignment / Instructor-created exams / Quiz |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus**

| Module | Unit | Content | Hrs (48+12) | Marks |
|---|---|---|---|---|
| **I** | | **THE SOFTWARE PROCESS** | **10** | **15** |
| | 1 | Software Engineering: Nature of Software, Software Engineering, Software Process, Software Development Life Cycle | 1 | |
| | 2 | Prescriptive Process Models – Waterfall, Incremental, Evolutionary | 3 | |
| | 3 | Agile Process: What is Agility, What is agile Process? | 2 | |
| | 4 | Extreme Programming: XP Values, XP Process, Industrial XP, XP Debate | 1 | |
| | 5 | Other Agile Process Models: Adaptive Software Development, , Scrum, Dynamic Systems Development Method, Crystal | 3 | |
| **II** | | **REQUIREMENT ENGINEERING** | **10** | **15** |
| | 6 | Introduction to Requirement Engineering: Functional and non-functional requirement (Types) | 2 | |
| | 7 | Requirement engineering process | 2 | |
| | 8 | Requirement Elicitation: Concept of Requirement Elicitation, Elicitation Technique, Stories and Scenarios, | 2 | |
| | 9 | Requirement Specification: Concept, Natural Language Specification, Structured Specification, Use Cases, Software Requirement Document, | 2 | |
| | 10 | Requirement Validation: Concept, Requirement Change, | 2 | |
| **III** | | **SYSTEM MODELLING, ARCHITECTURAL DESIGN** | **14** | **20** |
| | 11 | Context models: Detailed Concept | 2 | |
| | 12 | Interaction models: Concept, Use case modelling, Sequence Diagram, | 2 | |
| | 13 | Structural Models: Concept, Class Diagram, Generalization, Aggregation, | 2 | |

| | | | | |
|---|---|---|---|---|
| | 12 | Behavioural Models: Concept, Data driven modelling, Event driven modelling, Model driven engineering, | 2 | |
| | 13 | Architectural design decisions: Detailed concept | 2 | |
| | 14 | Architectural views: Detailed concept, Layered Architecture, Repository Architecture, Client-Server architecture, Pipe and Filter Architecture. | 2 | |
| | 14 | Architectural patterns: Transaction Processing Systems, Information Systems, Language Processing System, | 2 | |
| **IV** | **TESTING, MAINTANENCE AND RE ENGINEERING** | | **14** | **20** |
| | 16 | Strategic Approach to Software Testing: Verification and Validation, Organizing for Software Testing, Software Testing Strategy | 2 | |
| | 17 | Strategies for Conventional Software: Unit and Integration Testing | 2 | |
| | 18 | Strategies for Object Oriented Software: Unit Testing and Integration Testing in OO Context. | 2 | |
| | 19 | Validation Testing, System Testing, White Box Testing and Black Box Testing | 2 | |
| | 20 | Software Maintenance - Software Supportability, Reengineering | 2 | |
| | 21 | Business Process Reengineering: Business Process, BPR Model | 2 | |
| | 22 | Software Reengineering and Reverse Engineering | 2 | |
| **V** | **Open Ended Module- Trends in Software Engineering** | | **12** | |
| | | 1. Case Study.<br>2. Engage in a substantial project that integrates knowledge from various areas of software engineering.<br>3. Explore the process of creating a software startup.<br>4. Apply critical thinking skills to software design and implementation. | | |

**Mapping of COs with PSOs and POs:**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 1 | - | - | 2 | - | | | | | | |
| CO 2 | 1 | 1 | - | - | 2 | - | | | | | | |
| CO 3 | 1 | 1 | 2 | - | 3 | - | | | | | | |
| CO 4 | 1 | 1 | 2 | - | 3 | - | | | | | | |
| CO 5 | 1 | 1 | 2 | - | 3 | 3 | | | | | | |
| CO 6 | 1 | 1 | - | - | 3 | 2 | | | | | | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Practical Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | ✓ | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ |
| CO 3 | ✓ | ✓ | | ✓ |
| CO 4 | ✓ | ✓ | | ✓ |
| CO 5 | ✓ | ✓ | | ✓ |
| CO 6 | ✓ | ✓ | | ✓ |

**References:**


1. Sommerville, I. (2016). Software Engineering (10th ed.). Pearson Education.

2. Pressman, R. S. (2010). Software Engineering: A Practitioner's Approach (7th ed.).

3. Van Vliet, H. (2008). Software Engineering: Principles and Practices.

4. Fairley, R. E. (2008). Software Engineering Concepts.

5. Khurana, R. (n.d.). Software Engineering: Principles and Practices (2nd ed.). Vikas Publishing House Pvt Ltd.

6. Jalote, P. (n.d.). An Integrated Approach to Software Engineering (3rd ed.). Narosa Publishing House.

-

| Programme | BCA | | | | |
|---|---|---|---|---|---|
| Course Title | Automation and Robotics | | | | |
| Type of Course | Major | | | | |
| Semester | IV | | | | |
| Academic Level | 200-299 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 4 | - | - | 60 |
| Pre-requisites | No pre-requisites required | | | | |
| Course Summary | This course provides a comprehensive overview of automation which includes their production systems, elements, automation functions and usage of discrete and continuous control system. The course also explores the fundamentals of robotics, including anatomy, process control and how these functions could be improved by the integration of Artificial Intelligence. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | Understand the production systems and automation, enabling them to analyse, optimize and evaluate the different levels of automation. | U | C | Instructor- created exams / Quiz/Assignment/ Seminar |
| CO2 | Able to recognize the difference between the process industries, manufacturing industries, continuous and discrete control system. | U | C | Instructor-created exams/ Quiz/Assignment/ Seminar |
| CO3 | Proficiency in understanding the various forms of process control which includes the direct digital control, programmable logic control, distributable control systems etc. | U | C | Instructor-created exams/ Quiz/Assignment/ Seminar |
| CO4 | Familiarize with the various hardware components used for automation and process control such as sensors, actuators analog-digital converters etc. | U | C | Instructor-created exams/ Quiz/Assignment/ Seminar |
| CO5 | Understand the present developments in the field of automation and robotics and how integrating artificial intelligence can contribute to the future of these systems. | U | C | Instructor-created exams/ Quiz/Assignment/ Seminar |

| | | | | |
|---|---|---|---|---|
| CO6 | Represent various problems using algorithmic approaches and enhance problem-solving skills by visualizing solutions through the utilization of software tools. | U, Ap | C, P | Practical Assignment / Observation of Practical Skills |

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

**Detailed Syllabus**

| Module | Unit | Contents | Hrs (48+12) | Mark |
|---|---|---|---|---|
| I | | **Introduction to Automation** | **11** | **15** |
| | 1 | Production systems - Facilities, Manufacturing support systems | 2 | |
| | 2 | Automation in production systems – Automated manufacturing system, Computerized manufacturing support systems, Reasons for automating | 3 | |
| | 3 | Manual labour in production systems | 1 | |
| | 4 | Elements of automation - power to accomplish the process, Program of instructions, control system | 3 | |
| | 5 | Advanced automation functions – safety monitoring, maintenance and repair diagnostics, error detection and recovery | 1 | |
| | 6 | Levels of automation | 1 | |
| II | | **Control Systems** | **14** | **15** |
| | 7 | Process industries versus Discrete manufacturing industries, Continuous versus Discrete control | 2 | |
| | 8 | Continuous control system | 3 | |
| | 9 | Discrete control system | 1 | |
| | 10 | Computer process control, Control requirements, Capabilities of computer control | 2 | |
| | 11 | Forms of computer process control - Computer process monitoring, Direct digital control, Computer numerical control and robotics, Programmable logic controllers, Supervisory control and data acquisition, Distributed control systems | 3 | |
| | 12 | Hardware for automation and process control (Concept only) - Sensors, Actuators, Analog to Digital converters Digital to Analog converters, Input/output devices for discrete data. | 3 | |
| **III** | | **Industrial Robotics** | **15** | **25** |

| | | | | |
|---|---|---|---|---|
| | 13 | Robot anatomy – Joints and links, Common robot configurations, Joint drive systems, Sensors in robotics | 4 | |
| | 14 | Robot control systems – Limited sequence control, Playback with point-to-point control, Playback with continuous path control, Intelligent control | 2 | |
| | 15 | End effectors – Grippers, Tools | 1 | |
| | 16 | Robot Programming – Lead through programming, Powered lead through, Motion programming, Advantages and disadvantages | 2 | |
| | 17 | Discrete process control – logic control, sequence control | 4 | |
| | 18 | Programmable Logic Controllers, Components of PLC | 2 | |
| **IV** | **Automation and Robotics: Present and Future** | | **8** | **15** |
| | 19 | Machine Intelligence, Computer and Robotics | 2 | |
| | 20 | Flexible automation vs Robotics technology | 2 | |
| | 21 | Artificial Intelligence and Automated Manufacturing, AI and Robotics | 2 | |
| | 22 | Robotics in India, Future of Robotics | 2 | |
| **V** | **Open Ended Module – Application Level** | | **12** | |
| | 1 | Discuss topics from the following:<br>• Role of manual labour in modern manufacturing.<br>• Benefits and challenges of automation.<br>• Developing a simple automated process with control instructions.<br>• Types of error detection and recovery system.<br>• Discussion on the impact of automation levels on production efficiency.<br>• Exploring the role of computer process control in modern manufacturing<br>• Implementing basic computer process control using simulation software.<br>• Visioning the future of robotics in India. | 10 | |
| | 2 | Host a discussion session on the intersection of Artificial Intelligence (AI) and Robotics in automated manufacturing. | 2 | |

**Mapping of COs with PSOs and POs:**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | - | - | - | - | - | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 2 | 2 | 2 | - | - | 2 | - | | | | | | |
| CO 3 | 2 | 2 | - | - | 2 | - | | | | | | |
| CO 4 | 2 | 2 | - | - | 2 | - | | | | | | |
| CO 5 | 1 | - | - | - | - | 1 | | | | | | |
| CO 6 | - | - | 2 | 2 | - | - | | | | | | |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics:**

| | Internal Exam | Assignment | Practical Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | ✓ | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ |
| CO 3 | ✓ | ✓ | | ✓ |
| CO 4 | ✓ | ✓ | | ✓ |
| CO 5 | ✓ | ✓ | | ✓ |
| CO 6 | ✓ | ✓ | ✓ | ✓ |

**References:**


1. Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, 4th edition, Pearson Education, 2017.

2. S.R. Deb, S. Deb “ Robotics Technology and flexible automation,” Tata McGraw-Hill Education, 2017.

3. Mikell P. Groover, “ "Industrial Robots - Technology, Programming and Applications", McGraw-Hill Education, 2017.