# K.M.G. COLLEGE OF ARTS AND SCIENCE

## (AUTONOMOUS)

Approved by the Government of Tamil Nadu
Permanently Affiliated to Thiruvalluvar University, Vellore
Recognized under Section 2(f) and 12(B) of the UGC Act 1956
Accredited by NAAC (2nd Cycle) with (CGPA of 3.24/4) 'A' Grade

## P.G. & RESEARCH DEPARTMENT OF COMPUTER SCIENCE

# M.Sc., INFORMATION TECHNOLOGY

# SYLLABUS

## (CHOICE BASED CREDIT SYSTEM)

**Under**

## LEARNING OUTCOMES-BASED CURRICULUM

## FRAMEWORK (LOCF)

**(Effective for the Batch of Students Admitted from 2024-2025)**

# PREFACE

This course is designed to provide students with a working knowledge of computer concepts and essential skills necessary for work and communication in today's society. Students will learn safety, security, and ethical issues in computing and social networking. Students will also learn about input/output systems, computer hardware and operating systems. Students learn the basics of Database Management Systems (Access) as well as Personal Information Management software (Outlook). Students are also introduced to desktop publishing (Publisher), and video editing software (Movie Maker). Students will also be introduced to digital animation, 3D Design, and programming. Information Technology provides learners with a solid foundation in all major aspects of computing technology. The course covers Information Technology (IT) from the early days of computing to the current cloud computing, social media platforms, and beyond. Students will explore the fundamentals of networking, software, and programming. Students will learn to speak the complex language of information technology and gain an understanding of how to harness the power of sophisticated technology tools. The course includes pre-assessments, self-assessments, interactive exercises, videos, and games that appeal to a variety of learning styles. Narrative scenarios and case studies will give students opportunities to use critical thinking skills and apply their IT knowledge to real-world scenarios. Topics covered in this course include the evolution of information science, IT security, operating systems, computing architecture and design, programming languages, the software development life cycle, types of malware and computing attacks, networking, telecommunications, and the internet, networking devices and protocols, computer hardware and devices, database management, computing models, mobile computing, social media, cloud computing, e-commerce, ethics and IT, and IT policy and governance. The exposure to the industrial internship and MoUs with industries can open an avenue for a start-up and its progress would be followed regularly. The OBE based evaluation methods will reflect the true cognitive levels of the students as the curriculum is designed with course outcomes and cognitive level correlations as per BLOOM’s Taxonomy.

In pursuit of the Higher Education Department Policy Note 2022-23 Demand 20, Section 1.4, Tamil Nādu State Council for Higher Education took initiative to revamp the curriculum. On 27 July 2022, a meeting was convened by the Member-Secretary Dr. S. Krishnasamy enlightening the need of the hour to restructure the curriculum of both Undergraduate and Post-graduate programmes based on the speeches at the Tamil Nādu Legislative Assembly Budget meeting by the Honourable Higher Education Minister Dr K. Ponmudy and Honourable Finance Minister Dr. P. Thiagarajan. At present there are three

different modes of imparting education in most of the educational institutions throughout the globe. Outcome Based Education, Problem Based Education, and Project Based Education.

Now our Honourable Higher Education Minister announced Industry Aligned Education. During discussion, Member Secretary announced the importance of question papers and evaluation as envisaged by the Honourable Chief Secretary to Government Dr, V. IraiAnbu. This is very well imbedded in Revised Bloom's Taxonomy forms three learning domains: the cognitive (knowledge), affective(attitude), and psychomotor (skill). This classification enables to estimate the learning capabilities of students.

Briefly, it is aimed to restructure the curriculum as student-oriented, skill-based, and institution industry- interaction curriculum with the various courses under "Outcome Based Education with Problem Based Courses, Project Based Courses, and Industry Aligned Programmes" having revised Bloom's.

**ABOUT THE COLLEGE**

The College was established in the new millennium 2000 by the vision of late Shri.K.M.Govindarajan fondly known as Iyah, with a mission to offer higher education in the fields of Arts and Science to the needy and the poor middle class students of this area and make them fully employable and economically self-reliant. With a humble beginning of launching an elementary school named Thiruvalluvar Elementary School in the year 1952, Iyah groomed it into a Higher Secondary School and later into a college. Education was his soul and breath. The college has grown into a full-fledged educational hub offering 12 Under Graduate Programmes, 8 Post Graduate Programmes, 5 M.Phil Research Programmes and 4 Ph.D Programmes. The college has been accredited with ‘A’ grade by NAAC in 2nd cycle and recognized under section 2(f) & 12(B) of the UGC act 1956. The College is permanently affiliated to Thiruvalluvar University. The College is also acquired the status of Autonomous from the academic year 2024-2025. The College is an associate member of ICT Academy and registered member of NPTEL and Spoken Tutorials of IIT Bombay. The college is also a member of INFLIBNET and NDL.

## VISION OF THE COLLEGE

Empower young men and women by educating them in the pursuit of excellence, character building and responsible citizen.

## MISSION OF THE COLLEGE

Offer higher education in the fields of Arts, Science & Management to the needy and make them fully self-dependent.

## QUALITY POLICY OF THE COLLEGE

KMG Students achieve the best learning results and personal growth with modern education that equip them for working life and a changing society to become deserving citizens.

## ABOUT THE DEPARTMENT

The Department of Computer Science was established in the year 2000 with a view to fulfill the dynamic needs of IT sector all over the world. The department is well equipped with all basic and latest resources. The department comprises of well qualified and dedicated faculty members. The Department aims to make the students use their intellectual caliber for effective and quick acquisition. The Department runs the following courses.

## VISION OF THE DEPARTMENT

- To provide a pleasant and friendly environment for learning in discipline of computer science to mobilize students towards serving a globalized technological society.

## MISSION OF THE DEPARTMENT

- To ensure that every student is proficient with necessary computer skills.
- To inculcate strong ethical values, professional behavior and leadership abilities in students character so as to work with a commitment to the progress of the nation.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

**1. Professional Excellence:** Graduates will demonstrate competency and excellence in their chosen fields of study, applying theoretical knowledge to practical situations effectively.

**2. Character Development:** Graduates will exhibit strong moral and ethical character, upholding values of integrity, honesty, and respect for others in both personal and professional endeavors.

**3. Leadership and Citizenship:** Graduates will emerge as responsible leaders and active citizens, contributing positively to their communities and society at large through their actions and initiatives.

**4. Continuous Learning:** Graduates will engage in lifelong learning and professional development activities, adapting to evolving technologies, methodologies, and societal needs.

**5. Self-Dependency and Entrepreneurship:** Graduates will possess the skills and mindset necessary to be self-reliant and entrepreneurial, capable of creating opportunities for themselves and others through innovation and initiative.

**6. Effective Communication and Collaboration:** Graduates will demonstrate proficiency in communication skills, both verbal and written, and exhibit the ability to collaborate effectively with diverse teams and stakeholders.

**7. Global Perspective:** Graduates will have a broad understanding of global issues and perspectives, demonstrating cultural sensitivity and adaptability in multicultural environments.

## PROGRAM OUTCOMES (POs)

On successful completion of the programme, the students will be able to:

| POs | Graduate Attributes | Statements |
|---|---|---|
| PO1 | Disciplinary Knowledge | Acquire detailed knowledge and expertise in all the disciplines of the subject. |
| PO2 | Communication Skills | Ability to express thoughts and ideas effectively in writing, listening and confidently Communicate with others using appropriate media |
| PO3 | Critical Thinking | Students will develop aptitude Integrate skills of analysis, critiquing, application and creativity. |
| PO4 | Analytical Reasoning | Familiarize to evaluate the reliability and relevance of evidence, collect, analyze and interpret data. |
| PO5 | Problem Solving | Capacity to extrapolate the learned competencies to solve different kinds of non-familiar problems. |
| PO6 | Employability and Entrepreneurial Skill | Equip the skills in current trends and future expectations for placements and be efficient entrepreneurs by accelerating qualities to facilitate startups in the competitive environment. |
| PO7 | Individual and Team Leadership Skill | Capability to lead themselves and the team to achieve organizational goals and contribute significantly to society. |
| PO8 | Multicultural Competence | Possess knowledge of the values and beliefs of multiple cultures and a global perspective. |
| PO 9 | Moral and Ethical awareness/reasoning | Ability to embrace moral/ethical values in conducting one's life. |
| PO10 | Lifelong Learning | Identify the need for skills necessary to be successful in future at personal development and demands of work place. |

## PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the M.Sc., Information Technology, the students will be able to:

| PSOs | Statements |
|---|---|
| **PSO1** | Posses the knowledge in the field of Information Technology through theory and practical |
| **PSO2** | Demonstrate high-level expertise in the fields Information Technology and research. Use software development tools, software systems, and modern computing platforms. |
| **PSO3** | Communicate Information Technology concepts, designs, solutions, implement effectively and also professionally. |

## Correlation Rubrics:

| High | Moderate | Low | No Correlation |
|---|---|---|---|
| 3 | 2 | 1 | - |

## Mapping of PSOs with POs:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PSO1** | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | - | 3 |
| **PSO2** | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 1 | - | 3 |
| **PSO3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | - | 2 |

# K.M.G. COLLEGE OF ARTS AND SCIENCE

## (AUTONOMOUS)

## Subject and Credit System- M.Sc., Information Technology

**(Effective for the Batch of Students Admitted from 2024-2025)**

| Semester | Part | Category | Course Code | Course Title | Ins.Hrs/ Week | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Internal | External | Total |
| SEMESTER - I | Part I | Core-1 | APCIT11 | Python Programming | 7 | 5 | 25 | 75 | 100 |
| | | Core-2 | APCPIT12 | Python Programming - Practical | 7 | 5 | 25 | 75 | 100 |
| | | Core-3 | APCPIT13 | Web Development using Word Press– Practical | 6 | 4 | 25 | 75 | 100 |
| | | Elective I (Choose any One) | APEIT14A | Data structures | 5 | 3 | 25 | 75 | 100 |
| | | | APEIT14B | Compiler Design | | | | | |
| | | | APEIT14C | Natural Language Processing. | | | | | |
| | | | APEIT14D | Block Chain Technology | | | | | |
| | | Elective II (Choose any One) | APEIT15A | Operating Systems. | 5 | 3 | 25 | 75 | 100 |
| | | | APEIT15B | Digital Computer Architecture. | | | | | |
| | | | APEIT15C | Human Computer Interaction. | | | | | |
| | | | APEIT15D | Big Data Analytics | | | | | |
| | **Semester Total** | | | | **30** | **20** | | | |
| | | | | | | | | | |
| SEMESTER - II | Part I | Core-4 | APCIT21 | Database System | 5 | 5 | 25 | 75 | 100 |
| | | Core-5 | APCPIT22 | RDBMS- Practical | 6 | 5 | 25 | 75 | 100 |
| | | Core-6 | APCPIT23 | Mobile Development - Practical | 6 | 4 | 25 | 75 | 100 |
| | | Elective III (Choose any One) | APEIT24A | Networks and Security | 4 | 3 | 25 | 75 | 100 |
| | | | APEIT24B | Cloud Computing | | | | | |
| | | | APEIT24C | Biometric Techniques | | | | | |
| | | Elective IV (Choose any One) | APEIT25A | Software Engineering | 4 | 3 | 25 | 75 | 100 |
| | | | APEIT25B | Object Oriented Analysis and Design | | | | | |
| | | | APEIT25C | Software Project Management | | | | | |
| | | SEC1 | APSIT26 | Skill Enhancement Course -SEC Mobile Development | 3 | 2 | 25 | 75 | 100 |
| | Part II | Compulsory Paper | APHR20 | Human Rights | 2 | 2 | 25 | 75 | 100 |
| | | | APMOOC20 | MOOC Course | - | 2 | - | 100 | 100 |
| | **Semester Total** | | | | **30** | **26** | | | |
| | | | | | | | | | |

| Semester | Part | Category | Course Code | Course Title | Ins.Hrs/ Week | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Internal | External | Total |
| | | | | | | | | | |
| SEMESTER - III | Part - I | Core-7 | APCIT31 | Advanced Java | 6 | 5 | 25 | 75 | 100 |
| | | Core-8 | APCPIT32 | Advanced Java - Practical | 6 | 5 | 25 | 75 | 100 |
| | | Core-9 | APCIT33 | Open Source Technologies | 6 | 5 | 25 | 75 | 100 |
| | | Core-10 | APCPIT34 | Open Source Technologies - Practical | 5 | 4 | 25 | 75 | 100 |
| | | Elective V (Choose any One) | APEIT35A | Research Methodology | 4 | 3 | 25 | 75 | 100 |
| | | | APEIT35B | Internet of Things | | | | | |
| | | | APEIT35C | Trends in computing | | | | | |
| | | SEC2 | APSIT36 | Skill Enhancement Course –SEC Industry Module – Mini Project done with in the campus | 3 | 2 | 25 | 75 | 100 |
| | | Compulsory | APIIT37 | Internship/Industrial Activity | - | 2 | 100 | - | 100 |
| | **Semester Total** | | | | **30** | **26** | | | |
| | | | | | | | | | |
| SEMESTER - IV | Part - I | Core-11 | APCIT41 | Net with C# Programming | 6 | 5 | 25 | 75 | 100 |
| | | Core-12 | APCPIT42 | Net with C# Programming-Practical | 6 | 5 | 25 | 75 | 100 |
| | | Core-13 | APPIT43 | Project with viva voce-Industry related project and carried out in the industry | 10 | 7 | 25 | 75 | 100 |
| | | Elective VI (Choose any One) | APEIT44A | Intelligent Systems | 4 | 3 | 25 | 75 | 100 |
| | | | APEIT44B | Introduction to Robotics | | | 25 | 75 | 100 |
| | | | APEIT44C | Virtual and Augmented Reality | | | 25 | 75 | 100 |
| | | SEC3 | APSIT45 | Professional Competency Skill Enhancement Course Term Paper & Seminar Presentation – Staff supervisor should select and assign different Advanced Technology topics to the students. The students must give presentation of the allotted topic in the respective class hours. The document of the presentation of respective topic allotted to them must be prepared and submitted with soft binding (around 50 to 100 Pages). – Evaluation is done by the External examiners similar to Project Viva voce. | 4 | 2 | 25 | 75 | 100 |
| | Part II | Compulsory Paper | APEA40 | Extension Activity | - | 1 | 100 | - | 100 |
| | **Semester Total** | | | | **30** | **23** | | | |

## Consolidated Semester wise and Component wise Credit distribution

| Parts | Semester-I | Semester-II | Semester-III | Semester-IV | Total Credits |
|---|---|---|---|---|---|
| **Part-I** | 20 | 22 | 26 | 22 | 90 |
| **Part-II** | - | 4 | - | 1 | 5 |
| **Total** | 20 | 26 | 26 | 23 | **95** |

*****Part I and Part II components will be separately taken into account for CGPA calculation and classification for the post graduate programme and has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree.

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | PYTHON PROGRAMMING | **Hours/Week** | 7 |
| **Course Code** | APCIT11 | **Credits** | 5 |
| **Category** | CORE I | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding on object oriented programming concepts. | **Regulation** | 2024 |

**Objectives of the course:**

- To acquire programming skills in core Python and to develop database applications in Python

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Core Python: Introduction - Python Basics: Comments - Statements and syntax - variable Assignment - Identifiers - Python objects : Built-in-types - Internal types - Standard Type operators - Standard type Built-in-functions. Numbers : Introduction to Numbers - Integers - Floating point numbers - Complex numbers - Operators - Built-in and factory functions – Conditionals and Loops -Sequences : Strings, Lists and Tuples | CO1 | K1, K2 |
| UNIT-II | Mapping and set types.- Functions and functional programming: Introduction - Calling functions - Creating functions - passing functions - Formal arguments - Variable - Length Arguments - Functional Programming - Variable Scope – Recursion | CO2, CO3 | K1, K2 |
| UNIT-III | Modules: Modules and Files – namespaces - Importing Modules - Features - Built-in functions. Object Oriented Programming: Introduction - Object Oriented Programming – Encapsulation Inheritance – Polymorphism - Errors and Exceptions: Introduction – Exceptions in Python. | CO2, CO3 | K1, K2 |
| UNIT-IV | GUI Programming: Introduction – Using Widgets: Core widgets- Generic widget properties – Labels – Buttons – Radio Buttons – Check Buttons – Text – Entry – List Boxes – Menus – Frame – Scroll Bars – Scale – Data Visualization using Grid and Graph. | CO4 | K1, K2,K3,K5 |
| UNIT-V | Database Programming: Connecting to a database using MySQL - Creating Tables - INSERT-UPDATE - DELETE - READ operations **Case Studies**: analyzing and visualizing data using Grid and Graph, Database Access with Python, Web Designing using Python. | CO5 | K1,K2, K3, K6 |

**Recommended Text Books**

1. Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition – (Unit I,II,III).
2. 2. Charles Dierbach, (2015), "Introduction to Computer Science Using Python A Computational ProblemSolving Focus", Wiley India Edition- (Unit III- Object Oriented Programming)
3. 3. Martin C Brown, (2018), "The Complete Reference Python", McGraw Hill Education (India) Private Limited – (Unit IV)

**Reference Books**

1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition.
2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education Private Limited, First Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computer scientist: learning with Python"

**Website and e-learning source**

1.http://interactivepython.org/courselib/static/pythond
2. http://www.ibiblio.org/g2swap/byteofpython/read/
3. http://www.diveintopython3.net/
4. http://docs.python.org/3/tutorial/index.html

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Explain the basic concepts in python language. | K1, K2 |
| CO2 | Apply the various data types and identify the usage of control statements, loops, functions and modules in python for processing the data | K1, K2 |
| CO3 | Analyze and solve problems using basic constructs and techniques of python. | K1, K2 |
| CO4 | Assess the approaches used in the development of interactive application. | K1, K2,K3,K5 |
| CO5 | To build real time programs using python | K1,K2, K3, K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | - | - | 2 | 3 | 1 | 1 |
| CO2 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | - | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | - | - | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | - | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | - | - | 3 | 3 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | PYTHON PROGRAMMING – PRACTICAL | **Hours/Week** | 7 |
| **Course Code** | APCIT12 | **Credits** | 5 |
| **Category** | CORE II | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding of C, C++ and Java programming languages | **Regulation** | 2024 |

**Objectives of the course:**

- This course gives practical experience in Python basics, Object Oriented programming like Classes, Inheritance, and Polymorphism, GUI Applications and Database connection.

| S.No | List of Excersice | COs | Cognitive Levels |
|---|---|---|---|
| **1** | Python Basic programs | CO1 | K1, K2 |
| 2 | Control Structures | CO1 | K1, K2 |
| **3** | Lists | CO2 | K2, K3 |
| **4** | Functions and Recursions | CO1 | K1, K2 |
| **5** | Modules | CO1, CO2 | K1, K2, K3 |
| **6** | String Processing | CO1, CO2 | K1, K2, K3 |
| **7** | Dictionaries and Sets | CO1, CO2 | K1, K2, K3 |
| **8** | Classes and Objects using Machine learning Tools | CO3, CO4 | K1, K2, K4,K5 |
| **9** | Polymorphism using Machine learning Tools | CO3, CO4 | K1, K2, K4,K5 |
| **10** | Inheritance using Machine learning Tools | CO3, CO4 | K1, K2, K4,K5 |
| **11** | GUI Application with Data Visualization | CO4, CO5 | K1, K2, K3, K5, K6 |
| **12** | Working with Database | CO4, CO5 | K1, K2, K3, K5, K6 |

**Recommended Text Books**

1. Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition

**Reference Books**

1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition.
2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education Private Limited, First Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computer scientist: learning with Python"
4. Aditya Kanetkar , Yashavant Kanetkar,(2023) "Let us Python" – 6th Edition Publication: bpb

**Website and e-learning source**

1. http://interactivepython.org/courselib/static/pythonds
2. http://www.ibiblio.org/g2swap/byteofpython/read/
3. http://www.diveintopython3.net/
4. http://docs.python.org/3/tutorial/index.html
5. *https://youtu.be/eFByJkA3ti4?si=hqjcyt4sX2CpYe9m*

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Understand the significance of control statements, loops and functions in creating simple programs. | K1, K2 |
| CO2 | Apply the core data structures available in python to store, process and sort the data. | K2, K3 |
| CO3 | Analyze the real time problem using suitable python concepts | K2, K4 |
| CO4 | Assess the complex problems using appropriate concepts in python | K1, K2, K5 |
| CO5 | Develop the real time applications using python programming language. | K1, K2, K3, K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | - | - | 3 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | - | - | 2 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | - | - | 3 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 2 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 2 | 2 | 2 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | WEB DEVELOPMENT USING WORD PRESS - PRACTICAL | **Hours/Week** | 6 |
| **Course Code** | APCPIT13 | **Credits** | 4 |
| **Category** | CORE III | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding on HTML and CSS | **Regulation** | 2024 |

**Objectives of the course:**

- The primary course objective of this paper is to learn the fundamentals of basic web concepts, HTML, DHTML, JavaScript and Word Press

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **For each UNIT at least 2 Lab exercises should be carried out using the specified components in the syllabus** | | | |
| **UNIT-I** | Introduction to HTML - Lists - Adding Graphics to HTML Documents - Tables -Linking Documents - Frames- Developing HTML Forms | CO1 | K1, K2 |
| **UNIT-II** | Dynamic HTML - Cascading Style Sheets - Use of SPAN Tag - External Style Sheets -Use of DIV Tag - Developing Websites | CO1, CO2 | K1, K2, K3 |
| **UNIT-III** | Introduction to JavaScript - JavaScript in Web Pages - Advantages - Writing JavaScript into HTML - Basic Programming Techniques - Operators and Expressions- JavaScript Programming Construct: Conditional Checking, Controlled Loops, Functions: Built-in Functions, User-Defined Functions - Placing Text in a Browser - Dialog Boxes. | CO2, CO3 | K1,K2, K3, K4 |
| **UNIT-IV** | JavaScript Document Object Model: Introduction - Understanding Objects in HTML - Handling Events using JavaScript. Forms used by a Website: Form Object - Built-in Objects. | CO2, CO4 | K1,K2, K3, K5 |
| **UNIT-V** | Word Press: Installation - Stetting and administration- Word press: Theming basics - Our First Word Press Website - Theme Foundation - Menu and navigation - Home page - Dynamic Sidebars and Widgets - Page - archive Page results - Testing and Launching | CO5 | K1,K2,K3, K6 |

**Recommended Text Books**

1. Ivan N. Bayross, (2005), Web Enabled Commercial Applications Development Using HTML, DHTML, JavaScript, perlCGI, 3rd Edition, BPB Publications. (Unit I, II, III and IV)

2. Jesse Friedman,( 2012), Web Designer's Guide to WordPress: Plan, Theme, Build, Launch (Voices That Matter), 1st Edition , New Riders. (Unit V)

**Reference Books**

1. N.P. Gopalan, J. Akilandeswari, (2009), Web Technology: A Developer‟s Perspective, Eastern Economy Edition, PHI Learning Private Limited.
2. Deitel&Deitel, (2000), Internet and World Wide Web How to program, Prentice Hall.
3. Jon Duckett, (2004), Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publishing, Inc.

**Website and e-learning source**

1. http://www.sergey.com/web_course/content.html
2. http://www.pageresource.com/jscript/index.html
3. http://www.peachpit.com/guides/content.aspx
4. https://www.tutorialspoint.com/wordpress/index.html

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Identify the tools which will be suitable for the requirement of the webpage. | K1, K2 |
| CO2 | Implement Java script and Style Sheets effectively in the Web Pages | K1,K2, K3 |
| CO3 | Analyze the different tools and built-in functions available to be applied in the webpage | K1,K2, K3, K4 |
| CO4 | Rate the design and effectiveness of the Web Pages created. | K1,K2, K3, K5 |
| CO5 | Design and publish a website using Word press | K1,K2, K3, K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | 2 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | - | - | 2 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | - | - | 3 | 2 | 3 | 1 |
| CO4 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 3 | 3 |
| CO5 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 3 | 1 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | DATA STRUCTURES | **Hours/Week** | 5 |
| **Course Code** | APEIT14A | **Credits** | 3 |
| **Category** | ELECTIVE I (EC1) | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding of programming and foundational concepts in computer science | **Regulation** | 2024 |

**Objectives of the course:**

- To become familiar with the various data structures and their applications and to increase the understanding of basic concepts of the design and use of algorithms.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction and Overview: Definitions – Concept of Data Structures – Overview of Data Structures – Implementation of Data Structures – Arrays: Definition – One Dimensional Array – Multidimensional Arrays: Two Dimensional Array – Sparse Matrices – Three dimensional and n-dimensional Arrays – Stacks : Introduction – Definition – Representation of Stack – Operations on Stack – Applications of Stacks: Evaluation of Arithmetic Expressions – Implementation of Recursion - Tower of Hanoi Problem | CO1, CO2 | K1, K2 |
| UNIT-II | Queues: Introduction – Definition – Representation of Queues – Various Queue Structures : Circular Queue – Deque – Priority Queue – Applications of Queues : Simulation – CPU Scheduling in a Multiprogramming Environment – Round Robin Algorithm – Linked Lists: Single Linked List – Circular Linked List – Double Linked List – Circular Double Linked List – Applications of Linked List: Polynomial Representation | CO2, CO3 | K1, K2, K3, K4 |
| UNIT-III | Trees: Basic Terminologies – Representation of Binary Tree: Linear Representation – Linked Representation – Operations: Traversals – Types of Binary Trees: Expression Tree – Binary Search Tree – Splay tree | CO3, CO4 | K3, K4 |
| UNIT-IV | Sorting: Bubble Sort, Insertion Sort, Selection Sort, Shell Sort – Quick Sort - Merge Sort - Radix Sort - Heap Sort – Searching: Linear Search - Binary Search | CO3, CO4 | K3, K4 |
| UNIT-V | Graphs: Introduction – Graph representation and its operations – Path Matrix – Graph Traversal - Application of DFS – Shortest Path Algorithm - Minimum Spanning Tree : Prim‟s Algorithm – Kruskal‟s Algorthim - Greedy – Knapsack – Back Tracking – 8 Queens | CO4, CO5 | K4, K5 |

**Recommended Text Books**

1.Debasis Samantha (2013), Classic Data Structures, Second Edition, PHI Learning Private Limited.

2. P. Sudharsan, J. John Manoj Kumar, C & Data Structures, Third Edition, RBA Publications. Unit 4: Chapter 14, Unit 5: Chapter 13

3. Ellis Horowitz, SartajSahni, Sanguthevar Rajeshakaran, (2007), Fundamentals of Computer Algorithms, Second Edition, Universities Press (P) Limited

**Reference Books**

1. Sara Baase, (1991), Computer Algorithms – Introduction to Design and Analysis, Addison- Wesley Publishing Company 2. Robert Kruse, C.L.Tondo, Bruce Leung, Data Structures and Program Design in C ,2nd Edition, PHI Publications.

**Website and e-learning source**

1. http://www.cs.sunysb.edu/~skiena/214/lectures/
2. http://datastructures.itgo.com/graphs/dfsbfs.html
3. http://oopweb.com/Algorithms/Documents/PLDS210/Volum eFrames.html
4. http://discuss.codechef.com/questions/48877/data-structuresand-algorithms
5. http://code.tutsplus.com/tutorials/algorithms-and-datastructures--cms-20437

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Outline the basic data structures | K1 |
| CO2 | Identify the different operations and memory representations | K1, K2 |
| CO3 | Interpret different techniques with their complexities | K1, K2,K3, K4 |
| CO4 | Compare the applications of various data structures | K1, K2,K3, K4 |
| CO5 | Choose an algorithm to solve simple problems suited for appropriate situations | K1, K2,K3, K4, K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | 1 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | - | - | 1 | 2 | 3 | 1 |
| CO3 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | - | - | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | - | - | 3 | 3 | 2 | 1 |
| CO5 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | - | - | 3 | 2 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | COMPILER DESIGN | **Hours/Week** | 5 |
| **Course Code** | APEIT14B | **Credits** | 3 |
| **Category** | ELECTIVE I (EC1) | **Year & Semester** | I & I |
| **Prerequisites** | Basic knowledge in one of the programming language and data structures | **Regulation** | 2024 |

**Objectives of the course:**

- To acquire the knowledge about the compiler design and to understand the different phases of Compiler.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling | CO1 | K1, K2 |
| UNIT-II | Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Nondeterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing | CO1, CO2 | K1, K2 |
| UNIT-III | Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponic mode, Case study on Lex and Yacc | CO2 | K1, K2 |
| UNIT-IV | Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking | CO3, CO4 | K2, K3, K4 |

| | | | |
|---|---|---|---|
| **UNIT-V** | Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms | CO4, CO5 | K3, K4, K5 |

**Recommended Text Books**

1. Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman

**Reference Books**

1. Dhamdhere D.M., "Compiler Construction: Theory and Practice", McMillan India Ltd., 1983
2. Holub Allen, "Compiler Design in C", Prentice Hall of India, 1990

**Website and e-learning source**

*1)* 1. https://www.geeksforgeeks.org/compiler-design-tutorials/
2. https://www.tutorialspoint.com/compiler_design/
3. https://www.javatpoint.com/compiler-tutorial
4. https://onlinecourses.nptel.ac.in/noc19_cs01/preview
5. http://ecomputernotes.com/compiler-design

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Identify the major phases of compilation and the functionality of LEX and YACC | K1, K2 |
| CO2 | Describe the functionality of compilation process and symbol table management. | K1, K2 |
| CO3 | Apply the various parsing, optimization techniques and error recovery routines to have a better code for code generation. | K2, K3 |
| CO4 | Analyze the techniques and tools needed to design and implement compilers. | K3, K4 |
| CO5 | Test a compiler and experiment the knowledge of different phases in compilation. | K4, K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 2 | 2 | 1 | - | - | 1 | 3 | 2 | 2 |
| **CO2** | 3 | 2 | 1 | 1 | 1 | 1 | 2 | - | - | 1 | 3 | 2 | 2 |
| **CO3** | 3 | 1 | 2 | 2 | 3 | 2 | 2 | - | - | 1 | 3 | 2 | 3 |
| **CO4** | 3 | 1 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 1 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 3 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | NATURAL LANGUAGE PROCESSING | **Hours/Week** | 5 |
| **Course Code** | APEIT14C | **Credits** | 3 |
| **Category** | ELECTIVE I (EC1) | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding of natural language and linguistics | **Regulation** | 2024 |

**Objectives of the course:**

- To learn the fundamentals of natural language processing and to understand the role of CFG, semantics of sentences and pragmatics.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance | CO1, CO2 | K1, K2, K4 |
| **UNIT-II** | Word Level Analysis: Unsmoothed N-grams, Evaluating Ngrams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rulebased, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models | CO3 | K1, K2, K3 |
| **UNIT-III** | Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures | CO4 | K1, K2, K5 |
| **UNIT-IV** | Semantics and Pragmatics: Requirements for representation, FirstOrder Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods | CO2 | K1, K2, K4 |
| **UNIT-V** | Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC) | CO4, CO5 | K1, K2, K5, K6 |

**Recommended Text Books**

1. Daniel Jurafsky, James H. Martin;Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech; Pearson Publication; 2014.

2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python , First Edition, OReilly Media, 2009

**Reference Books**

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015. 2. Richard M Reese, ―Natural Language Processing with Java , O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

**Website and e-learning source**

1. http://www.cse.iitb.ac.in/~pb/papers/nlp-iitb.pdf
2. https://www.nitk.ac.in/faculty/dr-sarika-jain
3. https://www.simplilearn.com/tutorials/artificial-intelligencetutorial/what-is-natural-language-processing-nlp
4. https://www.sas.com/en_us/insights/analytics/what-isnatural-language-processing-nlp.html
5. https://towardsdatascience.com/your-guide-to-naturallanguage-processing-nlp-48ea25

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language | K1,K2 |
| CO2 | Identify various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parsing and semantic analysis | K1,K2,K4 |
| CO3 | Classify the text into an organized group using a set of handicraft linguistic rules with appropriate NLP processes and algorithms | K1,K2,K3 |
| CO4 | Analyze the system with various language analysis methods and interpret the results | K1,K2,K5 |
| CO5 | Assess NLP systems, identify and suggest solutions for the shortcomings | K1,K2,K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | 2 | 3 | 2 | 3 |
| CO2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | - | - | 1 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | 2 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | 2 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | 3 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | BLOCKCHAIN TECHNOLOGY | **Hours/Week** | 5 |
| **Course Code** | APEIT14D | **Credits** | 3 |
| **Category** | ELECTIVE I (EC1) | **Year & Semester** | I & I |
| **Prerequisites** | Basic knowledge of networking and cyber security concepts | **Regulation** | 2024 |

**Objectives of the course:**

- To study the basics of Blockchain technology, private and public Blockchain, and smart contract. This paper familiarizes the students to explore various aspects of Blockchain technology like application in various domains

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | **Introduction of Cryptography and Blockchain** : Definition of Blockchain - Blockchain Technology Mechanisms & Networks - Blockchain Origins - Objective of Blockchain - Blockchain Challenges - Transactions and Blocks - P2P Systems - Keys as Identity - Digital Signatures, Hashing, and public key cryptosystems - private vs. public Blockchain | CO1, CO2 | K1, K2, K4 |
| **UNIT-II** | **Bitcoin and Cryptocurrency** : Bitcoin Terminology- The Bitcoin Network - The Bitcoin Mining Process - Mining Developments - Bitcoin Wallets - Decentralization and Hard Forks - Ethereum Virtual Machine (EVM) - Merkle TreeDouble- Spend Problem - Blockchain and Digital CurrencyTransactional Blocks - Impact of Blockchain Technology on Cryptocurrency | CO3 | K1, K2, K3 |
| **UNIT-III** | **Introduction to Ethereum** : Introduction to Ethereum - Consensus Mechanisms- Metamask Setup - Ethereum Accounts - Transactions - Receiving Ethers- Smart Contracts | CO4 | K1, K2, K5 |
| **UNIT-IV** | **Introduction to Hyperledger and Solidity Programming** : Definition of Hyperledger - Distributed Ledger Technology & its Challenges - Hyperledger & Distributed Ledger Technology - Hyperledger Fabric -Hyperledger Composer - Solidity - Language of Smart Contracts - Installing Solidity & Ethereum Wallet - Basics of Solidity - Layout of a Solidity Source File & Structure of Smart Contracts - General Value Types | CO2 | K1, K2, K4 |
| **UNIT-V** | **Blockchain Applications :** Internet of Things -Medical Record Management System - Domain Name Service and Future of Blockchain -Alt Coins | CO4, CO5 | K1, K2, K5, K6 |

**Recommended Text Books**

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018

**Reference Books**

1. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014
2. D. Drescher, Blockchain Basics. Apress, 2017

**Website and e-learning source**

1. https://nptel.ac.in/courses/106/104/106104220/#
2. https://archive.nptel.ac.in/courses/106/105/106105235/
2. https://www.udemy.com/course/build-your-blockchain-az/
3. https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum
4. https://www.geeksforgeeks.org/consensus-algorithms-inblockchain/
5. https://ec.europa.eu/programmes/erasmus-plus/project-resultcontent/eb79d492-327b-43d8-b479-dd0fd9fd4490/BLISS%2003 T3%20Unit%201%20slides%20v3.0%20final%20controled.pptx

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Understand and explore the working of Block chain technology | K1,K2 |
| CO2 | Identify the security and privacy implications of block chain technology | K1,K2 |
| CO3 | Apply the learning of solidity to build de-centralized apps on Ethereum | K1,K2,K3 |
| CO4 | Analyze the working of Smart Contracts and the working of Hyperledger | K1,K2,K4 |
| CO5 | Assess the methods relevant for design, development and operation of block chain based applications | K1,K2,K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | 2 | 2 | 2 | 3 |
| CO2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | - | - | 1 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | 2 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | 3 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | OPERATING SYSTEMS | **Hours/Week** | 5 |
| **Course Code** | APEIT15A | **Credits** | 3 |
| **Category** | ELECTIVE II (EC2) | **Year & Semester** | I & I |
| **Prerequisites** | Basic understanding of working principles of computer and about hardware and software components | **Regulation** | 2024 |

**Objectives of the course:**

- To develop fundamental knowledge of Operating systems, to become familiar with CPU Scheduling, memory and file management concepts, to learn concepts and programming techniques of Linux.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction : Evolution of Operating System - Structure - Processes - The Process Concepts - Inter Process Communication - IPC Problems - Scheduling Levels - Preemptive Vs Non- Preemptive Scheduling - Scheduling Algorithms: First Come First Served - Shortest Job First - Shortest Remaining Time Next - Three Level Scheduling - Round Robin Scheduling - Priority Scheduling -Multiple Queues - Shortest Process Next - Guaranteed Scheduling - Lottery Scheduling - Fair-Share Scheduling - Thread Scheduling | CO1, CO5 | K1, K2, K4, K5 |
| UNIT-II | Swapping - Virtual Memory - Page Replacement Algorithm - Segmentation | CO3, CO4 | K1, K2, K3, K4 |
| UNIT-III | Deadlock - Examples of Deadlock - Detection - Recovery - Avoidance - Prevention – Semaphore -Shared Memory | CO5 | K1,K2, K4, K5 |
| UNIT-IV | File System - Files - Directories - I/O Management - Disks - Disk Arm Scheduling Algorithm | CO5 | K1,K2, K4, K5 |
| UNIT-V | Introduction to Linux: Introducing Shell Programming - Linux File Systems - Linux File system calls - Implementation of Linux File systems - Linux Commands - Directory Oriented Commands - File Oriented Commands - Communication Oriented Commands- General Purpose Commands | CO2 | K1,K2,K3 |

**Recommended Text Books**

1. Andrew S. Tanenbaum, (2001), Modern Operating Systems, 2nd Edition, Prentice Hall of India.
2. B.Mohamed Ibrahim, (2005) Linux Practical Approach, Firewall Media.

**Reference Books**

1. Silberchatz, Galvin, Gagne, (2003), Operating Systems Concepts, 6th Edition Wiley India Edition.
2. JhonGoerzen, (2002), Linux Programming Bible, 4th Edition, Wiley- dreamtech India (P) Ltd.

**Website and e-learning source**

1. https://www.webopedia.com/TERM/O/operating_system.html
2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
3. http://iips.icci.edu.iq/images/exam/AbrahamSilberschatz-Operating-System-Concepts---9th2012.12.pdf
4. https://www.informatics.indiana.edu/rocha/academics/i101/p dfs/os_intro.pdf
5. New folder

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Outline the fundamental concepts of an OS and their respective functionality | K1, K2 |
| CO2 | Demonstrate the importance of open-source operating system commands | K1, K2,K3 |
| CO3 | Identify and stimulate management activities of operating system | K1, K2, K3 |
| CO4 | Analyze the various services provided by the operating system | K1,K2, K4 |
| CO5 | Interpret different problems related to process, scheduling, deadlock, memory and files | K1, K2, K4, K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | 2 | 3 | 3 | 3 |
| CO2 | 3 | 1 | 1 | 2 | 1 | 2 | 1 | - | - | 2 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | - | - | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 3 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | DIGITAL COMPUTER ARCHITECTURE | **Hours/Week** | 5 |
| **Course Code** | APEIT15B | **Credits** | 3 |
| **Category** | ELECTIVE II (EC2) | **Year & Semester** | I & I |
| **Prerequisites** | Basic knowledge in Digital Design and Computer Architecture | **Regulation** | 2024 |

**Objectives of the course:**

- To provide a comprehensive introduction of the basic design of a computer and the interdependence and interoperation between the various components inside a computer.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Data Representation - Data Types - Number Systems - Decimal and Alphanumeric Representation - Complements - (r-1)"s complement - (r"s) complement - Fixedpoint Representation - Floating-point Representation - Binary Codes - Gray Codes - Decimal Codes - Alphanumeric Codes – Error Detection Codes | CO1 | K1, K4 |
| UNIT-II | Digital Computers - Logic Gates - Boolean Algebra - KMap Simplification - Combinational Circuits - Half Adder - Full Adder - SR, D, JK and T Flip Flops - Sequential Circuits - State Table - State Diagram - Digital Components: Integrated Circuits - Decoders - NAND Gate Decoder - Encoders - Multiplexers - Registers - Shift Registers - Binary Counters - Memory Unit | CO2, CO3, CO4 | K1,K2, K3, K4 |
| UNIT-III | Register Transfer and Micro-operations: Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-operations - Logic Micro-operations - Shift Micro- operations - Arithmetic Logic Shift Unit. Computer Organization and Programming: Instruction Codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input-Output and Interrupt | CO4 | K1,K2, K3, K4 |
| UNIT-IV | Central Processing Unit: General Register Organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control. I/O Organization: Peripheral Devices - I/O Interface - Asynchronous Data Transfer - Modes of Transfer - Priority Interrupt - DMA | CO4, CO5 | K1,K2, K3, K4 |
| UNIT-V | Memory Organization and CPU: Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory - Memory Management Hardware | CO5 | K1,K2, K3, K4 |

**Recommended Text Books**

*1.* M. Morris Mano, "Computer System Architecture", Prentice Hall of India, 2001

**Reference Books**

1. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, 1996.
2. V C Hamatcher et al, "Computer Organization", Tata McGraw Hill, 1996.

**Website and e-learning source**

1. http://www.labri.fr/perso/strandh/Teaching/AMP/Common/Stran dh-Tutorial/Dir.html
2. http://www.computer-pdf.com/architecture/
3. http://www.uotechnology.edu.iq/depcse/lectures/3/
4. http://www.csie.nuk.edu.tw/~kcf/course/ComputerArchitecture/
5. http://www.ecs.csun.edu/~cputnam/Comp546/Putnam/Cach e%20Memory.pdf(UnitV: Cache Memory)

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Demonstrate the fundamental concept of binary representation and codes, combinational circuits, Instruction formats, register operations and memory organization | K1, K4 |
| CO2 | Explain the various types of flip flops, different types of micro operations, as well as the addressing modes in the instruction set | K1,K2 |
| CO3 | Apply the various number conversion systems and simplification of equations using K-map | K1,K2,K3 |
| CO4 | Analyze the various design of combinational circuits and flip flops to design a computer | K1,K2,K3,K4 |
| CO5 | Distinguish the major components of a computer including CPU, memory, I/O and storage | K1,K2,K3,K4 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | - | - | - | 1 | 2 | 3 | 2 |
| CO2 | 3 | 1 | 1 | 1 | 2 | 2 | - | - | - | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 2 | 3 | 3 | 2 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | HUMAN COMPUTER INTERACTION | **Hours/Week** | 5 |
| **Course Code** | APEIT15C | **Credits** | 3 |
| **Category** | ELECTIVE II (EC2) | **Year & Semester** | I & I |
| **Prerequisites** | Understanding the impact of human factors and Computer Science fundamentals | **Regulation** | 2024 |

**Objectives of the course:**

- To provide a comprehensive introduction of the basic design of a computer and the interdependence and interoperation between the various components inside a computer.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | Foundations: The Human: Introduction-Input-Output Channels- Memory. The Computer: Introduction- Text Entry Devices- Display Devices- Memory. The Interaction: Introduction – Models of Interaction-Frameworks and HCI Ergonomics-Interaction Styles-Elements of the WIMP Interface-Interactivity - The Context of the Interactions | CO1 | K1 |
| **UNIT-II** | Design Process: Design Basics- Introduction - Process- User Focus- Scenarios- Navigation Design- Screen Design and Layout-Interaction and Prototyping. Design RulesIntroduction- Principles to Support Usability-GuidelinesGolden Rules and Heuristics-HCI Patterns | CO2 | K1, K2, K3 |
| **UNIT-III** | Implementation Support: Introduction - Elements of Windowing Systems - Programming the Application- Using Toolkits-User Interface Management Systems. Evaluation Techniques: What is an Evaluation- Goal of EvaluationEvaluation Through Expert Analysis-Choosing an Evaluation Method | CO3 | K1, K2, K3,K4 |
| **UNIT-IV** | Universal Design: Introduction - Universal Design Principles-Designing for Diversity. User Support: Introduction-Requirements of User Support-Approaches to User Support-Adaptive Help Systems-Designing User Support Systems | CO4 | K1, K2, K5 |
| **UNIT-V** | Models: Cognitive Models: Introduction-Goals and TaskLinguistic Models-Challenge of Display Based SystemPhysical and Device Models - Cognitive Architectu | CO5 | K1, K2, K3,K4 |

**Recommended Text Books**

*1.* Alan dix, Janet finlay, Gregory D. Abowd and Russell Beale,(2004),Human Computer Interaction, 3rd edition, Pearson Education

**Reference Books**

1 John C. Caroll, (2002), Human Computer Interaction in the new millennium, Pearson Education

2. Jenny Preece, Yvonne Rogers, Helen Sharp (2019), Interaction Design: Beyond Human–Computer Interaction,fifth edition, John Wiley & Sons In

**Website and e-learning source**

1. http://courses.iicm.tugraz.at/hci/
2. http://www.hcibook.com/hcibook/downloads/pdf/exercises.pdf
3. http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lectures.html

4.http://user.medunigraz.at/andreas.holzinger/holzinger/papersen/HCI/Workshop/forISSEP%202005.pdf

5. http://universaldesign.ie/What-is-Universal-Design/The7-Principles/ (Unit IV: Universal Design Principles)

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms | K1 |
| CO2 | Identify the usability and the beneficiary factors of User support systems | K1, K2 |
| CO3 | Analyze the core theories, models and methodologies in the field of HCI | K1, K2, K3,K4 |
| CO4 | Evaluate interactive systems based on the human factor theories | K1, K2, K5 |
| CO5 | Elaborate an interactive system based on the design principles, standards and guidelines | K1, K2, K3,K4 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| CO4 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | - | - | 2 | 3 | 2 | 3 |

# COURSE DESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Big Data Analytics | **Hours/Week** | 5 |
| **Course Code** | APEIT15D | **Credits** | 3 |
| **Category** | ELECTIVE II (EC2) | **Year & Semester** | I & I |
| **Prerequisites** | Basic idea of Data warehousing, basic programming. | **Regulation** | 2024 |

**Objectives of the course:**

- Understand the Big Data Platform and its Use cases, Map Reduce Jobs
- To identify and understand the basics of cluster and decision tree
- To study about the Association Rules, Recommendation System
- To learn about the concept of stream
- Understand the concepts of NoSQL Databases

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | Evolution of Big data - Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value - Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model | CO1 | K1 |
| **UNIT-II** | Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier. | CO2 | K1, K2, K3 |

| | | | |
|---|---|---|---|
| **UNIT-III** | Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches. | CO3 | K1, K2, K3,K4 |
| **UNIT-IV** | Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics | CO4 | K1, K2, K5 |
| **UNIT-V** | **NoSQL Databases** : Schema-less Models : Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding — Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R. | CO5 | K1, K2, K3,K4 |

**Recommended Text Books**

AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

**Reference Books**

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013
2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

**Website and e-learning source**

1. https://www.simplilearn.com
2. https://www.sas.com/en_us/insights/analytics/big-data-analytics.html
3. https://archive.nptel.ac.in/courses/106/104/106104189/

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Work with big data tools and its analysis techniques. | K1 |
| CO2 | Analyze data by utilizing clustering and classification algorithms. | K3, K4 |
| CO3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data | K1, K2, K3 |
| CO4 | Perform analytics on data streams. | K1, K2, K4 |
| CO5 | Learn NoSQL databases and management. | K1, K2, K3 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | - | - | 3 | 3 | 3 | 2 |
| CO4 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | - | - | 2 | 3 | 2 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Database System | **Hours/Week** | 5 |
| **Course Code** | APCIT21 | **Credits** | 5 |
| **Category** | Core-4 | **Year& Semester** | I & II |
| **Prerequisites** | Fundamental Computer Knowledge that Includes the hardware and memory storage. | **Regulation** | 2024 |

**Objectives of the course:**

- To under stand the basic DBMS models, architecture, query and to normalize the database.
- To Learn Transaction Processing, Recovery and Distributed Database.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | Introduction: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. Relational Database: Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams-Formal Relational Query Languages :Relational Algebra- Tuple Relational Calculus | CO1 | K1,K2 |
| **UNIT-II** | Database Design: Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas-Extended E-R features -Alternative Notations for Modeling Data. Relational Database Design: Features of Good Relational Design-Functional Dependency-Normalization: 1NF,2NF,3NF,BCNF,4NF,5NF-FunctionalDependency Theory | CO2, CO3 | K1,K2 |
| **UNIT-III** | Transaction Management: Transaction Concept Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation- Serializability. Concurrency Control: Lock Based Protocols-Locks- Granting of Locks-Two Phase Locking Protocol-Timestamp Based Protocol- Recovery System: Failure Classification-Recovery and Atomicity: Log Records-Database Modification-Concurrency Control and Recovery-Recovery Algorithm- **Database Recovery Management** | CO2, CO3 | K1,K2 |
| **UNIT-IV** | Distributed Database: Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases-Distributed Query Processing. – **Equivalence of Transformation of queries – Transforming Global Queries into Fragment Queries-** Case study :Mongo DB | CO4 | K1, K2,K3,K5 |

| | | | |
|---|---|---|---|
| **UNIT-V** | SQL-Table Fundamentals-Viewing Data - Inserting-Deleting - Updating - Modifying - Constraints - Functions - Grouping – Sub queries - Joins - Views.PL/SQL: Introduction -PL/SQL Block –Data Types And Variables - Control Structure - Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling-Packages-Procedures and Functions-Database Triggers | CO5 | K1,K2,K3, K6 |

**Recommended Text Books**

1. Abraham Silberchatz, Henry F.Korth,S.Sudarshan, DatabaseSystemsConcepts,7th Edition, Tata Mcgraw Hill.
2. IvanBayross,SQL,PL/SQLTheProgrammingLanguageofORACLE,Fourthedition,BPB Publications UnitIV&V

**Reference Books**

1. AtulKahate, Introduction to Database Management systems, Pearsoneducation.
2. CarloZaniolo, Stefano Ceri,Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian,(1997), Advanced Database Systems, Morgan Kaufman.
3. GeorgeKoch,KelvinLoney,(2002),Oracle9i:TheCompleteReference,OraclePress,Tata McGrawHill Publication.
4. RamezElmasri,ShamkantB.Navathe(2014),"DatabaseSystems",Sixthedition,Pearson Education, New Delhi

**Website and e-learning source**

1. *http://www.slideshare.net/SalamaAlbusaidi/emergingdatabase-technology-multimedia-database*
2. *http://www.tutorialspoint.com/plsql/index.htm*
3. *http://www.tutorialspoint.com/plsql/index.htm*

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Explain the relational databases and uses of PL/SQL | K1,K2 |
| CO2 | Apply Schema, ER-Model, normalization, transaction, concurrency ,and recovery on tables using SQL and PL/SQL. | K1,K2 |
| CO3 | Analyze and manage relational & distributed ,database, transaction, concurrency control and query languages | K1,K2 |
| CO4 | Assess databases based on models and Normal Forms. | K1,K2,K3,K5 |
| CO5 | Design and construct able and manipulate it effectively using PL/SQL database objects | K1,K2,K3,K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 2 | 2 | 2 | 1 | - | - | 2 | 3 | 1 | 2 |
| **CO2** | 3 | 1 | 1 | 1 | 2 | 1 | 1 | - | - | 2 | 3 | 2 | 1 |
| **CO3** | 3 | 2 | 1 | 3 | 2 | 2 | 1 | - | - | 2 | 3 | 1 | 2 |
| **CO4** | 3 | 2 | 1 | 3 | 2 | 2 | 1 | - | - | 2 | 2 | 2 | 1 |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 2 | 1 | - | - | 3 | 2 | 3 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | RDBMS-Practical | **Hours/Week** | 6 |
| **Course Code** | APCPIT22 | **Credits** | 5 |
| **Category** | Core-5 | **Year& Semester** | I&II |
| **Prerequisites** | Basic understanding of SQL queries | **Regulation** | 2024 |

**Objectives of the course:**

- TheprimaryCourseObjectiveofthispaperistolearnandimplementSQL&PL/SQL.

| S. No | List of Exercises | COs | Cognitive Levels |
|---|---|---|---|
| **1** | DDL Commands | CO1-CO5 | K1-K5 |
| 2 | DML Commands | CO1-CO5 | K1-K5 |
| **3** | DCL Commands | CO1-CO5 | K1-K5 |
| **4** | Usage of Sub Queries in DML and Create-SQL | CO1-CO5 | K1-K5 |
| **5** | Solving queries using built-in functions | CO1-CO5 | K1-K5 |
| **6** | Simple programs in PL/SQL block | CO1-CO5 | K1-K5 |
| **7** | Exception Handling in PL/SQL | CO1-CO5 | K1-K5 |
| **8** | Programs using Implicit Cursors | CO1-CO5 | K1-K5 |
| **9** | Programs using Explicit Cursors | CO1-CO5 | K1-K5 |
| **10** | Programs using Explicit Cursors | CO1-CO5 | K1-K5 |
| **11** | Procedures &User-defined functions | CO1-CO5 | K1-K5 |
| **12** | Creation of Triggers | CO1-CO5 | K1-K5 |

**Recommended Text Books**

**1.**IvanBayross,SQL,PL/SQLTheProgrammingLanguageofORACLE,Fourthedition,BPB Publications

**Reference Books**

1.RamezElmasri,ShamkantB.Navathe(2014),"DatabaseSystems",Sixthedition,Pearson Education, New Delhi

**Website and e-learning source**

1. http://www.slideshare.net/SalamaAlbusaidi/emergingdatabase-technology-multimedia-
2. http://www.tutorialspoint.com/dbms/index.htm
3. **http://www.tutorialspoint.com/plsql/index.htm**

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | CognitiveLevel |
|---|---|---|
| CO1 | Choose appropriate SQL queries and PL/SQL blocks for the database. | K1-K5 |
| CO2 | Implement SQL and PL/SQL blocks for the given problem effectively. | K1-K5 |
| CO3 | Analyze the problem and Exceptions using queries and PL/SQL blocks. | K1-K5 |
| CO4 | Validate the database for normalization using SQL and Pl/SQL blocks. | K1-K5 |
| CO5 | Design Data base tables, create Procedures, user-defined functions and Triggers. | K1-K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | - | - | 2 | 3 | 1 | 2 |
| CO3 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | - | - | 3 | 3 | 2 | 3 |
| CO4 | 1 | 1 | 2 | 3 | 2 | 1 | 1 | - | - | 3 | 3 | 2 | 3 |
| CO5 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | - | - | 3 | 3 | 2 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Mobile Development-Practical | **Hours/Week** | 6 |
| **Course Code** | APCPIT23 | **Credits** | 4 |
| **Category** | Core-6 | **Year& Semester** | I & II |
| **Prerequisites** | Basic understanding on Java Programming | **Regulation** | 2024 |

**Objectives of the course:**

To provide the students with the basics of Android Software Development tools, development of software on mobile platforms and deploying software to mobile devices.

| S.No | List of Exercises | COs | Cognitive Levels |
|---|---|---|---|
| | **Unit - I** | | |
| 1 | Build a basic calculator with addition functionality using Edit Text, Text View, and Button components. | CO1-CO5 | K1- K5 |
| 2 | Create and navigate between multiple screens in an Android application. | CO1-CO5 | K1-K5 |
| | **Unit - II** | | |
| 1 | Develop an Android app to demonstrate the usage of Date Picker and Time Picker. | CO1-CO5 | K1-K5 |
| 2 | Create an Android app to display a list of items using List View. | CO1-CO5 | K1-K5 |
| | **Unit - III** | | |
| 1 | Create an activity and apply styles and themes to enhance its appearance. | CO1-CO5 | K1-K5 |
| 2 | How to create and navigate between activities using explicit and implicit intents. | CO1-CO5 | K1-K5 |
| | **Unit - IV** | | |
| 1 | Develop an Android app to demonstrate the use of a context menu for specific UI elements. | CO1-CO5 | K1-K5 |
| 2 | How to play video files using the Video View widget in Android. | CO1-CO5 | K1-K5 |
| | **Unit - V** | | |
| 1 | Create, insert, and retrieve data from an SQLite database in an Android app. | CO1-CO5 | K1-K5 |
| 2 | Send SMS messages programmatically in an Android application. | CO1-CO5 | K1-K5 |

**Recommended Text Books**

Wei–MengLee,(2012),BeginningAndroid4ApplicationDevelopment,WileyIndiaEdition

**Reference Books**

1. OnurCinar,(2012),AndroidAppswithEclipse,Apress,Springer(India)PrivateLimited.

2. RetoMeier,(2010),ProfessionalAndroid2ApplicationDevelopment,WileyIndiaEdition

**Website and e-learning source**

1. http://devcloper.android.com/training/basics/firstapp/index.html
2. www.vogella.com/articles/Android/article.html
3. www.coreservlets.com/android-tutorial/
4. www.edumobile.org/android/category/android-beginner-tutorial
5. http://www.androidhive.info/2011/11/android-sqlitedatabase-tutorial/(Unit V: Ex. No.3 (SQ Lite Database)

**Course Learning Outcomes(for Mapping with POs and PSOs)**

On completion of the course the students should be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Demonstrate the set up and configuration of Android Development Environment. | K1,K2 |
| CO2 | ApplythenecessaryUIcomponentswithdifferentstyles,themes,views,and layouts | K1,K2,K3 |
| CO3 | Examine and implement their queried services such as messaging, mailing, Multimedia concepts for the given problem | K1,K2,K3,K4 |
| CO4 | Test and debug the Android applications with different inputs. | K1,K2,K3,K5 |
| CO5 | Create mobile applications that make use of various and void features, Functions and database tasks | K1,K2,K3,K6 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | - | - | 2 | 3 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | - | - | 2 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | - | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 3 | 1 | 1 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Network sand Security | **Hours/Week** | 4 |
| **Course Code** | APEIT24A | **Credits** | 3 |
| **Category** | Elective III | **Year& Semester** | I & II |
| **Prerequisites** | Basic knowledge about computer networks | **Regulation** | 2024 |

**Objectives of the course:**

- To become familiar with the various data structures and their applications and to increase the understanding of basic concepts of the design and use of algorithms.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Uses of Computer Networks – Network Hardware – Line Configuration – Topology–Transmission Modes–Reference Models: OSI Reference Model – TCP/IP Reference Model –Physical Layer: Guided Transmission Media – Wireless Transmission–Communication Satellites–Public Switched Telephone Network: Local Loop–Multiplexing–Switching | CO1, CO2 | K1,K2 |
| UNIT- II | Data Link Layer : Design Issues-Error Detection and Correction-Network Layer: Design Issues–Routing Algorithms :Shortest Path Routing– Distance Vector Routing–Link State Routing–Broad cast Routing– Multicast Routing–Congestion Control | CO2, CO3 | K1,K2, K3,K4 |
| UNIT-III | Network Layer in the Internet: IP Addresses –Transport Layer: Elements of Transport Protocols: Addressing – Connection Establishment – Connection Release–Application Layer: Domain Name System–Email: Architecture and Services | CO3, CO4 | K3,K4 |
| UNIT-IV | Network Security: Introduction to Cryptography - Symmetric - Key Cryptography - Asymmetric- key Cryptography – Security Services: Message Confidentiality - Message Integrity - Message Authentication – Digital Signature-Entity Authentication–Security in the Internet: IP Security-SSL/TLS: SSL services-SSL Protocols -Firewalls | CO3, CO4 | K3,K4 |
| UNIT-V | Security for Wireless Networks :Introduction–Protecting the wireless networks–Physical Security–Authentication and access control-Smartphone Security: Security Threats-Steps to smart phone security– Websites and Web application Security :Definition– Available Technologies -Threats-Strategies. Case Studies :To study recent Wi-Fi and Smartphone technologies | CO4, CO5 | K4,K5 |

**Recommended Text Books**

1. AndrewS.Tanenbaum,DavidJ.Wetherall(2022),ComputerNetworks,PrenticeHallofIndia,V Edition. (Unit I - Unit - III) Unit I – Chapter 1,2 Unit II – Chapter 3,5 Unit III – Chapter 5,6,7
2. BehrouzA.Forouzan,(2017),DataCommunicationsandNetworking,TataMcGraw-Hill PublishingCompanyLimited,IVEdition.(UnitIV)UnitIV-Chapter30,31,32

**Reference Books**

1. Charles P.Pfleeger, Shari Lawrence P fleeger (2002),SecurityinComputing,3rdEdition,Pearson Education.
2. JamesF.Kurose,KeithW.Ross(2005),ComputerNetworking,3rdEdition,Addison Wesley,.
3. WilliamStallings(2006),CryptographyandNetworkSecurity:PrinciplesandPractice,3rdEdition, PHI.

**Website and e-learning source**

1. 1.http://wndw.net/pdf/wndw3-en/ch09-security-for-wirelessnetworks.pdf(UnitV-WirelessNetworks Security)
2. https://www.fcc.gov/sites/default/files/smartphone_master_document.pdf(UnitV-Stepstosmartphone security)
3. https://www.csoonline.com/article/3241727/mobilesecurity/6-mobile-security-threats-you-should-take seriously-in-2019.html (Unit V – Smart Phone Security Threats)
4. https://kgk.uni-obuda.hu/sites/default/files/12_Kadena.pdf(UnitV–SmartPhoneSecurityThreats)
5. https://www.goodfirms.co/glossary/web-security/(UnitV–Web Secure

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Outline the concepts and fundamentals of data communication and computer networks | K1 |
| CO2 | Identify the usage and importance of layered model, network security and web security | K1,K2 |
| CO3 | Classify the techniques based on required application | K1,K2,K3,K4 |
| CO4 | Analyze the significant applications of protocols and layers used in data Communication and networking | K1,K2,K3,K4 |
| CO5 | Explain the functionality of various techniques and algorithms that works at different layers | K1,K2,K3,K4,K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 1 | - | 2 | - | - | - | - | 3 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | - | 2 | - | - | - | 1 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | - | - | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | - | - | 2 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | - | - | 2 | 2 | 2 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | CLOUDCOMPUTING | **Hours/Week** | 4 |
| **Course Code** | APEIT24B | **Credits** | 3 |
| **Category** | Elective III | **Year& Semester** | I&II |
| **Prerequisites** | Basic knowledge on software system Specifically on Operating System | **Regulation** | 2024 |

**Objectives of the course:**

- Understand the different concepts of cloud computing and its services

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction: Cloud Computing Basics :Cloud Computing Overview-Applications of cloud computing Intranets and the cloud– First movers in the cloud-Benefits-limitationsofcloudcomputing–SecurityConcerns–Cloud Computing Services–Salesforce.com | CO1 | K1,K2 |
| UNIT- II | Cloud Computing Technology: Hardware and Infrastructure–Clients–Security– Network– Services-Cloud Storage– Standards– Cloud Computing at work :Software as a Service–Software Plus Services–Developing Applications | CO1, CO2 | K1,K2 |
| UNIT-III | Virtual Machines and Virtualization: Introduction - Understanding Virtualization-History of Virtualization –Leveraging Blade Servers Server Virtualization – Desktop Virtualization – Virtual Networks – Data Storage Virtualization.DataStorageinCloud:EvolutionofNetworkStorage–Cloud based data Storage Advantages and disadvantages of Cloud based data storage-Cloud based Backup systems-File Systems Cloud based Block Storage | CO2 | K1,K2 |
| UNIT-IV | Migrating into a Cloud: Introduction– Broad approaches of Migrating into cloud –The Seven Step Models of Migrating into a Cloud. Mobile Cloud Computing :Evolution of Mobile Computing–Mobile Cloud Eco System Mobile Players | CO3, CO4 | K2,K3,K4 |
| UNIT-V | Data security in cloud: Introduction – Current state of data security – Homo sapiens and Digital Information – Cloud Computing and Data security Risk –Cloud Computing and Identity–The Cloud, Digital Identity and Data Security-Content Level Security-Pros and Cons | CO4, CO5 | K3,K4,K5 |

**Recommended Text Books**

1. 1.AnthonyT.Velte,TobyJ.Velte,RobertElsenpeter,"CloudComputing:APractical Approach", McGrawHill(2017)
2. Kris Jamsa ,"Cloud Computing" Jones and Barlett Student Edition 2016

**Reference Books**

1. Rajkumar Byya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", Wiley &sons

**Website and e-learning source**

1. https://swayam.gov.in/nd1_noc20_cs55/

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Articulate the main concepts, key technologies of cloud computing in terms Of strengths, limitations and applications. | K1,K2 |
| CO2 | Categorizethearchitectureandinfrastructureofcloudcomputingsuchas IaaS and SaaS | K1,K2 |
| CO3 | Explain the concept of virtual machines and virtualization | K2,K3 |
| CO4 | Apply suitable storage algorithms in cloud computing | K3,K4 |
| CO5 | Be expose in broad approaches of migrating into a cloud and mobile cloud computing, Describe about the data security concepts in cloud computing | K4,K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | - | - | 2 | - | - | - | 2 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | 2 | 3 | 2 | 1 |
| CO3 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | 1 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 3 | - | 2 | - | - | - | 3 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | - | 3 | 1 | - | - | 3 | 3 | 2 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Biometric Techniques | **Hours/Week** | 4 |
| **Course Code** | APEIT24C | **Credits** | 3 |
| **Category** | Elective III | **Year& Semester** | I & II |
| **Prerequisites** | Basic knowledge of computer vision and cyber Security concepts | **Regulation** | 2024 |

**Objectives of the course:**

- To acquire the knowledge about the compiler design and to understand the different phases of Compiler.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction: Biometric Fundamentals - Biometrics Vs Traditional Techniques - Benefits of Biometrics in Identification Systems - Key Biometric Terms and Processes: Verification, Identification and Biometric Matching-Accuracy in Biometric Systems :False Match Rate ,False Non-Match Rate ,Failure to Enroll Rate, Derived Metrics | CO1 | K1,K2 |
| UNIT- II | Physiological Biometrics: Finger Scan: Components-How it works-Competing Technologies- Deployments-Strengths and Weaknesses. Facial Scan: Components-How it Works Competing Technologies-Deployments-Strengths and Weaknesses | CO1, CO2 | K1,K2 |
| UNIT-III | Other Physiological Biometrics: Iris Scan: Components- How it Works-Competing Technologies-Deployments Strengths and Weaknesses. Voice Scan: How it Works Competing Technologies-Deployments-Strengths and Weaknesses .Other Physiological Biometrics: Hand Scan and Retina Scan | CO2 | K1,K2 |
| UNIT-IV | Behavioral Biometrics: Signature Scan and Keystroke Scan: How it Works-Competing Technologies Deployments-Strengths and Weaknesses. Esoteric Biometrics: Vein Pattern- Facial Thermograph-DNA- Sweat Pores- Hand Grip-Finger Nail Bed –Body Odor-Ear Gait-Skin Luminescence-Brain Wave Pattern-Foot Print and Foot Dynamics | CO3, CO4 | K2,K3,K4 |
| UNIT-V | Biometric Applications: Categorizing Biometric Applications - Application Areas: Criminal and Citizen Identification, Surveillance, PC/Network Access, E-Commerce/Telephony and Retail/ATM-Costs to Deploy-Issues In Deployment-Biometric Standards- **Multi Modal Biometric Concepts** | CO4, CO5 | K3,K4,K5 |

**Recommended Text Books**

1. Samir Nanavati, Michael Thieme, Raj Nanavati,(2018),Biometrics –Identity Verification in a Networked World, Wiley-dream tech India Pvt Ltd, New Delhi

2. JohnD.Woodward,NicholasM.Orlans,PeterT.Higgins,Biometrics:theultimatereference,Dreamtech Press(2017)

**Reference Books**

1.AnilKJain,PatrickFlynn,ArunARoss,(2008),Hand book of Biometrics, Springer

**Website and e-learning source**

1. http://www.sans.org/readingroom/whitepapers/authentication/biometric-scanning/
2. http://www.biometrics.gov/documents/biointro.pdf
3. http://www.cse.unr.edu/~bebis/CS790Q/Lect/IntroBiometrics.pdf
4. http://www.planetbiometrics.com/creo_files/upload/articlefiles/btamvol1update.pdf
5. http://www.biometrics.gov/documents/biointro.pdf(UnitV:BiometricApplications)

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Outline the existing theories ,methods and interpretations in the field of biometrics | K1,K2 |
| CO2 | Identify the deployment areas, competing technologies, strength and Weakens of various Physiological and Behavioral Biometrics | K1,K2 |
| CO3 | Analyze various Application areas, Biometric security issues and Biometric standards | K2,K3 |
| CO4 | Assess the methods relevant for design, development and operation of biometric access control systems | K3,K4 |
| CO5 | Determineidentification/verificationsystemstovalidatetheuseridentity andtechnologicalupliftsinbiometricscomparedtotraditionalsecuring mechanisms | K4,K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | - | 1 | 2 | 1 | - | - | 2 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | 2 | 2 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | - | - | 1 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 2 | - | 3 | 2 | 1 | - | - | 2 | 3 | 3 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Information Security | **Hours/Week** | 4 |
| **Course Code** | APEIT24D | **Credits** | 3 |
| **Category** | Elective III | **Year& Semester** | I & II |
| **Prerequisites** | Understand network security threats, security services, and countermeasures | **Regulation** | 2024 |

**Objectives of the course:**

This course has been designed for students to learn and understand

- The fundamental concepts of Security.
- The various methods and learning algorithms in Security.
- The underlying mathematical relationships within and across Cryptographic algorithms.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| **UNIT-I** | Introduction to Information Security : Attacks, Vulnerability, Security Goals, Security Services and mechanisms- Number Theory-Euclidean algorithm-Modular Arithmetic-Fermat and Euler Algorithm- The Chinese reminder Algorithm- Classical Encryption Techniques –Symmetric Cipher model-Substitution Techniques-Transposition Techniques | CO1 | |
| **UNIT-II** | Block Cipher and Data Encryption Standard-strength of DES-Strength Of DES-Advanced Encryption Standard-AES structure- AES Transformation Function-AES Key Expansion. –Public key Cryptography- RSA Algorithm-Differ Hellman Key Exchange-Elgamal Cryptographic System-Elliptic curve Arithmetic-Elliptic Curve Cryptography-Pseudo Random Generation | CO2 | |
| **UNIT-III** | **Cryptographic Hash Functions**-Secure Hash Functions-Message Authentication Code-HMAC-DAA-CMAC-**Digital Signatures**-Elgamal Digital Signature Scheme- Schnorr Digital Signature Scheme- NIST Digital Signature Scheme-**Key Management and Distribution**- using symmetric Encryption- Using Asymmetric Encryption-X.509 Certificates | CO3 | |
| **UNIT-IV** | Network Access Control –Extensible Authentication Protocol- Cloud Computing- Cloud Security Risk and Counter measures- Data protection in Cloud- Cloud Saas- Transport layer Security-Web Security Considerations-Https-SSH- wireless Network Security-IP Security-IDS-Firewalls | CO4 | |
| **UNIT-V** | **Non-Cryptographic Protocol Vulnerabilities**: DoS and D DoS, Session Hijacking and Spoofing, Pharming attacks. Software Vulnerabilities - Phishing, Buffer Overflow, Format String attacks, SQL Injection. | CO5 | |

**Recommended Text Books**

1. Cryptography And Network Security Principles And Practice, 7th Edition, William Stallings
2. Security in Computing, Fourth Edition, by Charles P. P fleeger, Pearson Education.

**Reference Books**

1. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
2. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

**Website and e-learning source**

1. https://www.barcodesinc.com/articles/cryptography-links.htm?srsltid=AfmBOoq4TLu0yniWCOhbXbvogG86LWf-1FCE0gA67oXlxmZLlfgv8l0v

**Course Learning Outcomes (for Mapping with Pos and PSOs)**

Students will be able to

| Cos | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity and encryption technique | K1,K2,K3 |
| CO2 | Understand the various encryption standards and public key cryptography | K3 |
| CO3 | Make use of application protocols to design and manage a secure system. | K4 |
| CO4 | Learn the configuration and manage Web and Transport layer Security | K4,K5 |
| CO5 | Learn about the Non Cryptographic protocol vulnerabilities | K2 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | 3 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | 1 | 1 | - | - | - | 1 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | - | - | 2 | 2 | 2 | 2 |
| CO4 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | - | - | 2 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | - | - | 2 | 2 | 2 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Software Engineering | **Hours/Week** | 4 |
| **Course Code** | APEIT25A | **Credits** | 3 |
| **Category** | Elective IV | **Year& Semester** | I & II |
| **Prerequisites** | Basic knowledge of software programs | **Regulation** | 2024 |

**Objectives of the course:**

- This paper familiarizes the students with the knowledge of basic Software engineering methods and practices and gives hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development..

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction: A Generic View of Process - Process Models: The Waterfall Model-Incremental Model-Evolutionary Model-Specialized Model-The Unified Process-Agile Process- Agile process Models Exercise: Choose any one project and do the following exercises for the chosen project<br>a. Student Result Management System<br>b. Library management system<br>c. Online course reservation system<br>d. Railway reservation system<br>e. Recruitment system<br>f. Stock Maintenance System<br>Write the Problem Statement for a suggested system of relevance | CO1, CO5 | K1,K2, K4,K5 |
| UNIT-II | System Engineering: System Engineering Hierarchy - System Modeling - Requirements Engineering: Tasks- Initiating The Process-Eliciting Requirements-DevelopingUseCases-NegotiatingRequirements-Validating Requirements - Building the Analysis Models: Data modeling concepts - Scenariobased-Floworiented-ClassbasedModelingExercise:Preparation Of Software Requirement Specification Document | CO3, CO4 | K1,K2, K3,K4 |
| UNIT-III | Design Engineering: Design Concepts - Design Models - Pattern Based Design - Architectural Design - Component Level Design: Component – Class Based and Conventional Components Design –User Interface Design: Analysis and Design Exercise: Draw DFD and Use Case diagram for the Chosen project using any CASE tools | CO5 | K1,K2,K4, K5 |

| | | | |
|---|---|---|---|
| UNIT-IV | Testing Strategies: Software Testing- Strategies: Conventional-Object Oriented-Validation Testing-System Testing: Recovery -Security-Stress - Performance - Testing Tactics: Testing Fundamentals- Black Box - White Box-BasisPath-ControlStructureExercise:Developtestcasesandperform Various testing using any one of the testing tools | CO5 | K1,K2,K4, K5 |
| UNIT-V | Estimation : Software project Estimation - Empirical Estimation models - Risk management : Software Risks - Risk Identification - Risk Projection - Risk Mitigation, Monitoring and Management - Quality Management: Quality Concepts - Quality Assurance -Software Reliability- Quality Standards Case Studies: Develops Tools Exercise: Perform Estimation of effort using FP Estimation for chosen system and prepare Gantt Chart/PERT Chart for the same. | CO2 | K1,K2,K3 |

**Recommended Text Books**

1. RogerPressman.S.,"SoftwareEngineering:APractitioner'sApproach",9th Edition, McgrawHill, 2023

**Reference Books**

1. RichardFailey,"SoftwareEngineeringConcepts",TataMcGraw-Hill,2019.
2. P.Fleeger,"SoftwareEngineering",PrenticeHall,2016
3. CarloGhezzi,MehdiJazayari,DinoMandrioli,"FundamentalsofSoftwareEngineering",Prentice Hall Of India 1991.
4. Sommerville,"SoftwareEngineering"7th Edition:AddisonWesley,2020

**Website and e-learning source**

1. http://productdevelop.blogspot.in/2011/03/what-areformal-technical-reviews-ftr.html
2. http://basicqafundamentals.blogspot.in/2011/03/difference-between-alpha-testing-beta.html
3. https://www.wiziq.com/tutorials/software-engineering
4. http://www.jkinfoline.com/software-engineering.html
5. http://www.freetutes.com/systemanalysis/
6. http://www.softwaretestingstuff.com/2007/09/whitebox-testing.html(UnitIV:WhiteBoxTesting)

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Recognize the software process models including the specification, design, implementation, and testing for a software project | K1,K2 |
| CO2 | Utilize recent and advanced tools necessary for software project development, testing, management and reuse | K1, K2,K3 |
| CO3 | Compare and contrast various design, testing and quality issues | K1,K2,K3 |
| CO4 | Prioritize the requirements and risk accordingly that meet user expected performance, maintenance and quality | K1,K2,K4 |
| CO5 | Design software projects with well-defined architecture, modules, Components and interfaces | K1,K2,K4,K5 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | 2 | 1 | - | - | 2 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | - | - | 3 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 2 | 3 | - | 2 | 2 | - | - | 3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 3 | - | 3 | 3 | - | - | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | 3 | 2 | 3 | 3 |

## COURSEDESCRIPTORS

**Objectives of the course:**

| | | | |
|---|---|---|---|
| **Title of the Course** | Object Oriented Analysis and Design | **Hours/Week** | 4 |
| **Course Code** | APEIT25B | **Credits** | 3 |
| **Category** | Elective IV | **Year& Semester** | I & II |
| **Prerequisites** | Basic understanding of at least one of the object-oriented programs | **Regulation** | 2024 |

- The primary objective is to understand the principles & requirements and apply the UML(Unified Modeling Language) and tools for OOA and Design..

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Object Basics: Object-oriented Philosophy–Object–Object State, Behaviors and Methods. Encapsulation and Information Hiding–Class Hierarchy–Polymorphism, Aggregation, Object Containment, Meta Classes. | CO1 | K1,K4 |
| UNIT-II | Object Oriented Methodologies: Rumbaugh Object Model, Booch Methodology- Jacobson Methodology, Patterns, Frameworks and Unified Approach. | CO2, CO3, CO4 | K1,K2,K3, K4 |
| UNIT-III | Object Oriented Analysis: Business Object Analysis–Use Case Driven Approach–Use Case Model. Object Analysis–Noun Phrase Approach–CRC–Identifying Object Relationships and Methods. | CO4 | K1,K2,K3, K4 |
| UNIT-IV | Object Oriented Design: The Design Process–Design Axioms–Corollaries – Design Patterns – Designing Classes. Software Quality: Tests- Testing Strategies–Test Cases–Test Plan–Continuous Testing–Miers Debugging Principles. | CO4, CO5 | K1,K2,K3, K4 |
| UNIT- V | UML and Programming: Introduction – State and Dynamic Models – UML Diagrams–Class Diagrams–Use Case Diagrams-UML Dynamic Modeling. Case Studies: Rational Rose – Real Time Applications: Student Result Management System –Library management system – Online course reservation system | CO5 | K1,K2,K3, K4 |

**Recommended Text Books**

*1.* AliBrahami,ObjectOrientedSystemsDevelopment,Tata-McGrawHill,NewDelhi.(2017)

**Reference Books**

1. Martin Fowler, Kendall Scott, UML Distilled-Applying the Standard Object Modeling Language, Addition Wesley.
2. GradyBooch,(1994),Object-orientedAnalysisandDesignwithapplications,2ndEdition,Addition Wesley.

**Website and e-learning source**

1. http://www.slideshare.net/helghareeb/object-orientedanalysis-and-design-12164752
2. http://www.uml-diagrams.org/uml-object-orientedconcepts.html
3. http://www.tutorialspoint.com/object_oriented_analysis_design/index.htm
4. https://www.mppmu.mpg.de/english/kluth_oo_intro.pdf

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| Cos | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Recognize the concepts and principles of object-oriented analysis, design and Testing | K1,K4 |
| CO2 | Demonstrate the importance of system development process using various Approaches and choose there levant technique for a system in each phases of SDLC | K1,K2 |
| CO3 | Differentiate various object-oriented analysis, design and testing methods and models. | K1,K2,K3 |
| CO4 | Assess various analysis, design and testing strategies appropriate to build high- performance object-oriented system. | K1,K2,K3,K4 |
| CO5 | Design Object oriented systems using object modeling techniques and analyze them for correctness and quality. | K1,K2,K3,K4 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | 2 | 2 | 2 | 2 | - | - | 3 | 2 | 2 | 1 |
| CO2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 2 | 2 | 3 |
| CO3 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | - | - | 3 | 2 | 3 | 2 |
| CO5 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | 2 | 2 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Software Project Management | **Hours/Week** | 4 |
| **Course Code** | APEIT25C | **Credits** | 3 |
| **Category** | Elective IV | **Year& Semester** | I & II |
| **Prerequisites** | Basic knowledge about the fundamentals of Software project development | **Regulation** | 2024 |

**Objectives of the course:**

- The primary objective is to define and highlight importance of software project management and to become familiarize in formulating software management metrics & strategy in managing projects.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models-The SEICMM-International Organization for Standardization. | CO1 | K1 |
| UNIT-II | Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure-Approaches to Building a WBS-Project Milestones -Work Packages- Building a WBS for Software. | CO2 | K1,K2,K3 |
| UNIT-III | Tasks and Activities- Software Size and Reuse Estimating-The SEICMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed. | CO3 | K1,K2, K3,K4 |
| UNIT-IV | Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments-Map the Schedule to a Real Calendar -Critical Chain Scheduling | CO4 | K1,K2,K5 |
| UNIT-V | Quality: Requirements – The SEICMM -Guidelines - Challenges -Quality Function Deployment - Building the Software Quality Assurance - Plan – Software Configuration Management: Principles-Requirements-Planning And Organizing-Tools-Benefits-Legal Issues in Software- Case Studies: Railway reservation system – Recruitment system – Stock Maintenance System | CO5 | K1,K2, K3,K4 |

**Recommended Text Books**

1. RobertT.Futrell,DonaldF.Shafer,LindaI.Safer,"QualitySoftwareProjectManagement", Pearson Education Asia 2020

**Reference Books**

1. PankajJalote,"SoftwareProjectManagementinPractice",AddisonWesley2017
2. Hughes,"SoftwareProjectManagement",TataMcGrawHill2004,5th Edition.2015

**Website and e-learning source**

1. https://highered.mheducation.com/sites/0077109899/information-center-view/
2. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
3. https://www.smartsheet.com/content/software-projectmanagement
4. https://www.philadelphia.edu.jo/academics/lalqoran/uploads/SPM_Chapter_1-%202016%204.ppt
5. https://cs.gmu.edu/~kdobolyi/cs421/projectmanagement.ppt

**Course Learning Outcomes (for Mapping with POs and PSOs)**

Students will be able to

| COs | CODescription | CognitiveLevel |
|---|---|---|
| CO1 | Understanding of project management fundamentals such as project planning, risk management and quality assurance | K1 |
| CO2 | Choose the appropriate scheduling and testing techniques to build a quality product | K1,K2 |
| CO3 | Apply different cost estimation techniques and quality measures for software development | K1,K2, K3,K4 |
| CO4 | Differentiate various software development models and methodologies, planning activities and scheduling methods | K1,K2,K5 |
| CO5 | Asses the importance of software project documentation and identify the Methods to create project documentation, including requirements documents, design documents, and project plans | K1,K2, K3,K4 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | - | - | 2 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | - | - | 2 | 3 | 2 | 3 |
| CO3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | 3 | 2 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | 2 | 2 | 3 | 3 |
| CO5 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | - | - | 3 | 3 | 3 | 3 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Cyber Security | **Hours/Week** | 4 |
| **Course Code** | APEIT25D | **Credits** | 3 |
| **Category** | Elective IV | **Year& Semester** | I & II |
| **Prerequisites** | Fundamentals of Security Concepts, Ethical Hacking, Digital Forensics | **Regulation** | 2024 |

**Objectives of the course:**

This course has been designed for students to learn and understand

- The need for cyber security and its related threats and attacks.
- The methods for secure communication in the cyber world.
- The best practices and regulations related to cyber security.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | **Basics of Cyber crime**<br>Introduction - Cyber Threat – Definition of Cyber Crime – Classification – Current Threats and Trends – Diversity of Cyber Crime–Cyber Hate Crimes–Cyber Terrorism-Need For cyber security. | CO1 | K1 |
| UNIT-II | **Responding to Cyber crime**<br>Cyber Strategy – National Security Strategy – Cyber Security Strategy–Organized Crime Strategy–Cyber Crime Strategy-Policy Cyber Crime – International Response – National Cyber Security Structure–Strategic Policy Requirements–Police And Crime Commissioners. | CO2 | K1,K2,K3 |
| UNIT-III | **Investigating Cyber Crime**<br>Preventing Cyber Crime –Password Protection–Get Safe Online–Cyber Security Guidance for Business-Cyber Crime Investigation Skills–Criminal Investigation–Code of Ethics –Evidence–Hi-Tech Investigations–Capturing and Analyzing Digital Evidence. | CO3 | K1,K2, K3,K4 |

| | | | |
|---|---|---|---|
| UNIT-IV | **Foundations of Digital Forensics**<br>Introduction to Digital Forensics - Forensic Software and Hardware - Analysis and Advanced Tools - Forensic Technology and Practices - Forensic Ballistics and Photography - Face-Iris and Fingerprint Recognition-Audio Video Analysis-Windows System Forensics-<br>Linux System Forensics-Network Forensics | CO4 | K1,K2,K5 |
| UNIT-V | **Case Studies**<br>Latest Study Topics on Cyber Crime and Investigations-Recent Cyber Crime Cases –Recent Digital Forensics Cases–Bridging the Gaps in Cyber Crime Investigations between the Cyber securities take holders. | CO5 | K1,K2, K3,K4 |

**Recommended Text Books**

*1.*ThomasHalt,AdamM.BosslerandKathrynC.SeigfriedSpellar,(2017),

"CybercrimeandDigitalForensics:AnIntroduction",RoutledgeTaylorandFrancisGroup

**Reference Books**

1. Bernadette H Schell, Clemens Martin,(2004),"Cybercrime", ABC–ClioInc, California.

**Website and e-learning source**

1.CyberSecurityandPrivacy-Course(nptel.ac.in)

**Course Learning Outcomes(for Mapping with POs and PSOs)**

Students will be able to

| COs | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Understand the concepts of cybercrime | K1 |
| CO2 | Describe the Cyber Crime Strategy. | K2 |
| CO3 | Identify the Cyber Crime Investigation Methodology. | K3 |
| CO4 | Generalize the knowledge on Digital Forensics. | K3 |
| CO5 | Apply the Cyber Crime and Digital Forensics concepts in real-time scenarios | K3 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | 1 | - | 1 | 1 | - | - | 2 | 2 | - | - |
| CO2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | - | - | 2 | 2 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | - | - | 3 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | 1 | 2 | 3 | 2 |

# COURSEDESCRIPTORS

| | | | |
|---|---|---|---|
| **Title of the Course** | Skill Enhancement Course-SEC-Mobile Development | **Hours/Week** | 2 |
| **Course Code** | APSIT26 | **Credits** | 3 |
| **Category** | Skill Enhancement Course | **Year& Semester** | I&II |
| **Prerequisites** | Basic understanding on Java Programming | **Regulation** | 2024 |

**Objectives of the course:**

- Toprovideacomprehensiveintroductionofthebasicdesignofacomputerandtheinterdependenceand interoperation between the various components inside a computer.

| UNITS | Contents | COs | Cognitive Levels |
|---|---|---|---|
| UNIT-I | Getting Started with Android Programming–Using Eclipse for Android Development – Using Android Emulator -Getting to know the Android User Interface: Understanding the Components of a Screen | CO1 | K1 |
| UNIT-II | Designing your User Interface with views :Basic Views–Picker Views–List Views - Displaying Pictures | CO2 | K1,K2,K3 |
| UNIT-III | Activities, Fragments and Intents :Understanding Activities–Applying Styles and Themes to an Activity–Displaying a Dialog Window–DisplayingaProgressDialog–LinkingActivitiesUsingIntents–Fragments. | CO3 | K1,K2, K3,K4 |
| UNIT-IV | Menus with Views : Option Menu–Context Menu. Utilizing the Action Bar: Adding Action Items to the Action Bar–Customizing the Action Items and Application Icon-Working with Audio and Video. | CO4 | K1,K2,K5 |
| UNIT-V | Messaging: SMS Messaging – Sending E- Mail- Data Persistence: Creating and Using Databases–Developing Android Services–Publishing Android Applications | CO5 | K1,K2, K3,K4 |

**Recommended Text Books**

*1.* Wei–MengLee,(2012),BeginningAndroid4ApplicationDevelopment,WileyIndiaEdition

**Reference Books**

1. OnurCinar,(2012),AndroidAppswithEclipse,Apress,Springer(India)PrivateLimited.

2. RetoMeier,(2010),ProfessionalAndroid2ApplicationDevelopment,WileyIndiaEdition

**Website and e-learning source**

1. http://devcloper.android.com/training/basics/firstapp/index.html
2. www.vogella.com/articles/Android/article.html
3. www.coreservlets.com/android-tutorial/
4. www.edumobile.org/android/category/android-beginner-tutorial
5. http://www.androidhive.info/2011/11/android-sqlitedatabase-tutorial/(UnitV:Ex.No.3(SQLite Database)

**Course Learning Outcomes(for Mapping with POs and PSOs)**

Students will be able to

| Cos | CO Description | Cognitive Level |
|---|---|---|
| CO1 | Demonstrate the setup and configuration of Android Development Environment. | K1 |
| CO2 | Apply the necessary UI components with different styles, themes, views, and layouts | K1,K2 |
| CO3 | Examine and implement the required services such as messaging, mailing, multimedia concepts for the given problem | K1,K2, K3,K4 |
| CO4 | Test and debug the Android applications with different inputs. | K1,K2,K5 |
| CO5 | Create mobile applications that make use of various and roid features, functions and database tasks | K1,K2, K3,K4 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | - | - | 2 | 3 | 1 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | - | - | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | - | - | 2 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | - | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | - | - | 2 | 3 | 1 | 1 |