UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 24th (1/2025) meeting held on 26.08.2025, the Syndicate in its 72nd (4/2025) meeting held on 12.09.2025 has approved the revised curricula of following programs for implementation w.e.f. **Fall 2024.**

I.	Associate Degree in Computer Science	(Annex-'**A**')
II.	BS in Computer Science	(Annex-'**B**')

(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/25/ 1187

Dated: 04.11.2025

Distribution:

- Chairman, Department of Computer Science
- Controller of Examinations
- Director Academics

C.C:

- Dean Faculty of Computing & Information Technology
- Director, QEC
- Additional Registrar (A & R) *{With the request to forward the notification alongwith curriculum to all Principals of affiliated colleges concerned}*
- Secretary to the Vice-Chancellor
- PA to Registrar
  Notification File

Curriculum

of

Associate Degree in Computer Science

for

Main Campus and Affiliated Colleges

Department of Computer Science

University of Sargodha

(Applicable from Fall 2024)

Table of Contents

Underlying Principles of Computer Science Degree Programs

Computing (a nucleus of all activities including technical, academic, professional and development practices relating to computers) provides a wide range of choices on how an individual might focus his or her professional life. This document provides an overview of the different kinds of degree programs in Computing that are currently available and for which curriculum standards are now available. It is believed that this report may be an essential source for university faculty, administrators, students, parents and professionals who need to be aware of Computing as a broad based discipline that crosses the boundaries between science, engineering, and professional practice. In reality, computing consists of several disciplines. Various questions are naturally critical including: what are the different kinds of Computing degree programs or how are they similar and how are they different? The variety of degree programs in Computing presents prospective students, educators, and administrators with important choices where they may focus their efforts.

The following sections of the report also provide a complete detail of the proposed curricula pertaining to the Computer Science BS program. All details regarding the scheme of study, course content with CLOs, and overall structure of the degree programs are presented in this document. Computing is a dynamic field and accordingly a good care has been taken to design a flexible structure that will maintain currency with the latest scientific and technological advancements in the field. Moreover, it seems that Computing is a discipline that incorporates scientific, engineering, and creative features. A reasonable emphasis has been given to formal scientific and engineering areas to enhance the level of formalization in the degree programs. Technology can play an important role in the implementation of Computing programs. As a result, all programs are structured on essential dimensions including scientific knowledge, technology, and design skills.

Curriculum for Associate Degree in Computer Science Program

ASSOCIATE DEGREE IN COMPUTER SCIENCE Program's Rationale

Computer Science is the systematic study of the feasibility, structure, expression, and mechanization of the methodical processes (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded in bits and bytes in a computer memory or transcribed in genes and protein structures in a human cell.

Computer Science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, image processing, computational biology, computational lenses, and other exciting areas. Computer scientists develop new programming approaches for software development, devise new ways to use computers and develop effective ways to solve computing problems. While other disciplines produce graduates with more immediately

relevant job-related skills, computer science offers a comprehensive foundation for research and innovation.

Recent developments in computer hardware, software and communication technologies have offered new exciting opportunities and challenges for creation of innovative learning environments for Computer Science and its curricula design. The challenge of getting all newly emerging technologies incorporated into the curriculum is becoming pivotal for the effectiveness of curricula. There is a need for curricula structures that are really able to meet the challenges of 21st century knowledge driven complex work places. The key rationale behind the Associate Degree in Computer Science program is to prepare a curriculum that provide integration of all components and the foundations that allow accessing all of the new knowledge and technology to fulfill the vision of future.

Objectives

ASSOCIATE DEGREE IN COMPUTER SCIENCE Program is committed to create, expand, disseminate and teach the computer science body of knowledge through academics, applications and research which positively impact society locally, nationally, and internationally.

ASSOCIATE DEGREE IN COMPUTER SCIENCE program aims to develop students' critical professional thinking and intuition. The program's curriculum provides a balanced mixture of learning experiences to make the graduates capable of sound professional decisions. As a result, the successful graduates will be able to assume responsible positions in business, government, and education at the research, development, and planning levels. The program also provides an excellent foundation for further formal learning and training. The program is also expected to provide environments to put into practice, the principles and techniques learnt during the course of implementation of the program's curriculum. Some of the key objectives of the program are listed below:

- The program should provide a broad understanding of the field through introducing concepts, theory, techniques, and through intensive education/training in focused areas of Computer Science.
- The program should encourage students to develop and use abstract models in addition to apply respective technology in practical situations.
- The program should promote students' special communication skills both orally and in writing. They must be able to produce well-organized reports/presentations/projects, which clearly delineate objectives, methods of solution, results, and conclusions for a complex task.
- The program should provide formal foundations for higher learning and education.
- The program should be dynamic and flexible enough to maintain its body of knowledge in line with the latest scientific and technological developments in the field.
- The program should provide professional orientation to prepare students for industry.

Curricula Consideration

During the revision of the Computing Curricula two major guidelines have been considered (ACM and Seoul Accord). However, in some cases the main focus of these guidelines is mostly traditional Computer Science programs.

Association of Computing Machinery (ACM) - Guidelines

Association of Computing Machinery (ACM), USA is the largest body in the world for computer scientists. Its membership is spread over the entire globe. It has a pool of highly reputed professionals which meet after a few years to assess the directions being taken by the computing discipline. In view of its assessment, it identifies knowledge areas and also their relative importance in the years to come. Thus, ACM shows the path to follow to the computing academia and professionals all over the world. Computing curricula are designed keeping in view following identified knowledge areas of ACM [ref # ACM 2013 curriculum report]. It has been tried to reasonably cover all knowledge areas without compromising the flexibility needed for a national model curriculum. The mapping of these key knowledge areas with the courses are given in the table below.

- AL - Algorithms and Complexity
- AR - Architecture and Organization
- CN - Computational Science
- DS - Discrete Structures
- GV - Graphics and Visual Computing
- HCI - Human-Computer Interaction
- IAS - Information Assurance and Security
- IM - Information Management
- IS - Intelligent Systems
- NC - Networking and Communications
- OS - Operating Systems
- PBD - Platform-based Development
- PD - Parallel and Distributed Computing
- PL - Programming Languages
- SDF - Software Development Fundamentals
- SE - Software Engineering
- SF - Systems Fundamentals
- SP - Social Issues and Professional Issues

The following knowledge areas have been addressed with the major computing courses.

Knowledge Areas in ACM CS 2013 Curriculum

	Knowledge Area	CS 2013		ACM 2013 Subjects Taught in Various Universities	NCEAC Revised 2023 Subjects in Core
		Tier-1	Tier-2		
1	AL-Algorithms and Complexity	19	9	Algorithms; Algorithms and Data Structures;	Data structures, Analysis of Algorithms, Theory of Automata

				Algorithm Design and Analysis	
2	AR-Architecture and Organization.	0	16	Intro to Computer Architecture; DLD; Computer Engineering	DLD, Computer Org & Assembly Language, Computer Architecture
3	CN-Computational Science	1	0	eScience; Modeling and Simulation; Computer Graphics	HCI & Computer Graphics; (Elective: Numerical Analysis)
4	DS-Discrete Structures	37	4	Discrete Mathematics; Mathematical Foundations of CS; Probability for CS; Discrete Structures 1; Discrete Str 2	Discrete Structures, Probability & Statistics
5	GV-Graphics and Visualization	2	1	Computer Graphics; Computer Graphics	HCI & Computer Graphics; (Elective: Computer Graphics)
6	HCI-Human-Computer Interaction	4	4	Human Computer Interaction	HCI & Computer Graphics
7	IAS-Information Assurance and Security	3	6	Computer Systems Security	Information Security; (Elective: Cyber Security)
8	IM-Information Management	1	9	Database Systems	Database Systems; Adv Database Management Sys
9	IS-Intelligent Systems	0	10	Artificial Intelligence Programming; Artificial Intelligence	Artificial Intelligence
10	NC-Networking and Communication	3	7	Introduction to Computer Networking; Computer Networks	Computer Networks

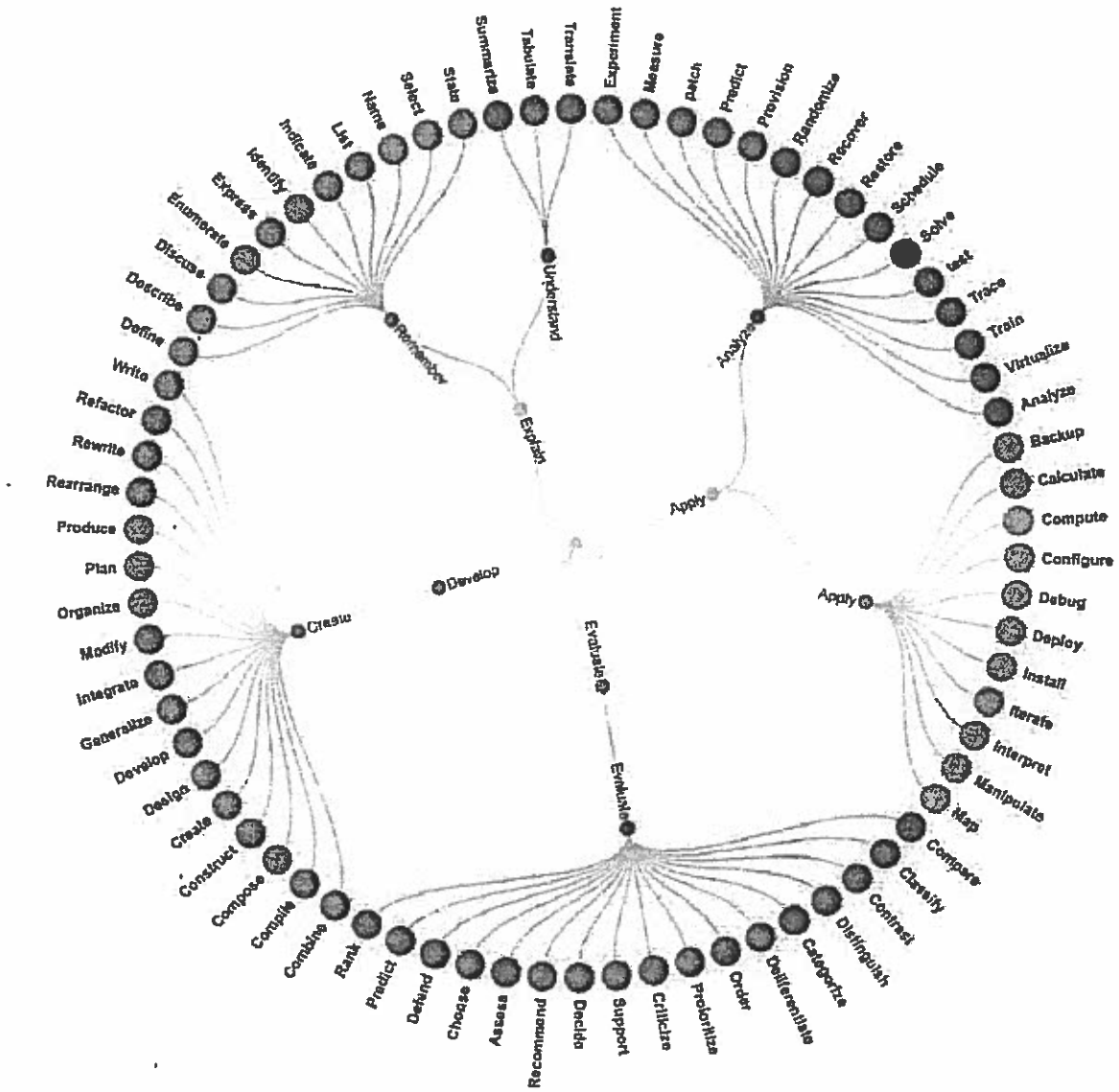
Outcome Based Education (OBE) System and Seoul Accord:

Keeping in view the latest transformation from knowledge-based education philosophy to Outcome based education (OBE) system, the OBE model based on Seoul Accord has also been considered. Computing programs prepare students to attain educational objectives by ensuring that students demonstrate achievement of the following outcomes (derived from Graduate Attributes define by Seoul Accord www.seoulaccord.org).

S#	Program Learning Outcomes (PLOs)	Computing Professional Graduate
1	Academic Education	To prepare graduates as computing professionals
2	Knowledge for Solving Computing Problems	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
3	Problem Analysis	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
4	Design/ Development of Solutions	Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
5	Modern Tool Usage	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
6	Individual and Team Work	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
7	Communication	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
8	Computing Professionalism and Society	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice
9	Ethics	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice
10	Life-long Learning	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional

Bloom's Taxonomy

Revised Bloom's Taxonomy	Skill level with applicable verbs
Remember	**Explain:** define, describe, discuss, enumerate, express, identify, indicate, list, name, select, state, summarize, tabulate, translate
Understand	
Apply	**Apply:** backup, calculate, compute, configure, debug, deploy, experiment, install, iterate, interpret, manipulate, map, measure, patch, predict, provision, randomize, recover, restore, schedule, solve, test, trace, train, virtualize
Analyze	**Evaluate:** analyze, compare, classify, contrast, distinguish, categorize, differentiate, discriminate, order, prioritize, criticize, support, decide, recommend, assess, choose, defend, predict, rank
Evaluate	
Create	**Develop:** combine, compile, compose, construct, create, design, develop, generalize, integrate, modify, organize, plan, produce, rearrange, rewrite, refactor, write



Program's Outcome

The program will produce Computer Scientists of great character, competence, vision and drive equipped with up-to-date knowledge, marketable skills, valuable competencies, unique expertise, globally compatible dispositions and culturally and professionally acceptable values to take on appropriate professional roles in computer science domain or proceed to further or higher education or training.

Program's Structure

The structure of Associate Degree in Computer Science program meets the needs of students with formal computing experience and relevant skills. The students are expected to learn theoretical and practical understanding of the entire field of Computer Science. The program structure is dynamic and provides basis for various

options including Breadth-Based, Depth-Based, and Integrated Breadth & Depth-Based specializations. Student may choose a particular option, which is the most appropriate to their planned future career. Followings are the program's details:

Degree Requirement

Minimum credit hours shall be 74 for the Associate Degree in Computer Science program.

Duration

The program shall comprise of minimum four semesters/terms spread over two calendar years with two semesters/terms a year as per the rules of the University.

Eligibility Criteria

The minimum requirements for admission in a bachelor degree program in Computer Science is at least 50% marks in Intermediate (HSSC) examination with one of the following combinations:

i. Pre-Engineering
ii. Pre-Medical (Admitted candidates have to pass 6-credit hours courses of mathematics in first two semesters.)
iii. General Science
    a. Mathematics, Statistics, Physics
    b. Mathematics, Statistics, Economics
    c. Mathematics, Statistics, Computer
    d. Mathematics, Physics, Computer
    e. Mathematics, Economics, Computer
iv. A-Levels (with equivalence of mentioned above by IBCC) with at-least 50% obtained marks

Assessment & Evaluation

University's semester and examination rules & regulations shall be followed for assessment & evaluation.

Distribution of Courses

The distribution of total credit hours for ASSOCIATE DEGREE IN COMPUTER SCIENCE is given as follows:

Associate Degree Computer Science			
Category	**Major Areas**	**Credit Hours**	**Courses**
General education	General Education Requirement	19	07
Major courses	Computing core	31	09
	Mathematics & Supporting	06	02
	Domain Core	03	01
	Domain Elective	12	04
	Elective Supporting Courses	03	01
		74	24

Mapping of BS Computer Science Program on the Generic Structure

Computing Core Courses – 31 Credit Hours (09 Courses)					
Sr#	**Sem#**	**Code**	**Pre-Req**	**Course Title**	**CH (Theory-Lab)**
1	1	CMPC-5201		Programming Fundamentals	4 (3-3)
2	2	CMPC-5202	CMPC-5201	Object-Oriented Programming	4 (3-3)
3	2	CMPC-5203		Database Systems	4 (3-3)
4	2	CMPC-5204		Digital Logic and Design	3 (2-3)
5	3	CMPC-5205	CMPC-5201	Data Structures	4 (3-3)
6	3	CMPC-5206		Information Security	3 (2-3)
7	3	CMPC-5207		Artificial Intelligence	3 (2-3)
8	3	CMPC-5101		Software Engineering	3 (3-0)
9	4	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	3 (2-3)

Domain Core – 03 Credit Hours (01 Courses)					
Sr #	**Sem#**	**Code**	**Pre-Req**	**Course Title**	**CH (Theory-Lab)**
1	4	CSDC-5101		Theory of Automata	3 (3-0)

Domain Elective – 13 Credit Hours (4Courses)					
Sr #	**Sem #**	**Code**	**Pre-Req**	**Course Title**	**CH (Theory-Lab)**
1	4	CSDE-5204		Advance Programming Lab	3 (0-9)
2	4	CSDE-5202		Web Technologies	3 (3-0)

3	4	CSDE-6202		Mobile Application Development-I	3 (3-0)
4	4	DSDE-5102		Database Administration and Management	3 (2-3)

Preliminary Courses for Pre-Medical Students – Non-Credit Hour (Courses)					
Sr#	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	1	URCM-5107		Mathematics I	0 (3-0)
2	2	URCM-5108	URCM-5107	Mathematics II	0 (3-0)

Mathematics & Supporting Courses – 12 Credit Hours (4 Courses)					
Sr#	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	2	MATH-5101	URCQ-5102	Multivariable Calculus	3 (3-0)
2	2	MATH-5102		Linear Algebra	3 (3-0)

Elective Supporting Courses (Social Science) – 3 Credit Hours (1 Course)					
Sr#	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	1	BUSB-6101		Introduction to Marketing	3 (3-0)

General Education Requirement – 19 Credit Hours (07 Courses)					
Sr#	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	1	URCG-5123		Application of Information & Communication Technologies	3 (2-3)
2	1	URCG-5118		Functional English	3 (3-0)
3	2	URCG-5119	URCG-5118	Expository Writing	3 (3-0)
4	1	URCQ-5101		Discrete Structures	3 (3-0)
5	1	URCQ-5102		Calculus and Analytic Geometry	3 (3-0)
6	4	URCG-5105/ URCG-5126		Islamic Studies/ Ethics (for non-Muslims)	2 (2-0)
7	2	URCG-5111		Translation of Holy Quran-I	0 (1-0)
8	4	URCG-5111		Translation of Holy Quran-II	0 (1-0)
9	2	URCG-5128		Pakistan Studies	2(2-0)
10	4	URCG-5126		Ethics*	2(2-0)

Course Coding Scheme

Level	Course Type
5	Foundation, Core Level 1 Courses
5	Foundation, Core Level 1 Courses
6	Core Level 2 + Specialization Level 1
6	Specialization Level 2

Code	Discipline
CMPC	Computing Core
CSDC	Computer Science Domain Core
CSDE	Computer Science Domain Elective
ITDC	Information Technology Domain Core
ITDE	Information Technology Domain Elective
SEDC	Software Engineering Domain Core
SEDE	Software Engineering Domain Elective
AIDC	Artificial Intelligence Domain Core
AIDE	Artificial Intelligence Domain Elective
DSDC	Data Science Domain Core
DSDE	Data Science Domain Elective
URCP	Pakistan Studies
URCI	General Science
MATH	
ENGL	
URCC	
URCQ	
URCS	
URCE	
URCA	
URCF	
URCW	
URCT	

Scheme of Studies for Associate Degree in Computer Science Program
(74 Credit Hours)

Semester I

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5201		Programming Fundamentals	Core	4 (3-3)
2	URCG-5123		Application of Information Communication Technologies (ICT)	GER	3 (2-3)
3	URCQ-5101		Discrete Structures	GER	3 (3-0)
4	URCQ-5102		Calculus and Analytic Geometry	GER	3 (3-0)
5	URCG-5118		Functional English	GER	3 (3-0)
6	BUSB-6101		Introduction to Marketing	ELEC	3 (3-0)
7	URCM-5107		Mathematics-I	PREL	0(3-0)
*Pre-Medical Students only			**Total Credit Hours**		**19 (20-6)**

Semester II

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5202	CMPC-5201	Object Oriented Programming	Core	4 (3-3)
2	CMPC-5203		Database Systems	Core	4 (3-3)
3	CMPC-5204		Digital Logic Design	Core	3 (2-3)
4	MATH-5101	URCQ-5102	Multivariable Calculus	MATH	3 (3-0)
5	MATH-5102		Linear Algebra	MATH	3 (3-0)
6	URCG-5128		Pakistan Studies	GER	2(2-0)
7	URCG-5111		Translation of Holy Quran-I	GER	0 (1-0)
8	URCM-5108		*Mathematics-II	PREL	0(3-0)
*Pre-Medical Students only			**Total Credit Hours**		**19 (20-9)**

Semester III

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5205	CMPC-5202	Data Structures	Core	4 (3-3)
2	CMPC-5207		Artificial Intelligence	Core	3 (2-3)
3	CSDE-5204		Advance Programming Lab	Domain Elective	3 (0-9)
4	CSDE-5202		Web Technologies	Domain Elective	3 (3-0)
5	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	Core	3 (2-3)
6	CMPC-5101		Software Engineering	Core	3 (3-0)

Total Credit Hours	**19 (13-18)**

Semester IV

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5206		Information Security	Core	3 (2-3)
2	CSDE-6202		Mobile Application Development-I	Domain Elective	3 (3-0)
3	DSDE-5102	CMPC-5203	Database Administration and Management	Domain Elective	3 (2-3)
4	URCG-5105		Islamic Studies/ Ethics	GER	2 (2-0)
	URCG-5126		Ethics*		
5	CSDC-5101		Theory of Automata	Domain Core	3 (3-0)
6	URCG-5119		Expository Writing	GER	3 (3-0)
7	URCG-5111		Translation of Holy Quran-II	GER	0 (1-0)
			Total Credit Hours		**17 (16-06)**

***Ethics for Non- Muslim students**

Computing Core Courses

CMPC-5201 Programming Fundamentals	
Credit Hours:	4 (3-1)
Contact Hours:	3-3
Pre-requisites:	None

Course Introduction:

This course provides fundamental concepts of programming to freshmen. The courses is prerequisite
to many other courses, therefore, students are strongly advised to cover all contents and try to achieve CLOs to the maximum possible level. The course may be taught as language independent. Further, it is up to the university to choose any language for the practical/Lab purpose but that must be latest and market oriented.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand basic problem solving steps and logic constructs	C2 (Understand)
CLO-2	Apply basic programing concepts	C3 (Apply)
CLO-3	Design and implement algorithms to solve real world problems	C3 (Solve)

Course Outline:

Introduction to problem solving, a brief review of Von-Neumann architecture, Introduction to programming, role of compiler and linker, introduction to algorithms, basic data types and variables, input/output constructs, arithmetic, comparison and logical operators, conditional statements and execution flow for conditional statements, repetitive statements and execution flow for repetitive statements, lists and their memory organization, multidimensional lists, introduction to modular programming, function definition and calling, stack rolling and unrolling, string and string operations, pointers/references, static and dynamic memory allocation, File I/O operations.

Reference Materials (or use any other standard and latest books):

1. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel
2. Object Oriented Programming in C++ latest edition by Robert Lafore.
3. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel
5. Problem Solving and Program Design in C++, latest Edition by Jeri R. Hanly& Elliot B. Koffman.

CMPC-5202 Object Oriented Programming	
Credit Hours:	4 (3-1)
Contact Hours:	3-3
Pre-requisites:	Programming Fundamentals

Course Introduction:

The course aims to focus on object-oriented concepts, analysis and software development. The basic concept of OOP is covered in this course.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand principles of object-oriented paradigm.	C2 (Understand)
CLO-2	Identify the objects & their relationships to build object-oriented solution	C3 (Apply)
CLO-3	Model a solution for a given problem using object-oriented principles	C3 (Solve)
CLO-4	Examine an object-oriented solution	C4 (Examine)

Course Outline:

Introduction to object oriented design, history and advantages of object oriented design, introduction to object oriented programming concepts, classes, objects, data encapsulation, constructors, destructors, access modifiers, const vs non-const functions, static data members & functions, function overloading, operator overloading, identification of classes and their relationships, composition, aggregation, inheritance, multiple inheritance, polymorphism, abstract classes and interfaces, generic programming concepts, function & class templates, standard template library, object streams, data and object serialization using object streams, exception handling.

Reference Materials (or use any other standard and latest books):

1. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel
2. Starting Out with C++ from Control Structures to Objects, latest Edition, Tony Gaddis
3. C++ How to Program, latest Edition, Deitel&Deitel.
4. Object Oriented Programming in C++, latest Edition by Robert Lafore

CMPC-5203 Database Systems

Credit Hours:	4 (3-1)
Contact Hours:	3-3
Pre-requisites:	None

Course Introduction:

The course aims to introduce basic database concepts, different data models, data storage and retrieval techniques and database design techniques. The course primarily focuses on relational data model and DBMS concepts.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Explain fundamental database concepts.	C2 (Explain)
CLO-2	Design conceptual, logical and physical database schemas using different data models.	C5 (Design)
CLO-3	Identify functional dependencies and resolve database anomalies by normalizing database tables.	C2 (Identify)
CLO-4	Use Structured Query Language (SQL) for database definition and manipulation in any DBMS	C4 (Use)

Course Outline:

Basic database concepts, Database approach vs. file based system, database architecture, three level schema architecture, data independence, relational data model, attributes, schemas, tuples, domains, relation instances, keys of relations, integrity constraints, relational algebra, selection, projection, Cartesian product, types of joins, normalization, functional dependencies, normal forms, entity relationship model, entity sets, attributes, relationship, entity-relationship diagrams, Structured Query Language (SQL), Joins and subqueries in SQL, Grouping and aggregation in SQL, concurrency control, database backup and recovery, indexes, NoSQL systems.

Reference Materials (or use any other standard and latest books):

1. Fundamentals of Database Management Systems,Mark L. Gillenson, 3rd Edition, 2023
2. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition by Thomas Connolly and Carolyn Begg, 2019
3. Database Systems: The Complete Book, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, 2013
4. Database System Concepts, 6th Edition by AviSilberschatz, Henry F. Korth and S. Sudarshan.2019
5. Database Management Systems, 3rd Edition by Raghu Ramakrishnan, Johannes Gehrke,2002

CMPC-5204 Digital Logic Design

Credit Hours:	3 (2-1)
Contact Hours:	2-3
Pre-requisites:	None

Course Introduction:

The course introduces the concept of digital logic, gates and the digital circuits. Further, it focuses on the design and analysis combinational and sequential circuits. It also serves to familiarize the student with the logic design of basic computer hardware components.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Acquire knowledge related to the concepts, tools and techniques for the design of digital electronic circuits	C2 (Understand)
CLO-2	Demonstrate the skills to design and analyze both combinational and sequential circuits using a variety of techniques	C3 (Apply)
CLO-3	Apply the acquired knowledge to simulate and implement small-scale digital circuits	C3 (Solve)
CLO-4	Understand the relationship between abstract logic characterizations and practical electrical implementations.	C4 (Examine)

Course Outline:

Number Systems, Logic Gates, Boolean Algebra, Combination logic circuits and designs, Simplification Methods (K-Map, Quinn Mc-Cluskey method), Flip Flops and Latches, Asynchronous and Synchronous circuits, Counters, Shift Registers, Counters, Triggered devices & its types. Mealy machines and Moore machines. Binary Arithmetic and Arithmetic Circuits, Memory Elements, State Machines. Introduction Programmable Logic Devices (CPLD, FPGA) Lab Assignments using tools such as Verilog HDL/VHDL, MultiSim.

Reference Materials (or use any other standard and latest books):
1. Digital Fundamentals by Floyd, Global Edition. 2. Fundamental of Digital Logic with Verilog Design, Stephen Brown, 2/e 3. DIGITAL DESIGN, GLOBAL EDITION, 6th/e by M. Morris Mano and Michael Ciletti

CMPC-5205 Data Structures

Credit Hours:	4 (3-1)
Contact Hours:	3-3
Pre-requisites:	Programming Fundamental

Course Introduction:

The course is designed to teach students structures and schemes, which allow them to write programmer to efficiently manipulate, store, and retrieve data. Students are exposed to the concepts of time and space complexity of computer programs.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Implement various data structures and their algorithms and apply them in implementing simple applications	C3 (Apply)
CLO-2	Analyze simple algorithms and determine their complexities.	C5 (Analyze)
CLO-3	Apply the knowledge of data structure to other application domains.	C3 (Apply)
CLO-4	Design new data structures and algorithms to solve problems.	C6 (Design)

Course Outline:

Abstract data types, complexity analysis, Big Oh notation, Stacks (linked lists and array implementations), Recursion and analyzing recursive algorithms, divide and conquer algorithms, Sorting algorithms (selection, insertion, merge, quick, bubble, heap, shell, radix, bucket), queue, dequeuer, priority queues (linked and array implementations of queues), linked list & its various types, sorted linked list, searching an unsorted array, binary search for sorted arrays, hashing and indexing, open addressing and chaining, trees and tree traversals, binary search trees, heaps, M-way tress, balanced trees, graphs, breadth-first and depth-first traversal, topological order, shortest path, adjacency matrix and adjacency list implementations, memory management and garbage collection.

Reference Materials (or use any other standard and latest books):

1. Data Structures and Algorithm Analysis in Java latest Edition by Mark A. Weiss
2. Data Structures and Abstractions with Java Latest Eidition by Frank M. Carrano& Timothy M. Henry
3. Data Structures and Algorithms in C++ 4th Edition by by Adam Drozdek
4. Data Structures and Algorithm Analysis in C++ Latest Edition by Mark Allen Weiss Java Software Structures: Designing and Using Data Structures by John Lewis and Joseph Chase

CMPC-5206 Information Security	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (2-1) 2-3 None

Course Introduction:

This course provides a broad overview of the threats to the security of information systems, the responsibilities and basic tools for information security, and the levels of training and expertise needed in organizations to reach and maintain a state of acceptable security. It covers concepts and applications of system and data security. Areas of particular focus include secure network design, implementation and transition issues, and techniques for responding to security breaches.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Explain key concepts of information security such as design principles, cryptography, risk management, and ethics	C2 (Explain)
CLO-2	Discuss legal, ethical, and professional issues in information security	A2 (Discuss)
CLO-3	Apply various security and risk management tools for achieving information security and privacy	C3 (Apply)
CLO-4	Identify appropriate techniques to tackle and solve problems in the discipline of information security	C4 (Identify)

Course Outline:

Information security foundations, security design principles; security mechanisms, symmetric and asymmetric cryptography, encryption, hash functions, digital signatures, key management, authentication and access control; software security, vulnerabilities and protections, malware, database security; network security, firewalls, intrusion detection; security policies, policy formation and enforcement, risk assessment, cybercrime, law and ethics in information security, privacy and anonymity of data.

Reference Materials (or use any other standard and latest books):

1. Computer Security: Principles and Practice, 3rd edition by William Stallings
2. Principles of Information Security, 6th edition by M. Whitman and H. Mattord
3. Computer Security, 3rd edition by Dieter Gollmann
4. Computer Security Fundamentals, 3rd edition by William Easttom
5. CISSP, 7th edition, Shon Harris

CMPC-5207 Artificial Intelligence	
Credit Hours:	3 (2-1)
Contact Hours:	2-3
Pre-requisites:	Object Oriented Programming

Course Introduction:

Artificial Intelligence has emerged as one of the most significant and promising areas of computing. This course focuses on the foundations of AI and its basic techniques like Symbolic manipulations, Pattern Matching, Knowledge Representation, Decision Making and Appreciating the differences between Knowledge, Data and Code. AI programming language Python has been proposed for the practical work of this course.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the fundamental constructs of Python programming language.	C2 (Understand)
CLO-2	Understand key concepts in the field of artificial intelligence	C2 (Understand)
CLO-3	Implement artificial intelligence techniques and case studies	C3 (Apply)

Course Outline:

An Introduction to Artificial Intelligence and its applications towards Knowledge Based Systems; Introduction to Reasoning and Knowledge Representation, Problem Solving by Searching (Informed searching, Uninformed searching, Heuristics, Local searching, Minmax algorithm, Alpha beta pruning, Game-playing); Case Studies: General Problem Solver, Eliza, Student, Macsyma; Learning from examples; ANN and Natural Language Processing; Recent trends in AI and applications of AI algorithms. Python programming language will be used to explore and illustrate various issues and techniques in Artificial Intelligence.

Reference Materials (or use any other standard and latest books):

1. Russell, S. and Norvig, P. "Artificial Intelligence. A Modern Approach", 3rd ed, Prentice Hall, Inc., 2020.
2. Norvig, P., "Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp", Morgan Kaufman Publishers, Inc., latest edition.
3. Luger, G.F. and Stubblefield, W.A., "AI algorithms, data structures, and idioms in Prolog, Lisp, and Java", Pearson Addison-Wesley. 2019.
4. Severance, C.R., 2016. "Python for everybody: Exploring data using Python 3." CreateSpace Independent Publ Platform.
5. Miller, B.N., Ranum, D.L. and Anderson, J., 2019. "Python programming in context." Jones & Bartlett Pub.
6. Joshi, P., 2022. "Artificial intelligence with python." Packt Publishing Ltd.

CMPC-5101 Software Engineering	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0 None

Course Introduction:

This course provides students with a foundational understanding of the principles, methodologies, and practices essential for designing, developing, and maintaining software systems. Emphasis is placed on the entire software development life cycle, covering requirements analysis, system design, quality assurance and testing.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Describe various software engineering processes and activates	C1 (Describe)
CLO-2	Apply the system modeling techniques to model a medium size software systems	C3 (Apply)
CLO-3	Apply software quality assurance and testing principles to medium size software systems	C4 (Apply)
CLO-4	Discuss key principles and common methods for software project management such as scheduling, size estimation, cost estimation and risk analysis	C2 (Discuss)

Course Outline:

Nature of Software, Overview of Software Engineering, Professional software development, Software engineering practice, Software process structure, Software process models, Agile software Development, Agile process models, Agile development techniques, Requirements engineering process, Functional and non-functional requirements, Context models, Interaction models, Structural models, behavioral models, model driven engineering, Architectural design, Design and implementation, UML diagrams, Design patterns, Software testing and quality assurance, Software evolution, Project management and project planning, configuration management, Software Process improvement

Reference Materials (or use any other standard and latest books):

1. Modern Software Engineering: Doing What Works to Build Better Software Faster,David Farley,1st Edition, 2022
2. Software Engineering, Sommerville I., 10th Edition, Pearson Inc., 2014
3. Software Engineering, A Practitioner's Approach, Pressman R. S.& Maxim B. R., 8th Edition, McGraw-Hill, 2015.

CMPC-5209 Computer Organization & Assembly Language	
Credit Hours:	3 (2-1)
Contact Hours:	2-3
Pre-requisites:	

Course Introduction:

This course helps students understanding the architecture and design principles of modern computing systems. They will explore the essentials of assembly language programming, understanding how low-level instructions contribute to the functioning of CPUs. They will also gain a profound understanding of hardware-software interactions, setting the foundation for advanced studies in computer science and programming.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understanding the basics of computer organization with emphasis on the lower level abstraction of a computer system	C1 (Memorize)
CLO-2	Understand the digital logic, instruction set	C2 (Understand)
CLO-3	Familiarity with assembly language programming.	C2 (Understand)

Course Outline:

Introduction to Microprocessor Architecture: Microprocessor Bus Structure -Addressing, Data and Control, Registers and Flags. Addressing Modes. Introduction to Assembly Language, 80x86 families; program layout. Data Definitions, Basic Instructions. Unsigned Arithmetic; Logic and Bit Operations. Modules; Separate Assembly; Argument Passing Libraries; Combining Assembly and C Code. String Instructions; Arrays. Macros; Structures. Floating Point Instruction. Bit MS-DOS. BIOS Disk Accessing. BIOS Keyboard/Video/Graphics. Interrupts; TSR Programs. Accessing I/O Ports; 8253 Timer

Reference Materials (or use any other standard and latest books):

1. Introduction to Computer Organization: An Under the Hood Look at Hardware and x86-64 Assembly,1st Edition, 2022
2. Assembly Language for x86 Processors by Kip R. Irvine, Prentice Hall; 6thEdition (March 7, 2010). ISBN-10: 013602212X
3. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel&Avtar Singh, Prentice Hall; 4thEdition (September 8, 2002). ISBN-10: 0130930814.
4. Lab Manual to Accompany - The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel&Avtar Singh, Pearson; 4thEdition (2003). ASIN: B000Q652KQ
5. Principles of Computer Organization and Assembly Language by Patrick Juola, Prentice Hall; 1stEdition (January 11, 2011). ASIN: B009TGBI1Q
6. The Art of Assembly Language by Randall Hyde, No Starch Press; 2ndEdition (March 22, 2010). ISBN-10: 1593272073.

Domain Core Courses

CSDC-5101 Theory of Automata	
Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	-

Course Introduction:

This course helps the students delving into the theoretical foundations of computation and automata theory. It uncovers the principles behind formal languages, regular expressions, finite automata, and Turing machines, gaining insights into the theoretical underpinnings of computer science.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Fundamental concepts of automata theory and formal languages to form basic models of computation which provide foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems.	C1 (Knowledge)

Course Outline:

Introduction to Automata: The Methods and the Madness, Introduction to Formal Proof, Inductive Proofs, the Central Concepts of Automata Theory. Finite Automata: Introduction of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata with Epsilon Transitions. Regular Expressions and Languages, Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions. Properties of Regular Languages, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata. Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Pushdown Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata. Properties of Context-Free Languages: Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages, Decision Properties of CFLs. Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers. Un-decidability: A Language That Is Not Recursively Enumerable, Un-decidable Problem That Is RE, Un-decidable Problems About Turing Machines, Posts Correspondence Problem, Other Un-decidable Problems. Intractable Problems: The Classes P and NP, an NP-Complete Problem, A Restricted Satisfiability Problem.

Reference Materials (or use any other standard and latest books):

1. Introduction to Automata Theory, Languages, and Computation by J. Hopcroft, R. Motwani, and J. Ullman, 3rdEdition, 2006, Addison-Wesley.
2. An Introduction to Formal Language and Automata by Peter Linz, Jones & Bartlett Pub; 4th Edition (2006). ISBN-10: 0763737984
3. 3. Automata and Formal Languages: An Introduction by Dean Kelley, Prentice Hall (1995). ISBN-10: 0134977777

Domain Elective Courses

DSDE-5102 Database Administration and Management	
Credit Hours:	3(2-1)
Contact Hours:	2-3
Pre-requisites:	Database Systems

Course Introduction:

The course will focus on the complexities of managing Oracle databases, gaining the expertise needed to administer intricate database systems effectively. From mastering Oracle Database Architecture fundamentals to advanced tasks like managing database instances, administering user access, and implementing multi tenancy.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the fundamental concepts of Oracle Database Administration, including Oracle Database Architecture, physical database files, memory structures, background processes, and Oracle Net Services configuration..	C2 (Understand)
CLO-2	Manage Oracle Database instances proficiently, including tasks such as starting and shutting down the database, working with initialization parameters, diagnosing problems, and utilizing the Data Dictionary for database administration tasks.	C3 (Apply)
CLO-3	Administer user access effectively by configuring user privileges, roles, and resource limitations. Understand multitenancy concepts in Oracle databases, including creating and managing pluggable databases (PDBs), data encryption, and managing tablespaces	C3 (Apply)

Course Outline:

Oracle Database Administration, Oracle Database Architecture, Physical files of the DB, Memory Structures, Memory Management, Background Processes, How to install Oracle Database Software on the server without GUI ,How to access Oracle Database via sqlplus, sqlcl and SQL Developer, Managing Database Instance: Starting and Shutting down DB, working with initialization parameters, Diagnosing problems, working with Data DictionaryOracle Net Services, Administering User Access, Privileges & Roles, Resource LimitationMultitenancy: Creating PDBs from SEED, Clonning PDBs, creating Refreshable Clones, Unplug/Plug PDBs, Transparent Data Encryption (TDE), Creating and Managing TablespacesManaging UNDO Data, Practicing different Backup and Recovery scenarious via RMAN, Moving Data: Data Pump, SQL Loader, Data Guard configuration, Applying the latest Database Patch, Database Upgrade from 19c to 21c

Reference Materials (or use any other standard and latest books):

1. DBA Essentials for 21c: Installing Oracle Database 21c on OCI Compute (English Edition), by Divit Gupta, 1st Edition, 2023
2. Oracle Database 19c DBA By Examples: Installation and Administration by Ravinder Gupta 1st Edition, 2021
3. https://docs.oracle.com/en/database/oracle/oracle-database/21/admin/index.html
4. https://www.udemy.com/course/oracle-database-course/

CSDE-6202 Mobile Application Development I	
Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	None

Course Introduction:

Mobile Application Development I equips learners with fundamental skills to create responsive and feature-rich mobile applications. Explore key concepts in UI/UX design, programming, and mobile platforms, fostering proficiency in app development. Gain hands-on experience to launch their journey into the dynamic realm of mobile application creation.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Discuss different architectures & framework for Mobile Application development.	C1 (Knowledge)
CLO-2	Develop mobile applications using current software development environments.	C3 (Apply)
CLO-3	Compare the different performance tradeoffs in mobile application development.	C3 (Apply)

Course Outline:

What is Android? Obtaining the Required Tools, Installing and Configuring the Android SDK Manager, Creating Your First Android Application, Anatomy of an Android Application. The Big Picture, How to Get Started, Your First Android Project, A bit About Eclipse, Enhancing Your First Project. Understanding Activities, Linking Activities Using Intents, Fragments, Calling Built-In Applications Using Intents, Displaying Notifications. Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Creating the User Interface Programmatically, and Listening for UI Notifications. Using Basic Views, Using Picker Views, Using List View to Display Long Lists, Understanding Specialized Fragments. Using Image Views to Display Pictures, Using Menus with Views, Analog Clock and Digital Clock Views. Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases. Sharing Data in Android, using a Content Provider, Creating Your Own Content Providers, Using the Content Provider. Sending SMS Messages Programmatically, Getting Feedback after Sending a Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Sending E-mail. Displaying Maps, Getting Location Data, Monitoring a Location, Building a Location Tracker. Consuming Web Services Using HTTP, Accessing Web Services Using the Get Method, Consuming JSON Services, Sockets Programming. Creating Your Own Services, Establishing Communication between a Service and an Activity, Binding Activities to Services, Understanding Threading. Android games Development, Publishing Android Applications. Handling Telephone Calls, Fonts.

Reference Materials (or use any other standard and latest books):

1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart - A comprehensive guide for Android app development with hands-on examples and practical insights 2022, 5th Edition ISBN-10: 0137645546
2. Professional Android application development, Reto Meier, Wrox Programmer to Programmer, 2012,

3rd Edition, ISBN-10: 1118102274.
3. React Native in Action: Developing iOS and Android apps with JavaScript 1st Edition, Kindle Edition, 2019, ISBN-13 978-1617294051
4. Flutter in Action by Eric Windmill, 2019, .ISBN-10: 1617296147

CSDE-5204	Advance Programming Lab
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (0-3) 0-9 None

Course Introduction:

This course provides an in-depth exploration of advanced Python programming concepts, enabling students to develop robust, efficient, and scalable software solutions. It covers essential programming skills, data structures, object-oriented programming, working with libraries and frameworks, data analysis and visualization, web development, GUI applications, and deployment practices. The course emphasizes hands-on learning through practical exercises and real-world projects.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand advanced data models, technologies, and approaches for building robust and efficient Python applications.	C1 (Remember)
CLO-2	Apply object-oriented programming, data analysis, and web development frameworks to develop real-world applications..	C2 (Understand)
CLO-3	Evaluate and create software solutions integrating modern libraries, frameworks, and deployment strategies in diverse project scenarios	C4 (Apply)

Course Outline:

Introduction and setup: Overview, IDE configuration, environment preparation
Basic programming concepts: Variables, data types, operators, control structures
Functions and modules: Arguments, return values, package management
File handling and exception handling: Reading/writing files, managing errors
Data structures: Lists, tuples, dictionaries, sets, nested structures
Object-oriented programming: Classes, objects, inheritance
Advanced OOP concepts: Decorators, generators, design patterns
Libraries and third-party packages: os, sys, math, datetime, requests, numpy, pandas
Data analysis and visualization: pandas, matplotlib, seaborn
Web development basics: Flask or Django
Working with APIs and web services: JSON handling, third-party APIs

GUI programming: Tkinter
Testing and debugging: Unit testing frameworks, logging
Deployment and version control: Git, cloud deployment (Heroku), environment management
Portfolio project: Planning, development, documentation, presentation

Reference Materials (or use any other standard and latest books):

1. "Fluent Python" by Luciano Ramalho, Latest Edition
2. "Effective Python" by Brett Slatkin, Latest Edition
3. "Python Cookbook" by David Beazley and Brian K. Jones, Latest Edition
4. "Python for Data Analysis" by Wes McKinney, Latest Edition
5. "Programming Python" by Mark Lutz, Latest Edition

ITDC-5201 Web Technologies

Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	None

Course Introduction:

The Web Technologies course provides a comprehensive understanding of internet-based technologies, covering web development, protocols, and design principles. Participants acquire skills in creating dynamic and interactive web applications.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Learn basic WWW, its structure and working.	C1 (Remember)
CLO-2	Describe the constraints that the web puts on developers.	C2 (Understand)
CLO-3	Implement basic client side and server-side languages.	C4 (Apply)
CLO-4	Design and implement a simple web application.	C4 (Apply)
CLO-5	Review an existing web application against a current web standard.	C4 (Apply)

Course Outline:

Overview of WWW, Web Pages, Web Sites, Web Applications, TCP/IP, TCP/IP Application. Services, Web Servers, WAMP, LAMP,WAMP Configuration. Introduction to HTTP, HTML & HTML5 Tags, and Dynamic Web Content. CSS and CSS3. Client Side Programming: Programing in JavaScript: Basics, Expressions and Control Flow. Javascript Functions, Objects, and Arrays, Accessing CSS from JavaScript. Form Handling. Server Side Programing: Programing in PHP. PHP functions and objects,

PHP arrays. Introduction MySQL, MySQL Functions, Normalization, Relationships. Accessing MySQL via PHP. Cookies, Sessions, and Authentication. Introduction to Ajax. Introduction to JQuery. Browsers and the DOM [W3 Schools Tutorial]. Designing a Social Networking Site
Reference Materials (or use any other standard and latest books):
1. Learning PHP, MySQL, JavaScript, and CSS, A Step-by-Step Guide to Creating Dy-namic Websites By Robin Nixon, O'Reilly Media; 6th Edition 2. WEB TECHNOLOGIES A Computer Science Perspective Kindle Edition by Jeffrey C. Jackson, Prentice Hall; (September06, 2022). 3. Web Technologies by Uttam Kumar Roy, Oxford University Press, USA (June 13, 2011). ISBN-10: 0198066228 4. Web Application Architecture: Principles, protocols and practices by Leon Shklar and Richard Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10: 047051860X

Preliminary Courses for Pre-Medical Students

URCM-5107 Mathematics I	
Credit Hours:	Non-Credit Hour
Contact Hours:	3
Pre-requisites:	None
Course Introduction:	
The goal of Mathematics I is to prepare students for first-year Calculus. Helping students gain proficiency in their understanding and ability to utilize real-valued functions, the primary tool in Calculus, accomplishes this goal. Students are presented a broad set of 'function tools', including a general understanding of function properties together with a 'library' of commonly used functions. It is intended that students become skilled at recognizing the different families of functions and the primary properties that set each apart, are able to apply the general function properties to each type of function, andare able to use the special set of algebraic skills associated with each. Students are also expected to become adept in utilizing and interpreting the results from graphing calculators, as an important investigative tool.	
Course Content:	
1. Preliminaries 2 Real-number system, complex numbers 5. Introduction to sets, set operations, functions, types of functions. 4. Matrices Introduction to matrices, types, matrix inverse, determinants, system of lim Cramer's rule. 5. Quadratic Equations 6. Solution of quadratic equations, qualitative analysis of roots of a quadratice 7. Equations reducible to quadratic equstions 8. Cube roots of unity, relation between roots and coefficients of quadratic	

9. Sequences and Series
10. Arithmetic progression
11. Geometric progression
12. Harmonic progression
13. Binomial Theorem
14. Introduction to mathematical induction
15. Binomial theorem with rational and irrational indices.
16. Trigonometry, Fundamentals of trigonometry, Trigonometric identities

Reference Materials:

1. Thomas B & Finney, B. (2005). Calculus. Reading: Addison-Wesley
2. Anton, H., Bevens. I., & Davis, S. (2005). *Calculus: A new horizon* (8th ed.). New York: John Wiley.
3. Stewart, J. (1995). *Calculus* (3rd ed.).Pacific Grove, California: Brooks/Cole.
4. Swokowski, E. W. (1983). *Calculus and analytic geometry*. Boston: PWS-Kent Company.
5. Thomas, G. B., & Finney, A. R. (2005). *Calculus* (11th ed.). Reading: Addison-Wesley.

URCM-5108 Mathematics II

Credit Hours:	Non-Credit Hour
Contact Hours:	3
Pre-requisites:	Mathematics I

Course Introduction:

Calculus is the mathematical study of continuous change. It has two major branches, differential calculus and integral calculus. Both branches make use of the fundamental notions of convergence of infinite sequences and infinite series to a well-defined limit. Modern calculus is considered to have been developed in 17th century. A course in calculus is a gateway to other, more advanced courses in mathematics devoted to the study of functions and limits, broadly called mathematical analysis. Calculus is used in every branch of the physical sciences, actuarial science, computer science, medicine, demography, and in other fields. It allows one to go from rates of change to the total change or vice versa, and many times in studying a problem we know one and are trying to find the other. This course aims to provide students with the essential concepts of mathematics and how these can be employed for analyzing real data.

Course Content:

1.Preliminaries
2.Real-sumber line
3.Functions and their graphs
4. Solusion of equations involving absolute values, inequalicies.
5. Limits and Continuiry
6. Limit of a function
7. Left-hand and right-hand limits
8. Continuiry
9. Continuous functions.
10. Derivatives and their Applications
11. Differentiable functions
12. Differentiation of polynomial
13. Rational and transcendental functions, derivatives.

14. Integration and Definite Integrals 15. Techniques of evaluating indefinite integrals 16. Integration by substitution, integration by parts 17. Change of variables in Indefinite integrals
Reference Materials:
Recommended Text 1. Thomas. G. B.. & Finney, A. R. (2005). Calculus. Reading: Addison-Wesley. 2. Anton. H., Bevens. L., & Davis. S. (2005). Calculus: A new horizon (8th ed.). New York: Joll Wiley. **Suggested Readings** 1. Stewart. J. (1995). Calculus (3rd ed.). Pacific Grove, California: Brooks/Cole. 2.Swokowski, E. W. (1983). Calculus and analytic geamerry. Boston: PWS-Kent Company. 3. Thomas. G. B. & Finney, A. R. (2005). Calculus (11th ed.), Reading: Addison-Wesley

Mathematics & Supporting Courses

MATH-5101 Multivariable Calculus	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3 Calculus and Analytical Geometry

Course Introduction:

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Develop the skills to have ground knowledge of multivariate calculus and appreciation for further computer science courses.	C2 (Understand)

Course Outline:

Multivariable Functions and Partial Derivatives: Functions of Several Variables. Limits and Continuity. Partial Derivatives. Differentiability, Linearization, and Differentials. The Chain Rule. Partial Derivatives with Constrained Variables. Directional Derivatives, Gradient Vectors, and Tangent Planes. Extreme Values and Saddle Points. Lagrange Multipliers. Taylor's Formula. Multiple Integrals: Double Integrals. Areas, Moments, and Centers of Mass. Double Integrals in Polar Form. Triple Integrals in Rectangular Coordinates. Masses and Moments in Three Dimensions. Triple Integrals in Cylindrical and Spherical Coordinates. Substitutions in Multiple Integrals. Laplace Transforms: Laplace Transform. Inverse Transform. Linearity. First Shifting Theorem (s-Shifting). Transforms of Derivatives and Integrals. ODEs. Unit Step Function (Heaviside Function). Second Shifting Theorem (t-Shifting). Short Impulses. Dirac's Delta Function. Partial Fractions. Convolution. Integral Equations. Differentiation and Integration of Transform. Systems of ODEs. Laplace Transform: General Formulas. Table of Laplace Transforms. Fourier Analysis: Fourier Series, Arbitrary Period. Even and Odd Function. Half-Rang Expansions. Forced Oscillations. Approximation by Trigonometric Polynomials. SturmLiouville Problems. Orthogonal Functions. Orthogonal Series. Generalized Fourier Series. Fourier Integral. Fourier Cosine and Sine Transforms. Fourier Transform. Power Series, Taylor Series: Sequences, Series, Convergence Tests. Power Series. Functions Given by Power Series. Taylor and Maclaurin Series. Laurent Series. Residue Integration: Laurent Series. Singularities and Zeros. Infinity. Residue Integration Method. Residue Integration of Real Integrals.

Reference Materials (or use any other standard and latest books):

1. Calculus & Analytic Geometry by Thomas, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364
3. Multivariable Calculus by James Stewart, Brooks Cole; 7th Edition (January 1, 2011). ISBN-10: 0538497874
4. Multivariable Calculus by James Stewart 6th Edition, 2007, Cengage Learning publishers.
5. Calculus and Analytical Geometry by Swokowski, Olinick and Pence, 6th Edition, 1994, Thomson Learning EMEA, Ltd.
6. Elementary Multivariable Calculus by Bernard Kolman William F. Trench, 1971, Academic Press.
7. Multivariable Calculus by Howard Anton, Albert Herr 5th Edition, 1995, John Wiley

MATH-5102 Linear Algebra

Credit Hours:	3 (3-0)
Contact Hours:	3
Pre-requisites:	

Course Introduction:

To provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Develops students fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems	C2(Understand)

Course Outline:

Algebra of linear transformations and matrices. determinants, rank, systems of equations, vector spaces, orthogonal transformations, linear dependence, linear Independence and bases, eigenvalues and eigenvectors, characteristic equations, Inner product space and quadratic forms.

Reference Materials (or use any other standard and latest books):

1. Introduction to Linear Algebra by Gilbert Strang, Wellesley Cambridge Press; latest Edition
2. Elementary Linear Algebra with Applications by Bernard Kolman, David Hill, latest Edition, Prentice Hall.

Elective Supporting Courses

BUSB-6101 Introduction to Marketing	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3 None

Course Introduction:

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	-	-

Course Outline:

Defining Marketing and the Marketing Process, Marketing: Creating and Capturing, Customer Value, Company and Marketing Strategy: Partnering to Build Customer Relationships, Analyzing the Marketing Environment, Managing Marketing Information to Gain Customer Insights, Consumer Markets and Consumer Buyer Behavior, Customer-Driven Marketing Strategy: Creating Value for Target Customers, New Product Development and Product Life-Cycle Strategies, New Product Development and Product Life-Cycle Strategies, Pricing: Understanding and Capturing Customer Value, Pricing Strategies, Marketing Channels: Delivering Customer Value, Retailing and Wholesaling, Advertising and Public Relations

Reference Materials (or use any other standard and latest books):

1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company, 8th Edition.
2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.

General Education Courses

URCG-5123 Applications of Information Communication Technologies (ICT)	
Credit Hours: **Contact Hours:** **Pre-requisites:**	**3 (2-1)** 3 None

Course Introduction:

The course introduces students to information and communication technologies and their application in the workplace. Objectives include basic understanding of computer software, hardware, and associated technologies. How computers can be used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace. Students will get basic understanding of computer software, hardware, and associated technologies. They will also learn how computers are used in the workplace, how communications systems can help to boost productivity, and how the Internet technologies can influence the workplace.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand basics of computing technology	C1 (Knowledge)
CLO-2	Do number systems conversions and arithmetic	C2 (Understand)
CLO-3	Have knowledge of types of software	C2 (Understand)
CLO-4	Have knowledge of computing related technologies	C3 (Apply)

Course Outline:

1. Introduction, Overview of Information Technology.
2. Hardware: Computer Systems & Components, Storage Devices.
3. Software: Operating Systems, Programming and Application Software.
4. Databases and Information Systems Networks.
5. File Processing Versus Database Management Systems.
6. Data Communication and Networks.
7. Physical Transmission Media & Wireless Transmission Media.
8. Applications of smart phone and usage.
9. The Internet, Browsers and Search Engines.
10. Websites and their types.
11. Email Collaborative Computing and Social Networking.
12. E-Commerce.
13. IT Security and other issues.
14. Cyber Laws and Ethics of using Social media.
15. Use of Microsoft Office tools (Word, Power Point, Excel) or other similar tools depending on the operating system.
16. Other IT tools/software specific to field of study of the students if any.

Reference Materials (or use any other standard and latest books):

1. Discovering Computers 2022: Digital Technology, Data and Devices by Misty E. Vermaat, Susan L. sebok; 17th edition.

Suggested Books

1. Computing Essentials 2021 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 26th edition.
2. Computers: Understanding Technology by Fuller, Floyd; Larson, Brian: edition 2018.

URCG-5118	Functional English
Credit Hours:	3 (3-0)
Contact Hours:	3
Pre-requisites:	None

Course Introduction:

The course aims at providing understanding of a writer's goal of writing (i.e. clear, organized and effective content and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the grammatical academic writing skills. The course would enable the students to develop argumentative writing techniques. The students would be able to logically add specific details on the topics such as facts, examples

and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in an objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation, plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	-	-

Course Outline:

1. Developing Analytical Skills
2. Transitional devices (word, phrase and expressions)
3. Development of ideas in writing
4. Reading Comprehension
5. Precis Writing
6. Developing argument
7. Sentence structure: Accuracy, variation, appropriateness, and conciseness
8. Appropriate use of active and passive voice
9. Organization and Structure of a Paragraph
10. Organization and structure of Essay
11. Types of Essays

Reference Materials (or use any other standard and latest books):

Recommended Texts

1. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). New York: Routledge.
2. Eastwood, J. (2011). A Basic English grammar. Oxford: Oxford University Press.
3. Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills (3rd ed.). Ann Arbor: The University of Michigan Press.
4. Swan, M. (2018). Practical English usage (8th ed.). Oxford: Oxford University Press.

Suggested Readings

1. Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). Longman grammar of spoken and written English. Harlow Essex: MIT Press.
2. Cresswell, G. (2004). Writing for academic success. London: SAGE.
3. Johnson-Sheehan, R. (2019). Writing today. Don Mills: Pearson.
4. Silvia, P. J. (2019). How to write a lot: A practical guide to productive academic writing. Washington: American Psychological Association
5. Thomson, A. J., & Martinet, A. V. (1986). A Practical English Grammar. Oxford: Oxford University Press

URCG- 5119	Expository Writing
Credit Hours:	3 (3-0)
Contact Hours:	3
Pre-requisites:	Functional English

Course Introduction:

This course prepares undergraduates to become successful writers and readers of English. The course helps students develop their fundamental language skills with a focus on writing so that they can gain the confidence to communicate in oral and written English outside the classroom. The course is divided into five units and takes a Project-based Learning approach. Unit themes target the development of 21st century skills and focus on self-reflection and active community engagement. The course completion will enable the students to develop communication skills as reflective and self-directed learners. They will be able to intellectually engage with different stages of writing process, and develop analytical and problem-solving skills to address various community-specific challenges.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	-	-

Course Outline:

1. Self-Reflection
   - Introduction to the basics of the writing process
   - Introduction to the steps of essay writing
   - Prewriting activities: Brainstorming, listing, clustering and freewriting
   - Practicing Outlining of the essay
2. Personalized Learning
   - Learning Process, Learning Styles, Goal Setting and Learning Plan
3. Oral Presentation
   - Structure and Significance, Content Selection and Slide Presentation, Peer Review
4. Critical Reading Skills
   - Introducing Authentic Reading (Dawn and non-specialist academic books/texts)
   - Reading Strategies and Practice: Skimming, scanning, SQW3R, Annotating, Detailed reading and note-taking, Standard Test Practice: TOEFL and IELTS, Model Review Reports and Annotated Bibliographies
5. Community Engagement
   - Student-led brainstorming on local versus global issues, Identifying research problems
   - Drafting research questions, Drafting interview/survey questions for community research (in English or L1)
   - Engaging students in Critical reading, Presenting interview/ survey information, Field work,
   - Writing Community Engagement Project
6. Letter to the Editor
   - Types of letters, Format and purpose of letter to the editor, Steps in writing letter-to-editor

Reference Materials (or use any other standard and latest books):

1. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). New York: Routledge.
2. Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills (3rd ed.). Ann Arbor: The University of Michigan Press.

Suggested Readings

1. Cresswell, G. (2004). Writing for academic success. London: SAGE.
2. Johnson-Sheehan, R. (2019). Writing today. Don Mills: Pearson.
3. Silvia, P., J. (2019). How to write a lot: A practical guide to productive academic writing.

Washington: American Psychological Association.

URCQ-5101 Discrete Structures

Credit Hours:	3 (3-0)
Contact Hours:	3
Pre-requisites:	-

Course Introduction:

Introduces the foundations of discrete mathematics as they apply to Computer Science, focusing on providing a solid theoretical foundation for further work. Further, this course aims to develop understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, abstract algebra, iterative procedures, predicate calculus, tree and graph structures. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the key concepts of Discrete Structures such as Sets, Permutations, Relations, Graphs and Trees etc.	C2 (understand)
CLO-2	Apply formal logic proofs and/or informal, but rigorous, logical reasoning to real problems, such as predicting the behavior of software or solving problems such as puzzles.	C3 (Apply)
CLO-3	Apply discrete structures into other computing problems such as formal specification, verification, databases, artificial intelligence, and cryptography.	C3 (Apply)
CLO-4	Differentiate various discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular	C4 (Differentiate)

Course Outline:

Mathematical reasoning, propositional and predicate logic, rules of inference, proof by induction, proof by contraposition, proof by contradiction, proof by implication, set theory, relations, equivalence relations and partitions, partial orderings, recurrence relations, functions, mappings, function composition, inverse functions, recursive functions, Number Theory, sequences, series, counting, inclusion and exclusion principle, pigeonhole principle, permutations and combinations. Algorithms, Searching and Sorting Algorithms, elements of graph theory, planar graphs, graph coloring, Graph Algorithms, euler graph, Hamiltonian path, rooted trees, traversals.

Reference Materials (or use any other standard and latest books):

1. Schaum's Outline of Discrete Mathematics, Fourth Edition, 2021
2. Discrete Mathematics and Its Applications, 8th edition by Kenneth H. Rosen, 2018
3. Discrete Mathematics with Applications, 5th Edition by Susanna S. Epp, 2019
4. Discrete Mathematics, 7th edition by Richard Johnson Baugh, 2007

URCQ-5102 Calculus and Analytic Geometry	
Credit Hours:	3 (3-0)
Contact Hours:	3
Pre-requisites:	-

Course Introduction:

To provide foundation and basic ground for calculus and analytical geometry background.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
-	-	

Course Outline:

Limits and Continuity; Introduction to functions, Introduction to limits, Techniques of funding limits, Indeterminate forms of limits, Continuous and discontinuous functions and their applications, Differential calculus; Concept and idea of differentiation, Geometrical and Physical meaning of derivatives, Rules of differentiation, Techniques of differentiation, Rates of change, Tangents and Normals lines, Chain rule, implicit differentiation, linear approximation, Applications of differentiation; Extreme value functions, Mean value theorems, Maxima and Minima of a function for single-variable, Concavity, Integral calculus; Concept and idea of Integration, Indefinite Integrals, Techniques of integration, Riemann sums and Definite Integrals, Applications of definite integrals, Improper integral, Applications of Integration; Area under the curve, Analytical Geometry; Straight lines in R3, Equations for planes.

Reference Materials (or use any other standard and latest books):

1. Calculus and Analytic Geometry by Kenneth W. Thomas.
2. Calculus by Stewart, James.
3. Calculus by Earl William Swokowski; Michael Olinick; Dennis Pence; Jeffery A. Cole

URCG-5105 Islamic Studies	
Credit Hours:	2 (2-0)
Contact Hours:	2
Pre-requisites:	-

Course Introduction:

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources of Islam; Qur'aan and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational basis of Islam in fields that include Qur'aanic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'aan and Sunnah.

- To make students understand the relevance and pragmatic significance of Islam in their lives.
- To make learners comprehend the true spirit of Islam with reference to modern world.

- To generate a sense of Islamic principles as a code of living that guarantee the effective solutions to the current challenges of being.
- To provide Basic information about Islamic Studies
- To enhance understanding of the students regarding Islamic Civilization
- To improve Students skill to perform prayers and other worships
- To enhance the skill of the students for understanding the issues related to faith and religious life.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	To further enhance the knowledge of Islam.	
CLO-2	To understand the basic concept of Islam and Quran Pak.	
CLO-3	To understand the concept of Haqooqulibad in the light of Quran.	
CLO-4	To know the importance of Islamic concept about other religions.	

Course Outline:

1. Introduction to Qur'aanic Studies — تعارف قرآن مجید

1) Basic Concepts of Qur'aan — قرآن مجید کا بنیادی تعارف
2) History of the compilation of Qur'aa — تاریخ جمع و تدوین قرآن مجید
3) Uloom-ul-Qur'aan — علوم القرآن

مطالعہ قرآن (تعارف قرآن مجید ، منتخب آیات کا ترجمہ و تفسیر سورۃ البقرہ آیات 1-5-284-286 سورۃ الحجرات آیات 1-18 - سورۃ الفرقان آیات 77-63؛ سورۃ المومنون آیات 1-11 سورۃ الاحزاب آیات 6، 21-32 33-5640 59 سورۃ الانعام آیات 151-153، سورۃ الصف آیات 1 - 14: الحشر آیات 18 - 20 آل عمران آیات 190 - 192 النحل آیات 12-14 : لقمٰن آیت 20 ، حم السجدہ آیت 53

2. Introduction to Hadith — تعارف حدیث
1) Legal Status of Hadith — حدیث کی قانونی
2) History of the compilation of Hadith — حیثیت ترین جمع وتدوین حدیث
3) Classifications of Hadith — حدیث کی اقسام

متن حدیث: درج ذیل موضوعات پر احادیث کا مطالعہ
1- اعمال کا اجر نیت پر منحصر ہے- 2- بہترین انسان قرآن کا طالب علم اور اس کا معلم ہے 3- کتاب وسنت گمراہی سے بچنے کا ذریعہ ہیں 4- ارکان اسلام 5- اسلام، ایمان، احسان اور قیامت کی نشانیاں 6- بچوں کو نماز کی تلقین 7- دین کا گہرا فہم اللہ کی خاص عنا یت ہے 8 حصول علم، تلاوت قرآن اور عمل کی اہمیت و فضیلت 9- روز محشر میں ہونے والا محاسبہ 10- حقوق اللہ کے ساتھ ساتھ حق العباد کالحاظ رکھنا بھی لازم ہے 11- حسن خلق کی عظمت اور فحش و بد گوئی کی مذمت 12 - دنیا و آخرت کی بھلائی کی ضامن چار چیزیں 13- ہلاک کر دینے والی سات چیزیں - 14- بے عمل مبلغ کا عبرت ناک انجام 15 - ہر شخص نگران ہے اور ہر شخص مسئول

3. Sirah of the Prophet (PBUH) — سیرت النبی ﷺ

1. Significance of Seerah Studies — مطالعہ سیرت کی ضرورت واہمیت
2. Prophetic principles of Character building — تعمیر سیرت و شخصیت کا نبوی منہاج

اقامت دین کا نبوی طریق کار ا قامت دین بعید خلافت را شدہ، میثاق مدینہ ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ ، قرآن مجید میں سیرت سرور عالم کا بیان، غردات نبوی ﷺ کے مقاصد و حکمتیں 4. Islamic Culture & Civilization — اسلامی تہذیب و تمدن 1) Basic Concepts of Islamic Civilization — اسلامی تہذیب کا مفہوم 2) Historical evaluation of Islamic Civilization — اسلامی تہذیب کا تاریخی ارتقاء 3) Salient feature of Islamic Civilization — اسلامی تہذیب کی نمایاں خصوصیات 4) Islamic Civilization and Contemporary Issues — اسلامی تہذیب و تمد ن اور معاصر مسائل اسلامی تہذیب کے عوامل و عناصر ، اسلامی تہذیب کے علمی، معاشرتی اور سماجی اثرات، تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ، تہزیبی تصادم کے اثرات و نتائج ، طبیعی، حیاتیاتی اور معاشرتی علوم میں مسلمانوں کا کردار، نامور مسلمان سائنسدان
Reference Materials (or use any other standard and latest books):
1) Hameed Ullah Muhammad, -Emergence of Islam, IRI, Islamabad 2) Hameed Ullah Muhammad, Muslim Conduct of State 3) Hameed Ullah Muhammad, Introduction to Islam 4) Ahmad Hasan, -Principles of Islamic Jurisprudence, Islamic Research Institute, International Islamic University, Islamabad (1993) 5) Dr. Muhammad Zia-ul-Haq,-Introduction to Al Sharia Al Islamia, Allama Iqbal Open University, Islamabad(2001) 6) Dr. Muhammad ShahbazManj, Teleecmat-e-Islam

URCG-5126	**ETHICS**
Credit Hours:	2 (2-0)
Contact Hours:	2
Pre-requisites:	-
Course Introduction:	

CLO No.	**Course Learning Outcomes**	**Bloom Taxonomy**
CLO-1		
CLO-2		
CLO-3		
CLO-4		
Course Outline:		

1. Meaning and Scope of Ethics.
2. Relation of Ethics with:
   (a) Religion
   (b) Science
   (c) Law
3. Historical Development of Morality:
   (a). Instinctive Moral Life.
   (b). Customary Morality.
   (c). Reflective Morality.
4. Moral Theories:
   (a). Hedonism (Mill)
   (b). Intuitionism (Butler)
   (c). Kant's Moral Theory.
5. Moral Ethics and Society.
   (a). Freedom and Responsibility.
   (b). Tolerance
   (c). Justice
   (d). Punishment (Theories of Punishment)
6. Moral Teachings of Major Religions:
   a). Judaism
   b). Christianity
   c). Islam
7. Professional Ethics:
   a). Medical Ethics
   b). Ethics of Students
   c). Ethics of Teachers
   d). Business Ethics

Reference Materials (or use any other standard and latest books):

1. William Lille. An Introduction to Ethics., London Methuen & Co. latest edition.
2. Titus, H.H. Ethics for Today. New York: American Book, latest edition.
3. Hill, Thomas. Ethics in Theory and Practice. N.Y. Thomas Y. Crowel, latest edition
4. Ameer Ali, S. The Ethics of Islam. Culcutta: Noor Library Publishers, latest edition
5. Donaldson, D.M. Studies in Muslim Ethics. London: latest edition. 6. Sayeed, S.M.A.(Tr.) Ta'aruf-e-Akhlaqiat. Karachi: BCC&T, University ofKarachi

URCG-5111	Translation of the Holy Quran - I
Credit Hours:	Non-Credit
Contact Hours:	-
Pre-requisites:	None

Course Introduction:

This course is designed to develop the recitation skills in students.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	To familiarize the students to keys and fundamentals of	-

	recitation of the holy Quran.	
CLO-2	To develop the skill of the students of recitation the last revelation.	-
CLO-3	Students will learn the basic Arabic grammar in a practical way.	-
CLO-4	To develop an eagerness among the students to explore the last divine Book.	-

Objectives

- To familiarize the students to keys and fundamentals of recitation of the holy Quran.
- To develop the skill of the students of recitation the last revelation.
- Students will learn the basic Arabic grammar in a practical way.
- To develop an eagerness among the students to explore the last divine Book.

Course Outline:

- تیسواں پارہ - ناظرہ مع تجوید
- بنیادی عربی گرامر

اسم اور اسکے متعلقات : اسم فاعل ،مفعول ،تفضیل ،مبالغہ

فعل اور اسکی اقسام : ماضی ،مضارع ،امر ، نہی

- حرف اور اسکی اقسام : حروف علت ،حروف جارہ ،مشبہ بالفعل

Memorization:

تیسویں پارے کی آخری بیس سورتیں (حفظ مع ترجمہ)

URCG-5111	Translation of the Holy Quran - II
Credit Hours:	Non-Credit
Contact Hours:	-
Pre-requisites:	None

Course Introduction:

In some discipline 3rd semester and in some discipline 4th Semester/ ADP Program 2nd Year

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Students will come to know about the real nature, significance and relevance of the Islamic beliefs in light of the text of the Holy Quran.	-
CLO-2	Students will seek knowledge of translation and transliteration of the Holy Book Quran.	-
CLO-3	To familiarize the students with the concept of Ibādah (Its significance, scope and relevance) and its types in Islam.	
CLO-4	Students will learn literal and idiomatic way of translation of the Holy Book.	-
CLO-5	Students will learn about the polytheism and its incompatibility in Islam highlighted by the Holy Quran.	-
CLO-6	To highlight the significance of learning through using all human faculties provided by the almighty Allah and	-

	familiarize the students about condemnation of ignorance mentioned in the Quranic text.	
CLO-7	To develop Awareness among the students about rights and duties of different circles of society in the light of Holy Quran.	-
CLO-8	To introduce the students to Quranic Arabic grammar in practical manner.	-

Objectives

- Students will come to know about the real nature, significance and relevance of the Islamic beliefs in light of the text of the Holy Quran.
- Students will seek knowledge of translation and transliteration of the Holy Book Quran.
- To familiarize the students with the concept of Ibādah (Its significance, scope and relevance) and its types in Islam.
- Students will learn literal and idiomatic way of translation of the Holy Book.
- Students will learn about the polytheism and its incompatibility in Islam highlighted by the Holy Quran.
- To highlight the significance of learning through using all human faculties provided by the almighty Allah and familiarize the students about condemnation of ignorance mentioned in the Quranic text.
- To develop Awareness among the students about rights and duties of different circles of society in the light of Holy Quran.
- To introduce the students to Quranic Arabic grammar in practical manner.

Course Outline:

- ایمانیات اور عبادات
  - اللہ پر ایمان ،فرشتوں پر ایمان ،رسولوں پر ایمان ،آسمانی کتابوں پر ایمان
  - یوم آخرت پر ایمان ، تقدیر پر ایمان
  - نماز ،روزہ ،زکوۃ،حج ،جہاد
- معاشرے کے حقوق
  - خاندان کی تکوین
  - حق مہر
  - رضاعت و حمل
  - اولاد کو قتل کرنے کے ممانعت
  - شوہر کی نافرمانی
  - طلاق
  - بیوہ کی عدت کے احکام
  - نکاح کا پیغام بھیجنا
  - عورت کی وراثت(اس کے شوہر کی طرف سے)
  - والدین کے حقوق
  - بیویوں اور اولاد کے بیچ عداوت
- خاندان کے حقوق
  - مہمان کی عزت
  - اجازت طلب کرنے کے اصول
  - مجلس کے آداب
  - تعاون اور بھائی چارہ
  - گروہ بندی
  - محبت
  - لوگوں کے درمیان صلح
  - عفو ودرگزر، غصہ پر قابو اور معاف کرنا

• شعوب و قبائل • لوگوں کے بیچ اختلافات • حمایت و نگہبانی
Grammar:
قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of Chapters and verse Numbers:
منتخب آیات مع ترجمہ وتجوید
▪ البقرہ ((۱۷۷، ۲۳۸، ۴۵، ۲۷۷، ۲۱۹، ۱۱۰، ۴۵، ۱۵۳، ۲۴۷، ۲۰۱، ۲۸۵، ۳۴، ۲۸۵، ۱۵، ۱۲۹، ۲۵۳، ۹۸، ۶۲، ۱۲۶، ۲۸۵، ۲۵۶، ۱۷۷، ۱۳۶، ۱۸۹، ۲۰۰، ۱۸۴، ۱۸۳، ۲۱۸، ۱۵۸، ۲۴۱،۱۹۹، ۲۲۷، ۲۲۶، ۲۳۷، ۲۲۸، ۲۲۹، ۲۳۱، ۲۳۷، ۲۳۵، ۲۳۰ ، ۸۲ ، ۱۸۴، ۲۳۳، ۱۸۲، ۱۶۰، ۸۳ (▪ النساء ،۲۴ ،۱۷۶ ،۴ ،۱۱ ،۳۴ ،۱۲۸ ،۳۵ ،۱۲ ،۱۷۶ ،۳۶ ،۸۶،۸۰ ،۶۹ ،۱۳ ،۸۰ ،۶۹ ،۱۳۶ ،۵۹ ،۹۲ ،۹۵) (۸۱ ،۱۲۸ ،۵۴ ،۱۴۶ ،۱۶ ،۱ ،۲۰ ،۱ ،۶ ،۱۹۱ ،۳۵ ،۲۰ ،۳۵ ،۱۹۱ ،۱۲۸ ،۱۱ ،۱۱ ،۲۵ ▪ الانعام(۵۴ ،۴۸ ،۱۵۱ ،۱۳۷،۱۴،۹۲ ،۲۲) ▪ آل عمران(۱۹،۱ ،۱۴۴ ،۸۴ ،۱۲۵ ،۸۵ ،۳۹ ،۹۷) ▪ المائدہ(۵ ،۲ ،۸۲ ،۱۹،۳۹ ،۹۲ ،۲ ،۵۴) ▪ الاعراف(۱۸۹ ،۱۸۹ ،۳۵) ▪ التوبہ(۷۱،۱۶ ،۲۰) ▪ ہود(۱۲) ▪ الزمر(۶) ▪ النور(۲۹ ،۶۰ ،۲۷ ،۲۸،۵۲ ،۵۴) ▪ محمد(۳۳) ▪ انفال(۲۰ ،۸۲) ▪ الرعد(۳) ▪ الطلاق(۴) ▪ الحج(۵) ▪ ابراہیم ((۲۳،۴۴(▪ الاسراء(۲۴ ،۲۳) ▪ الاحقاف(۱۵) ▪ المومنون(۲۷) ▪ العنکبوت(۸ ،۲۵،۴۸) ▪ النحل(۲۲) ▪ لقمان(۱۴ ،۱۵،۴) ▪ الاحزاب ((۳۵، ۵۰،۳۸، ۴۹(▪ الشعراء(۷) ▪ الروم(۲۱) ▪ مریم(۱۴،۲۶) ▪ المجادلہ(۱۱ ،۱۲)

URCG-5128 **Pakistan Studies**

PAKISTAN STUDIES

UGE POLICY V1.1 : GENERAL EDUCATION COURSE

Credits:	02
Pre-Requisite:	Nil
Offering:	Undergraduate Degrees
Placement:	1st & 5th Semesters
Type:	General Education
Fields:	All

DESCRIPTION

This course is designed to provide students with a comprehensive exploration of Pakistan's identity, spanning geographical, historical, and cultural dimensions. It delves into the diverse landscapes, ancient civilizations, and rich cultural heritage that define Pakistan. Moreover, it examines the socio-cultural and political transformations in Pakistan over time including democratic transitions and military interventions. The aim of this course is to inculcate in students a nuanced understanding of Pakistan's past, present, and potential future trajectories, enabling them to critically evaluate the complex dynamics shaping the nation's development.

COURSE LEARNING OUTCOMES

By the end of this course, students will be able to:

1. Have enhanced knowledge of the geographical, historical, and political aspects of Pakistan.
2. Understand the society and culture of Pakistan.
3. Understand and explain the socio-economic developments in Pakistan.
4. Explore contemporary issues and challenges faced by Pakistan and their implications for the future.

SYLLABUS

1. **Introduction to Pakistan:**
   - Geographical location and significance.
   - Historical background: Ancient civilizations in the region.
   - Factors leading to the creation of Pakistan.
2. **Political History of Pakistan:**
   - Formative phase.
   - Military interventions and democratic transitions.
3. **Geography of Pakistan:**
   - Physiography: Mountains, plains, plateaus, deserts, valleys and coastal areas.
   - River systems: Indus River and its tributaries.
   - Climatic regions of Pakistan.
4. **Society and Culture of Pakistan:**
   - Socio-cultural diversity.
   - Languages and literature of Pakistan.
5. **Economic Development of Pakistan:**
   - Agriculture and industrial sectors of Pakistan.
   - Economic challenges of Pakistan.

6. **Contemporary Issues:**
   - Foreign relations of Pakistan.
   - Security challenges: terrorism, extremism, and regional conflicts.
   - Environmental problems and sustainable development (SDGs).
   - Media and social change.

SUGGESTED INSTRUCTIONAL / READING MATERIALS

1. "Jinnah of Pakistan" by Stanley Wolpert
2. "The Sole Spokesman: Jinnah, the Muslim League, and the Demand for Pakistan" by Ayesha Jalal
3. "The struggle for Pakistan" by Ishtiaq Husain Qureshi
4. "Pakistan, the Formative Phase, 1857-1948" by Khalid B. Sayeed
5. "Pakistan Studies: A Book of Readings" by Sikandar Hayat
6. "Constitutional and Political History of Pakistan" by Hamid Khan
7. "Trek to Pakistan" by Ahmad Saeed and Kh. Mansur Sarwar
8. "Pakistan: A Modern History" by Ian Talbot
9. "Politics in Pakistan: The Nature and Direction of Change" by Khalid B. Sayeed
10. "Physical Geography of Pakistan" by Umar Jahangir
11. "A Geography of Pakistan: Environment, People, and Economy" by Fazle Karim Khan
12. "Pakistan's Foreign Policy: An Historical Analysis" by S.M. Burke
13. "Separatism in East Pakistan" by Rizwan Ullah Kokab
14. "Being Pakistani: Society, Culture and the Arts" by Raza Rumi
15. "Pakistan's Cultural Heritage: Socio-Economic and Technological Aspects" edited by Abdul Jabbar Khan
16. "Language and Politics in Pakistan" by Tariq Rahman
17. "Sociology" by Horton and Hunt
18. "Pakistan in the Twentieth Century: A Political History" by Lawrence Ziring
19. "Economic Development of Pakistan" by Ishrat Husain
20. "Issues in Pakistan's Economy" by S. Zaidi

Restructuring of Semester III and Semester IV for Fall 2024 and Spring 2025 Admissions offered in Affiliated Colleges

Semester III

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5205	CMPC-5202	Data Structures	Core	4 (3-3)
2	CMPC-5207		Artificial Intelligence	Core	3 (2-3)
3	CSDE-5204		Advance Programming Lab	Domain Elective	3(0-9)
4	CSDE-5202		Web Technologies	Domain Elective	3(2-3)
5	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	Core	3 (2-3)
6	CMPC-5101		Software Engineering	Core	3 (3-0)
7	**URCG-5128**		**Pakistan Studies**	**GER**	**2(2-0)**
				Total Credit Hours	**21 (14-21)**

Semester IV

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-5206		Information Security	Core	3 (2-3)
2	CSDE-6202		Mobile Application Development-I	Domain Elective	3(3-0)
3	DSDE-5102	CMPC-5203	Database Administration and Management	Domain Elective	3 (2-3)
4	URCG-5105		Islamic Studies/ Ethics	GER	2 (2-0)
	URCG-5126		Ethics*		
5	CSDC-5101		Theory of Automata	Domain Core	3 (3-0)
6	**MATH-5101**	**URCQ-5102**	**Multivariable Calculus**	**MATH**	**3 (3-0)**
7	URCG-5111		Translation of Holy Quran-II	GER	0 (1-0)
8	**CMPC-5204**		**Digital Logic and Design**	**Core**	**3 (2-3)**
				Total Credit Hours	**20 (18-09)**