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

Revised Curriculum
of
BS 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 BS Computer Science Program

BSCS 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 BS 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

BSCS 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.

BSCS 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; Algorithm Design and Analysis	Data structures, Analysis of Algorithms, Theory of Automata
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

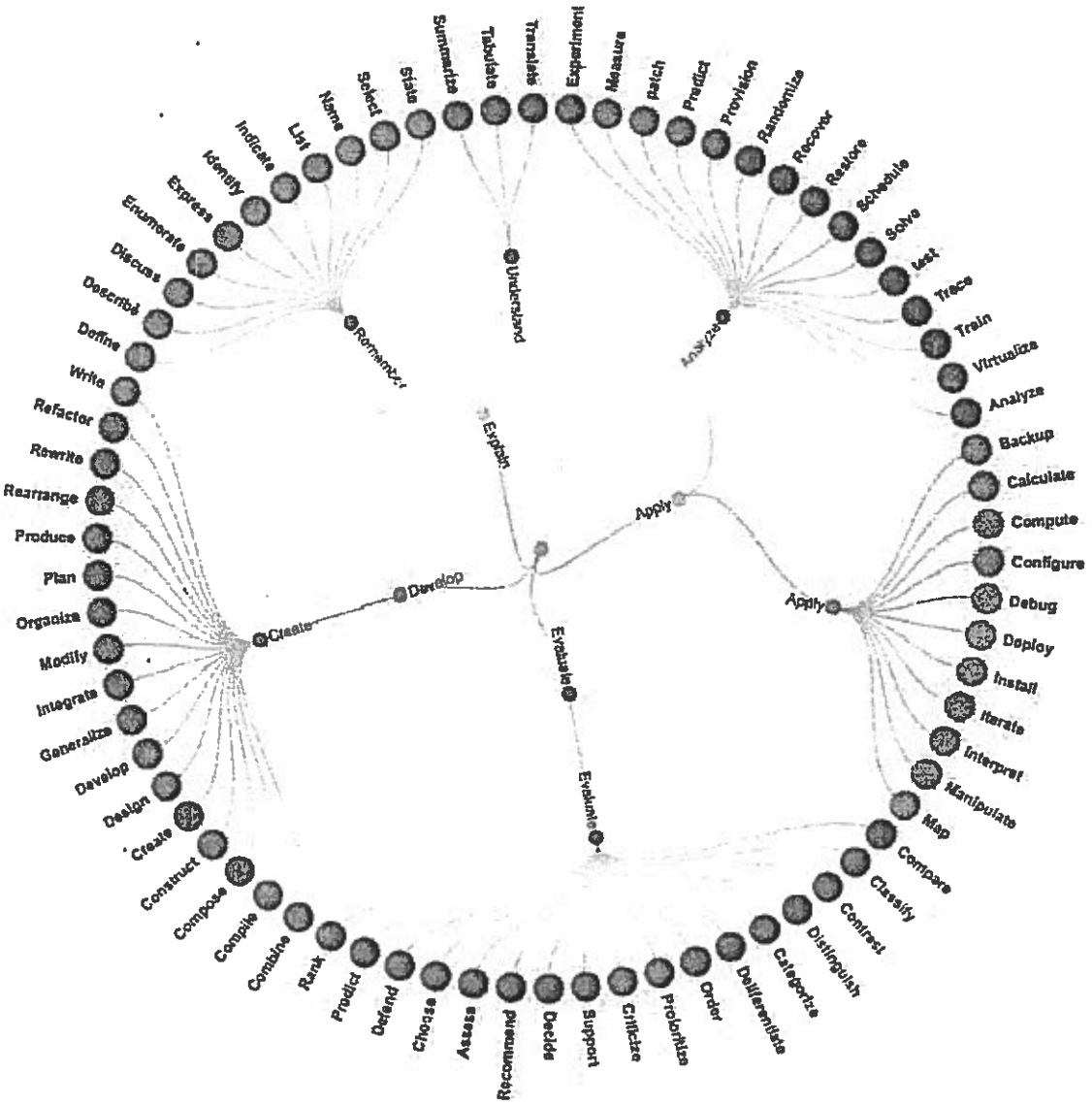
philosophy to Outcome based education (OBE) system, the OBE model based on Seoul Accord has also been considered. Computing programs prepare students to attain educational objectives by ensuring that students demonstrate achievement of the following outcomes (derived from Graduate Attributes define by 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 computingspecialization, 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 BS 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 132 for the BS Computer Science program.

Duration

The program shall comprise of minimum eight semesters/terms spread over four 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 BSCS is given as follows:

BS Computer Science			
Category	**Major Areas**	**Credit Hours**	**Courses**
General education	General Education Requirement	32	13

Major courses	Computing core	46	14
	Domain core	18	06
	Domain elective	24	08
Interdisciplinary courses	Mathematics & supporting	09	03
	Elective supporting	03	01
		132	45

Mapping of BS Computer Science Program on the Generic Structure

Computing Core Courses – 46 Credit Hours (14 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-5208		Computer Networks	3 (2-3)
9	3	CMPC-5101		Software Engineering	3 (3-0)
10	4	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	3 (2-3)
11	5	CMPC-6201		Operating Systems	3 (2-3)
12	7	CMPC-6101		Analysis of Algorithms	3 (3-0)
13	7	CMPC-6702		Final Year Project - I	2 (0-6)

14	8	CMPC-6703	CMPC-6702	Final Year Project - II	4 (0-12)

Domain Core – 18 Credit Hours (6 Courses)					
Sr #	Sem #	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	4	CSDC-5101		Theory of Automata	3 (3-0)
2	4	CSDC-5102		Advanced Database Management Systems	3 (3-0)
3	5	CSDC-6201		HCI & Computer Graphics	3 (3-0)
4	5	CSDC-6202		Computer Architecture	3 (3-0)
5	6	CSDC-6203		Compiler Construction	3 (3-0)
6	6	ITDC-6204		Parallel & Distributed Computing	3 (3-0)

Domain Elective – 24 Credit Hours (8 Courses)					
Sr #	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	3/4/5	ITDC-5201		Web Technologies	3 (3-0)
2	4/5/6	CSDE-6202		Mobile Application Development - I	3 (3-0)
3	5/6/7	ITDC-5202		Cyber Security	3 (3-0)
4	5/6/7	CSDE-6505		Introduction to Large Language Models	3 (3-0)
5	5/6/7	CSDE-6209		Semantic Web	3 (3-0)
6	5/6/7	SEDC-6202		Software Project Management	3 (3-0)
7	5/6/7	DSDC-5201		Introduction to Data Science	3 (3-0)
8	5/6/7	DSDC-6203		Data Warehousing & Business Intelligence	3 (3-0)
9	5/6/7	DSDE-6201		Big Data Analytics	3 (3-0)
10	5/6/7	AIDC-6101		Computer Vision	3 (3-0)
11	5/6/7	CSDE-6501		MERN Stack Development	3 (3-0)
12	5/6/7	CSDE-6502		Django Web Framework	3 (3-0)
13	5/6/7	CSDE-6503		Introduction to DevOps	3 (3-0)
14	5/6/7	CSDE-6504		Software Testing & Quality Assurance	3 (3-0)
15	5/6/7	DSDE-5102		Database Administration and Management	3 (2-3)
16	3/4/5	CSDE-5204		Advance Programming Lab	3 (0-9)

Preliminary Courses for Pre-Medical Students – Non-Credit Hour (2 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 – 09 Credit Hours (3 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)
3	3	MATH-5103		Probability & Statistics	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 – 32 Credit Hours (13 Courses)					
Sr#	Sem#	Code	Pre-Req	Course Title	CH (Theory-Lab)
1	1	URCG-5123		Applications 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)
11	8	URCG-5122		Ideology and Constitution of Pakistan	2 (2-0)
12	8	URCS-6101		Professional Practices	2 (2-0)
13	8	URCG-5125		Civics and Community Engagement	2 (2-0)
14	7	URCG-5124		Entrepreneurship	2 (2-0)
15	7	ENGL-6101	URCG-5118	Technical & Business Writing	3 (3-0)
16	5	URCA-5101		Introduction to Management	2 (2-0)
17	6	URCG-5111		Translation of Holy Quran-III	0 (1-0)
18	8	URCG-5111		Translation of Holy Quran-IV	0 (1-0)

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 BS Computer Science Program
Main Campus

(132 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	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	Elective supporting	3 (3-0)
7	URCM-5107		*Mathematics-I	PREL	0(3-0)
*For 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)
*For 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-5201	Data Structures	Core	4 (3-3)
2	CMPC-5207		Artificial Intelligence	Core	3 (2-3)
3	CSDE-5204		Domain Elective-I	Domain Elective	3 (0-9)
4	CSDE-5202		Domain Elective-II	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		Domain Elective-III	Domain Elective	3 (3-0)
3	DSDE-5102		Domain Elective-IV	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

Semester V

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6201		Operating Systems	Core	3 (2-3)
2	CMPC-5208		Computer Networks	Core	3 (2-3)
2	CSDC-6201		HCI & Computer Graphics	Domain Core	3 (3-0)
3	CSDC-6202		Computer Architecture	Domain Core	3 (3-0)
4	CSDC-6203		Compiler Construction	Domain Core	3 (3-0)
5	DSDC-5201		Domain Elective-V	Domain Elective	3 (3-0)
6	URCA-5101		Introduction to Management	GER	2 (2-0)
				Total Credit Hours	**20 (18-06)**

Semester VI

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CSDC-5102		Advance Data Base Management System	Domain Core	3 (3-0)
2	ITDC-6204		Parallel & Distributed Computing	Domain Core	3 (3-0)
3	SEDC-6202		Domain Elective-VI	Domain Elective	3 (3-0)
4	CSDE-6501		Domain Elective-VII	Domain Elective	3 (3-0)
5	CSDE-6502		Domain Elective-VIII	Domain Elective	3 (3-0)
6	URCG-5111		Translation of Holy Quran-III	GER	0 (1-0)
				Total Credit Hours	**15 (16-0)**

Semester VII

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6702		Final Year Project - I	Core	2 (0-6)
2	CMPC-6101		Analysis of Algorithms	Core	3 (3-0)
3	MATH-5103		Probability & Statistics	MATH	3 (3-0)
4	ENGL-6101	URCG-5118	Technical & Business Writing	GER	3 (3-0)
5	URCG-5124		Entrepreneurship	GER	2 (2-0)
			Total Credit Hours		**13 (11-6)**

Semester VIII

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6703	CMPC-6702	Final Year Project - II	Core	4 (0-12)
2	URCG-5122		Ideology and Constitution of Pakistan	GER	2 (2-0)
3	URCS-6101		Professional Practices	GER	2 (2-0)
4	URCG-5125		Civics and Community Engagement	GER	2 (2-0)
5	URCG-5111		Translation of Holy Quran-IV	GER	0 (1-0)
			Total Credit Hours		**10 (7-12)**

Scheme of Studies for BS Computer Science Program Affiliated Colleges

(132 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	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	Elective supporting	3 (3-0)
7	URCM-5107		*Mathematics-I	PREL	0(3-0)
*For 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)
*For 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-5201	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		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 (16-6)**

*Ethics for Non- Muslim students

Semester V

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6201		Operating Systems	Core	3 (2-3)
2	CMPC-5208		Computer Networks	Core	3 (2-3)
2	CSDC-6201		HCI & Computer Graphics	Domain Core	3 (3-0)
3	CSDC-6202		Computer Architecture	Domain Core	3 (3-0)
4	CSDC-6203		Compiler Construction	Domain Core	3 (3-0)
5	DSDC-5201		Introduction to Data Science	Domain Core	3 (3-0)
6	URCA-5101		Introduction to Management	GER	2 (2-0)
				Total Credit Hours	**20 (18-06)**

Semester VI

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CSDC-5102		Advance Data Base Management System	Domain Core	3 (3-0)
2	ITDC-6204		Parallel & Distributed Computing	Domain Core	3 (3-0)
3	SEDC-6202		Software Project Management	Domain Elective	3 (3-0)
4	CSDE-6501		MERN Stack Development	Domain Elective	3 (3-0)
5	CSDE-6502		Django Web Framework	Domain Elective	3 (3-0)
6	URCG-5111		Translation of Holy Quran-III	GER	0 (1-0)
				Total Credit Hours	**15 (16-0)**

Semester VII

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6702		Final Year Project - I	Core	2 (0-6)
2	CMPC-6101		Analysis of Algorithms	Core	3 (3-0)
3	MATH-5103		Probability & Statistics	MATH	3 (3-0)
4	ENGL-6101	URCG-5118	Technical & Business Writing	GER	3 (3-0)
5	URCG-5124		Entrepreneurship	GER	2 (2-0)
				Total Credit Hours	**13 (11-6)**

Semester VIII

S#	Code	Pre-requisite	Course Title	Domain	CH (Theory-Lab)
1	CMPC-6703	CMPC-6702	Final Year Project - II	Core	4 (0-12)

2	URCG-5122		Ideology and Constitution of Pakistan	GER	2 (2-0)
3	URCS-6101		Professional Practices	GER	2 (2-0)
4	URCG-5125		Civics and Community Engagement	GER	2 (2-0)
5	URCG-5111		Translation of Holy Quran-IV	GER	0 (1-0)
				Total Credit Hours	**10 (7-12)**

Computing Core Courses

CMPC-5201 Programming Fundamentals	
Credit Hours: **Contact Hours:** **Pre-requisites:**	4 (3-1) 3-3 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. Object Oriented Programming in C++ latest edition by Robert Lafore. 2. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel 3. Starting Out with Programming Logic and Design: latest edition by Tony Gaddis. 4. 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. Object Oriented Programming in C++ latest edition by Robert Lafore.
2. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel
3. Starting Out with Programming Logic and Design: latest edition by Tony Gaddis.
4. 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.

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:	
Contact Hours:	4 (3-1) 3-3
Pre-requisites:	Object Oriented Programming

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:	3 (2-1)
Contact Hours:	2-3
Pre-requisites:	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: **Contact Hours:** **Pre-requisites:**	3 (2-1) 2-3 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-5208 Computer Networks

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

Course Introduction:

This course introduces the basic concept of computer network to the students. Network layers, Network models (OSI, TCP/IP) and protocol standards are part of the course.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Describe the key terminologies and technologies of computer networks	C2 (Describe)
CLO-2	Explain the services and functions provided by each layer in the Internet protocol stack.	C2 (Explain)
CLO-3	Identify various internetworking devices and protocols and their functions in a networking	C4 (Identify)
CLO-4	Analyze working and performance of key technologies, algorithms and protocols	C4 (Analyze)
CLO-5	Build Computer Network on various Topologies	P3 (Build)

Course Outline:

Introduction and protocols architecture, basic concepts of networking, network topologies,

layered architecture, physical layer functionality, data link layer functionality, multiple access techniques, circuit switching and packet switching, LAN technologies, wireless networks, MAC addressing, networking devices, network layer protocols, IPv4 and IPv6, IP addressing, sub netting, CIDR, routing protocols, transport layer protocols, ports and sockets, connection establishment, flow and congestion control, application layer protocols, latest trends in computer networks.
Reference Materials (or use any other standard and latest books):
1. Computer Networking: A Top-Down Approach Featuring the Internet, 6th edition by James F. Kurose and Keith W. Ross 2. Computer Networks, 5th Edition by Andrew S. Tanenbaum 3. Data and Computer Communications, 10th Edition by William Stallings 4. Data Communication and Computer Networks, 5th Edition by Behrouz A. Forouzan

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: **Contact Hours:** **Pre-requisites:**	3 (2-1) 2-3 Digital Logic Design
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.

CMPC-6201 Operating Systems	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (2-1) 2-3 Data Structures
Course Introduction:	
To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.	

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the characteristics of different structures of the Operating Systems and identify the core functions of the Operating Systems	C2 (Understand)
CLO-2	Analyze and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance	C5 (Evaluate)

	issues with regard to the core functions	
CLO-3	Demonstrate the knowledge in applying system software and tools available in modern operating systems.	C3 (Demonstrate)

Course Outline:

Operating systems basics, system calls, process concept and scheduling, inter-process communication, multithreaded programming, multithreading models, threading issues, process scheduling algorithms, thread scheduling, multiple-processor scheduling, synchronization, critical section, synchronization hardware, synchronization problems, deadlocks, detecting and recovering from deadlocks, memory management, swapping, contiguous memory allocation, segmentation & paging, virtual memory management, demand paging, thrashing, memory-mapped files, file systems, file concept, directory and
disk structure, directory implementation, free space management, disk structure and scheduling, swap space management, system protection, virtual machines, operating system security

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

1. Modern Operating Systems, 5th edition by Andrew S. Tanenbaum, 2022
2. Operating Systems: Three Easy Pieces,byRemzi H Arpaci-Dusseau and Andrea C Arpaci-Dusseau,1st Edition, 2018
3. Operating Systems Concepts, 9th edition by Abraham Silberschatz,2012
4. Operating Systems, Internals and Design Principles, 9th edition by William Stallings, 2017

CMPC-6101 Analysis of Algorithms

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

Course Introduction:

Detailed study of the basic notions of the design of algorithms and the underlying data structures. Several measures of complexity are introduced. Emphasis on the structure, complexity, and efficiency of algorithms.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Explain what is meant by "best", "expected", and "worst" case behavior of an algorithm	C2 (Understand)
CLO-2	Identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors.	C3 (Apply)
CLO-3	Determine informally the time and space complexity of simple algorithms	C3 (Solve)

CLO-4	List and contrast standard complexity classes	C4 (Examine)
CLO-5	Use big O, Omega, Theta notation formally to give asymptotic upper bounds on time and space complexity of algorithms	
CLO-6	Use of the strategies(brute-force, greedy, divide-andconquer, and dynamic programming) to solve an appropriate problem	
CLO-7	Solve problems using graph algorithms, including single source and all-pairs shortest paths, and at least one minimum spanning tree algorithm	
CLO-8	Trace and/or implement a string-matching algorithm	

Course Outline:

Introduction; role of algorithms in computing, Analysis on nature of input and size of input Asymptotic notations; Big-O, Big Ω, Big Θ, little-o, little-ω, Sorting Algorithm analysis, loop invariants, Recursion and recurrence relations; Algorithm Design Techniques, Brute Force Approach, Divide-and-conquer approach; Merge, Quick Sort, Greedy approach; Dynamic programming; Elements of Dynamic Programming, Search trees; Heaps; Hashing; Graph algorithms, shortest paths, sparse graphs, String matching; Introduction to complexity classes.

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

1. Introduction to Algorithms (3rd edition) by Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein
2. Algorithm Design, (1st edition, 2013/2014), Jon Kleinberg, Eva Tardos,
3. Algorithms, (4th edition, 2011), Robert Sedgewick, Kevin Wayne

CMPC-6702 Final Year Project-I

Credit Hours:	2 (0-6)
Contact Hours:	0-6
Pre-requisites:	None

Course Introduction:

This course marks a crucial phase in the undergraduate program, providing students with a unique opportunity for hands-on research and/or project development.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Undertake problem identification, formulation and solution.	C2 (Understand)
CLO-2	Define project scope and set milestones.	C3 (Apply)

CLO-3	Attain proficiency in creating comprehensive project documentation.	C3 (Apply)
CLO-4	Cultivate effective teamwork and collaboration skills, fostering ability to work with team members towards shared objectives.	-

Course Outline:

1. Project Proposal
2. Introduction Software Requirement Specification
3. Software Function Specification
4. Design Documentation

CMPC-6703 Final Year Project-II	
Credit Hours: **Contact Hours:** **Pre-requisites:**	4 (0-12) 0-12 Final Year Project-I

Course Introduction:

Final Year Project-II represents the culmination of the undergraduate program, where students bring their projects to completion. Students engage in refining their projects, addressing challenges, and contributing to the existing body of knowledge in their chosen fields.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Develop, implement, and test solutions to real world problems.	C3 (Apply)

Course Outline:

1. Database Design
2. Interface Design
3. Initial Prototype
4. Implementation
5. Testing

Domain Core Courses

CSDC-5101 Theory of Automata	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (2-1) 2-3 -

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

CSDC-5102 Advanced Database Management System	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0

Course Introduction:

Advanced Database Management Systems is an extension to "Database Systems" course. The aim of the course is to enhance the previous knowledge of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies, and showing the need for distributed database technology to tackle deficiencies of the centralized database systems. Moreover, it focuses to introduce the basic principles and implementation techniques of distributed database systems, andexpose emerging research issues in database systems and application development.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understanding advance data models, technologies and approaches for building distributed database systems.	C2 (Understand)
CLO-2	Applying the models and approaches in order to become enabled to select and apply appropriate methods for a particular case	C3 (Apply)
CLO-3	To develop a database solution for a given scenario/ challenging problem in the domain of distributed database systems.	C3 (Apply)

Course Outline:

Introduction to advance data models such as object relational, object oriented. File organizations concepts, Transactional processing and Concurrency control techniques, Recovery techniques, Query processing and optimization, Database Programming (PL/SQL, T-SQL or similar technology), Integrity and security, Database Administration (Role management, managing database access, views), Physical database design and tuning, Distributed database systems, Emerging research trends in database systems, MONGO DB, NO SQL (or similar technologies)

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

1. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th

Edition by Thomas Connolly and Carolyn Begg
2. Database Management Systems, 3rd Edition by Raghu Ramakrishnan, Johannes Gehrke
3. Database System Concepts, 6th Edition by AviSilberschatz, Henry F. Korth and S. Sudarshan.
4. Database Systems: The Complete Book, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom

CSDC-6201 HCI & Computer Graphics	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0 N/A

Course Introduction:

The course concerns interaction between humans (the users) and computers. The course is used in UI design, rendering, geometric objects, animation, and many more.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Explain context of HCI and different measures for evaluation.	C2 (Understand)
CLO-2	Apply the principles of good design	C3 (Apply)
CLO-3	Perspective of age and disabilities.	C4 (Analyze)

Course Outline:

The human: Input–output channels, Human memory, Thinking, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Text entry devices, Positioning, pointing and drawing, display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks. The interaction: Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction, Experience, engagement and fun. Interaction design basics: What is design? The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping. HCI in the software process: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale. Design rules: Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. Implementation support: Elements of windowing systems, Programming the application. Using toolkits, User interface management systems. Evaluation techniques: What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method. Universal design: Universal design principles, Multi-modal interaction, Designing for diversity. User support: Requirements of user support, Approaches to user support, Adaptive help systems, designing user support systems. Task analysis: Differences between task analysis and other techniques, Task decomposition, Knowledge-based analysis, Entity–relationship-based techniques, Sources of information and data collection, Uses of task analysis. Dialog notations and design: What is dialog? Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design. Models of the system: Standard formalisms, Interaction models, Continuous behavior. Modeling rich interaction: Introduction, Status–event analysis, Rich contexts, Low intention and sensor-based interaction. Groupware: Groupware systems, Computer-mediated communication, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware, implementing synchronous groupware. Ubiquitous computing and augmented realities: Ubiquitous computing applications research, Virtual and augmented reality, Information and data visualization. Hypertext, multimedia and the World Wide Web: Understanding hypertext, Finding things, Web technology and issues, Static web content, Dynamic web content.

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

1. Kunigk, J., Buss, I., Wilkinson, P., & George, L. (2018). *Architecting modern data platforms: a guide to enterprise hadoop at scale*. O'Reilly Media.
2. Marcus, A. (2015). HCI and user-experience design. *Human–Computer Interaction Series*, 265-269.
3. Grudin, J. (2006). The GUI shock: computer graphics and human-computer interaction. *Interactions*, *13*(2), 46-ff.
4. Jacko, J. A. (Ed.). (2012). Human computer interaction handbook: Fundamentals, evolving technologies, and emerging applications.

CSDC-6202 Computer Architecture	
Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	

Course Introduction:

This course in computer architecture will take you from an understanding of digital design using combinational logic and synchronous sequential building blocks to building your own single-cycle multicycle, and pipelined microprocessors.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand structure and behavior of the various functional modules of the computer	C2 (Understand)
CLO-2	How these structure and behavior interact to provide the processing needs of the user.	C3 (Apply)

Course Outline:

Introduction to a Simple Computer: CPU Basics and Organization, The Bus, Clock, The Input/Output Subsystem, Memory Organization and Addressing, Interrupts, MARIE, Instruction Processing, Hardware vs Micro-programmed Control, Real-World Examples of Computer. Architectures: Intel & MIPs Architecture. Instruction Set Architecture: Instruction Format, Instruction Types, Addressing, Instruction Pipelining, ISAs – Intel, MIPS, Java Virtual Machine. Micro-architecture: Single-Cycle Processor, Multicycle Processor, Pipeline Processors, DDL Representation, Exceptions. Advanced Micro-architecture: Deep Pipelines, Branch Prediction, Superscalar Processor, Out-of-Order Processor, Register Renaming, Single Instruction Multiple Data, Multithreading, Homogeneous Multiprocessing, Heterogeneous Multiprocessor. Memory: Types of Memory, The Memory Hierarchy, Cache Memory, Virtual Memory, Memory Management. Input/Output and Storage System: I/O and Performance, Amdahl's Law, I/O architectures, Data Transmission Modes, Magnetic Disk Technology, Optical Disk Technology, Magnatic Tape, RAID, Future of Data Storage. Alternative Architectures: RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architecture, Alternative Parallel Processing Approaches, Quantum Computing. Embedded Systems: Embedded Hardware & Embedded Software.

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

1. Harris, S., & Harris, D. (2015). Digital design and computer architecture. Morgan Kaufmann.
2. Null, L. (2023). Essentials of Computer Organization and Architecture. Jones & Bartlett Learning.
3. Hennessy, J. L., & Patterson, D. A. (2011). *Computer architecture: a quantitative approach.* Elsevier.
4. Harris, D., & Harris, S. (2010). *Digital design and computer architecture.* Morgan Kaufmann.

CSDC-6203 Compiler Construction

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

Course Introduction:

This course introduces students to the essential elements of building a compiler: parsing, context-sensitive property checking, code linearization, register allocation, etc.

CLO No.	Course Learning Outcomes	Bloom Taxonomy

CLO-1	Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation	C2 (Understand)
CLO-2	Understand the basic data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code, and stack machines	C2 (Understand)
CLO-3	Design and implement a compiler using a software engineering approach	C2 (Understand)

Course Outline:

Overview of Compilation: Principles of Compilation, Compiler Structure, High-Level View of Translation, Desirable Properties of a Compiler. Scanners: Recognizing Words, Regular Expressions, Implementing Scanners. Parsers: Expressing Syntax, Top-Down Parsing, Bottom-Up Parsing. Context-Sensitive Analysis: Type Systems, Attribute-Grammar Framework, Ad Hoc Syntax-Directed Translation. Intermediate Representations: Graphical IRs, Linear IRs, Mapping Values to Names, Symbol Tables. The Procedure Abstraction: Procedure Calls, Name Spaces, Communicating Values Between Procedures, Standardized Linkages. Code Shape: Assigning Storage Locations, Arithmetic Operators, Boolean and Relational Operators, Storing and Accessing Arrays, Character Strings, Structure References, Control-Flow Constructs, Procedure Calls. Code Optimization: Scope of Optimization, Local Optimization, Regional Optimization, Global Optimization, Interprocedural Optimization. Data-Flow Analysis: Iterative Data-Flow Analysis, Static Single-Assignment Form, Inter-procedural Analysis. Scalar Optimizations: Taxonomy for Transformations, Example Optimizations. Instruction Selection: Code Generation, Extending the Simple Tree-Walk Scheme, Instruction Selection via Tree-Pattern Matching, Instruction Selection via Peephole Optimization. Instruction Scheduling: The Instruction-Scheduling Problem, Local List Scheduling, Regional Scheduling. Register Allocation: Background Issues, Local Register Allocation and Assignment, Moving Beyond Single Blocks, Global Register Allocation and Assignment. Implementation of a prototype compiler (Class Assignment for the Semester)

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

1. Engineering a Compiler, Second Edition by Keith Cooper and Linda Torczon, Morgan Kaufmann; 2ndEdition (February 21, 2017). ISBN-10: 012088478X
2. Compilers: Principles, Techniques, and Tools, A. V. Aho, R. Sethi and J. D. Ullman, Addison-Wesley, 2nd ed., 2007
3. Modern Compiler Design, D. Grune, H. E. Bal, C. J. H. Jacobs, K. G. Langendoen, John Wiley, 2012.
4. Modern Compiler Implementation in C, A. W. Appel, M. Ginsburg, Cambridge University Press, 2004.

ITDC-6204 Parallel and Distributed Computing	
Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	None

Course Introduction:

The Parallel and Distributed Computing course explores advanced computing paradigms, covering parallel processing and distributed systems. Participants gain expertise in designing and optimizing algorithms for parallel execution, addressing challenges in distributed computing environments.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Learn about parallel and distributed computers.	C2 (Understand)
CLO-2	Write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library	C3 (Apply)
CLO-3	Analyze complex problems with shared memory programming with openMP.	C4 (Analyze)

Course Outline:

Asynchronous/synchronous computation/communication, concurrency control, fault tolerance, GPU architecture and programming, heterogeneity, interconnection topologies, load balancing, memory consistency model, memory hierarchies, Message passing interface (MPI), MIMD/SIMD, multithreaded programming, parallel algorithms & architectures, parallel I/O, performance analysis and tuning, power, programming models (data parallel, task parallel, process-centric, shared/distributed memory), scalability and performance studies, scheduling, storage systems, synchronization, and tools (Cuda, Swift, Globus, Condor, Amazon AWS, OpenStack, Cilk, gdb, threads, MPICH, OpenMP, Hadoop, FUSE).

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

1. An Introduction to Parallel Programming, P. S. Pacheco and M. Malensek, Morgan Kaufmann, 2nd Edition.2021
2. Parallel And Distributed Computing,AjitSingh, Kindle Edition,2021
3. Distributed Systems: Principles and Paradigms, A. S. Tanenbaum and M. V. Steen, Prentice Hall, 4th Edition, 2008

Domain Elective Courses

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

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

ITDC-5202 Cyber Security	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0

Course Introduction:

The Cyber Security course focuses on safeguarding digital systems and data, covering threat detection, encryption, and risk management strategies, preparing participants to defend against cyber threats and secure information assets.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	To be able to identify computer system threats	C2 (Understand)
CLO-2	To be able to identify Malware attacks, and understand the stages of attack and payloads.	C2 (Understand)
CLO-3	Implement various cryptographic techniques and simulate attack scenarios	C3 (Apply)

Course Outline:

Introduction to Cyber security; Networks and the Internet; cyber threat landscape; understanding security; information security Principles (Confidentiality, Integrity, Availability); Information Security Terminology; Who are the attackers; Advanced Persistent Threat (APT); Malware, types of malware; Attacks using malware; Malware Attack Lifecycle: Stages of Attack; Social engineering attacks; types of payload; Industrial Espionage in Cyberspace; Basic cryptography; Web application attacks; Database security; Cyber kill chain; Privacy and anonymity; Network security; Wireless Security; Software security; Mobile device security; Mobile app security; Cyber Terrorism and Information Warfare; Introduction to Digital Forensics; Digital Forensics Categories.

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

1. Computer Security Fundamentals by Chuck Easttom, 4th edition or latest
2. Security+ Guide to Network Security Fundamentals, by Mark Ciampa, 5th Edition
3. Security in Computing by C.P. Pfleeger, Prentice-Hall, 4th Edition or Latest

CSDE-6505 Introduction to Large Language Models	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0 None

Course Introduction:

The student will journey through the world of Large Language Models (LLMs) and discover how they are reshaping the AI landscape. You'll explore the factors fueling the LLM boom, such as the deep learning revolution, data availability, and computing power. This conceptual course will dig into LLMs and how they revolutionize businesses and everyday life with real-world examples, from finance to content creation.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Deepens your understanding of the end-to-end AI system architecture needed to design and deploy large language models	C2 (Understand)
CLO-2	Acquire the tools, skills, and strategies to successfully deploy LLMs	C3 (Apply)
CLO-3	Implement an LLM application of your own during a hands-on group project	C3 (Apply)

Course Outline:

Overview of LLMs, Lifecycle of LLMs (pre-training, fine-tuning, and inference), LLM Hallucination & causes, LLM downstream tasks (Text classification, text similarity, search, question-answering, summarization, translation, and named entity recognition), Prompt engineering & optimization overview, Zero-shot and few-shot in-context learning, Fine-tune and evaluate models, Tradeoffs between various in-context learning approaches, Various types of embedding and their applications, Synthetic data generation, knowledge graph creation using LLM, Comparison of LLM models (GPT Turbo 3.5, GPT 4, Llama 2, Claude, BERT, Cohere, Lamda, Orca, Palm), HuggingFace Models, Integration Framework (LangChain), Data Framework (LlamaIndex).

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

1. Quick Start Guide to Large Language Models: Strategies and Best Practices for Using ChatGPT and Other LLMs by Ozdemir, Sinan. Addison-Wesley Professional.
2. Natural language understanding with Python: combine natural language technology, deep learning, and large language models to create human-like language comprehension in computer systems by Dahl, Deborah Anna.
3. Modern Generative AI with ChatGPT and OpenAI models: leverage the capabilities of OpenAI's LLM for productivity and innovation with GPT3 and GPT4 by Alto, Valentina.

CSDE-6209 Semantic Web	
Credit Hours: **Contact Hours:** **Pre-requisites:**	3 (3-0) 3-0 None

Course Introduction:

This course provides an overview of Semantic Web technologies, including RDF, OWL, and SPARQL. Students will learn to model, represent, and query semantic data, enabling them to build intelligent and interoperable web applications.

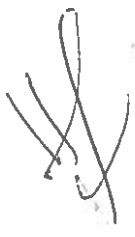
CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the foundational principles and components of the Semantic Web, including RDF, OWL, and SPARQL.	C2 (Understand)
CLO-2	Apply Semantic Web technologies to model information using RDF, create ontologies with OWL, and execute complex queries using SPARQL with hands-on projects and real-world applications.	C3 (Apply)
CLO-3	Analyze and evaluate semantic data models, ontologies, and SPARQL queries.	C4 (Analyze)

Course Outline:

Semantic Web – Introduction and Vision , Structured Web Documents, XML, RDF, RDF-S, Web Ontology Language, WL, Ontology Engineering (Protégé) ,Discovering Information, Querying (SPARQL) Semantic Web Applications (E-learning, Web services), Description Logic Reasoning (Fact++); Rules (SWRL) Building Semantic Web Applications (Apache Jena Framework), Building Semantic Web Applications, State-of-the-art in Semantic Web community (Linked data and applications)

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

1. A Semantic Web Primer third edition Grigoris Antoniou,Paul Groth,Frank van Harmelen,Rinke Hoekstra ISBN:0262018284 9780262018289
2. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management by Michael C. Daconta Leo J. Obrst and Kevin T. Smith
3. Explorer's Guide to the Semantic Web by Thomas B. Passin



SEDC-6202 Software Project Management	
Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	None

Course Introduction:

In Software Project Management course students will navigate the intricate landscape of planning, execution, and control in software development projects. This course will equip them with essential skills to lead teams, manage resources, and ensure the successful delivery of software projects on time and within budget. The students will comprehensively explore project management principles tailored for the dynamic realm of software development.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Explain principles of the project lifecycle and how to identify opportunities to work with learners on relevant and appropriate project scenarios to share this understanding.	C2 (Understand)
CLO-2	Critically evaluate and discuss the issues around project management and its application in the real world with course participants and learners	C3 (Apply)
CLO-3	Choose project management techniques for IT projects to initiate, plan, execute and evaluate a project and work in teams to create a project plan for a project scenario that includes key tasks, critical path, dependencies and a realistic timeline.	C3 (Apply)
CLO-4	Present strategies for gaining confidence in managing projects through simple project planning examples.	C3 (Apply)

Course Outline:

Introduction: Software Project Versus Other Type of Projects Dimensions of a Software Project, Activities in SPM, Setting Goals & Objectives, Business Case, Significance of Processes, Project Vs. Program Management. Introduction of PM Tools, PMI's Knowledge Areas, Technical Fundamentals in SPM, Lifecycle Relationships, Classic Mistakes Product-Process-Peoples-Technology Mistakes PMI Framework, PMI Process Groups: Process Initiating Process Group, Planning Process Group, Executing Process, Process Monitoring and controlling, Closing Process Group, Project Charter, Statement of Work. Understanding Organizations, Organizational Structures, Functional -Project –Matrix, Organizational Impact on Projects, Identifying stakeholders: Define Responsibilities, Authority Relationships, Position Qualifications. Project Planning: Project Selection, Project Scope, Project Infrastructure, Analyze Project Characteristics, Identify Project & Product Activities, Work Break Down Structure. Project Evaluation: Strategic Assessment, Technical Assessment, Economic Assessment, Project Portfolio Management, Cost-Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Procurement Management, Procurement Tools &Techniques, Types of Contracts. Selection of an Appropriate Approach in Project: Choosing Technologies, Technical Plan, Waterfall Model, V-Model, Spiral Model, Software Prototyping, Incremental Delivery, Agile Process Model: Dynamic Systems Development Method, Extreme Programming, Selection of Most Appropriate Process Model. Software Effort Estimation: Work Breakdown Structure (WBS) and Its Types, Estimation Problems, Software Estimation Techniques: Expert Judgment, Estimating By Analogy, LOC, Function

Point Estimation, and COCOMO. Activity Planning: Project and Activities, Sequencings and Scheduling Activities, Network Planning Models, Formulation of Network Model, Adding the Time Dimensions, The Forward Pass, The Backward Pass, Identifying the Critical Path, Identifying the Critical Activities Project, AOA, GanttChart, (Installation & Configuration of Software Tools like MS-Project). Risk Management: Categories of Risks, A Framework for Dealing with Risks, Evaluating the Risks to the Schedule: PERT, Importance of Risk, Types Of Risk, Risk Identification Techniques, Project Risk and Change Management. Risk Control, RMMM, Configuration Management & Maintenance, Environment for Configuration Control, Configuration Control vs. Version Control. Resource Allocation: Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Resource Scheduling Techniques. Monitoring & Control: Creating Framework, Collecting Data, Visualizing Progress, Cost Monitoring, Earned Value, Change Control. Review and Evaluation: Determining Satisfaction of Requirements, Reviewing And Evaluating Performance, Project Closure: Project Documentation, Cutover/Migration, Quality Standards, Project Closing. Challenges of Outsourcing in Project Management, Presentations

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

1. Software Project Management by Bob Hughes and Mike Cotterell, McGraw-Hill Education; 5th Edition. ISBN-10: 0077122798
2. Information Technology Project Management with MindTap by Kathy Schwalbe, 9E ISBN: 9789355736130, Edition: 9th, Year : 2019
3. A Guide to the Project Management Body of Knowledge, Seventh Edition (PMBOK Guide) (2021)
4. Applied Software Project Management by Andrew Stellman and Jennifer Greene, O'Reilly Media; 1st Edition (2005). ISBN-10: 0596009488
5. Mastering Software Project Management: Best Practices, Tools and Techniques by Murali K. Chemuturi and Thomas M. Cagley Jr., J. Ross Publishing (2010). ISBN-10: 1604270349
6. Effective Project Management: Traditional, Agile, Extreme by Robert K. Wysocki, Wiley; (2019). ISBN:9781119562801
7. The Software Project Manager's Handbook - Principles that work at work by Dwayne Phillips, 2ndEdition, IEEE Computer Society Press and Wiley Inter-science, . ISBN 0-471-67420-6

DSDC-5201 Introduction to Data Science

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

Course Introduction:

Data Science is the study of the generalizable extraction of knowledge from data. Being a data scientist requires an integrated skill set spanning mathematics, statistics, machine learning, databases and other branches of computer science along with a good understanding of the craft of problem formulation to engineer effective solutions. The aim of this course is to: Introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Explain the significance of exploratory data analysis in data science. Identify common approaches used for Feature Generation as well as Feature Selection, and finally discuss the Ethical and Privacy issues. Programming language Python has been

proposed for the practical work of this course.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Describe what Data Science is and the skill sets needed to be a data scientist.	C2 (Understand)
CLO-2	Apply EDA and the Data Science process in a case study.	C3 (Apply)
CLO-3	Comprehend the fundamental constructs of Python programming language.	C2 (Understand)
CLO-4	Apply basic machine learning algorithms to solve real world problems of moderate complexity.	C3 (Apply)

Course Outline:

Introduction: What is Data Science? Big Data and Data Science hype, Datafication, Current landscape of perspectives, Skill sets needed; Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, Intro to Python; Exploratory Data Analysis and the Data Science Process; Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes; Feature Generation and Feature Selection; Dimensionality Reduction: Singular Value Decomposition, Principal Component Analysis; Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs; Data Visualization: Basic principles, ideas and tools for data visualization; Data Science and Ethical Issues: Discussions on privacy, security, ethics, Next-generation data scientists.

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

1. Foundations of data science, Blum, A., Hopcroft, J., & Kannan, R., VorabversioneinesLehrbuchs, 2016.
2. An Introduction to Data Science, Jeffrey S. Saltz, Jeffrey M. Stanton, SAGE Publications, 2017.
3. Python for everybody: Exploring data using Python 3, Severance, C.R., CreateSpace Independent Pub Platform. 2016.
1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly. 2014.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, John Wiley & Sons, 2015.

DSDC- 6203 Data Warehousing & Business Intelligence

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

Course Introduction:

Gives an overview about importance & significance of Data Warehousing (DWH) and Business Intelligence (BI). Discusses the main concepts and solutions for DWH and BI. The key concepts underpinning the logical design, physical design and implementation of data warehouses are appraised. Data collection, data extraction, cleansing, transformation and loading methods are considered along with query optimization techniques. Differentiation

between OLAP & OLTP. Data Warehousing supports information processing by providing a solid platform of integrated, historical, and consistent data for performing enterprise- wide data analysis.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Demonstrate an appreciation of the role that Data Warehouses and Business Intelligence play in enhancing the decision-making process.	C2 (Understand)
CLO-2	Demonstrate an understanding of the fundamental concepts of the Star and the Snowflake Schema; learn how to design the schema of a DW based on these two models.	C2 (Understand)
CLO-3	Understand the architecture of DW Systems and be able to specify the advantages and potential problem areas	C3 (Apply)
CLO-4	Use Analytic SQL to aggregate, analyze and report, and model data.	C3 (Apply)

Course Outline:

Introduction to Data Warehouse and Business Intelligence; Necessities and essentials of Business Intelligence; DW Life Cycle and Basic Architecture; DW Architecture in SQL Server; Logical Model; Indexes; Physical Model; Optimizations; OLAP Operations, Queries and Query Optimization; Building the DW; Data visualization and reporting based on Data warehouse using SSAS and Tableau; Data visualization and reporting based on Cube; Reports and Dashboard management on PowerBI; Dashboard Enrichment; Business Intelligence Tools.

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

1. W. H. Inmon, "Building the Data Warehouse", Wiley-India Edition.
2. Ralph Kimball, "The Data Warehouse Toolkit – Practical Techniques for Building Dimensional Data Warehouse." John Wiley & Sons, Inc.
3. Matteo Golfarelli, Stefano Rizzi, "Data Warehouse Design - Modern Principles and Methodologies", McGraw Hill Publisher

DSDE-6201 Big Data Analytics

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

Course Introduction:

The course objective is to develop understanding about the core concept of Big Data, why Big Data requires a different programming paradigm and mindset, and what are the various programming approaches used, what type of data can be processed.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the fundamental concepts of Big Data and its programming paradigm.	C2 (Understand)
CLO-2	Hadoop/MapReduce Programming, Framework, and Ecosystem	C3 (Apply)

CLO-3	Apache Spark Programming	C3 (Apply)

Course Outline:

Introduction and Overview of Big Data Systems; Platforms for Big Data, Hadoop as a Platform, Hadoop Distributed File Systems (HDFS), MapReduce Framework, Resource Management in the cluster (YARN), Apache Scala Basic, Apache Scala Advances, Resilient Distributed Datasets (RDD), Apache Spark, Apache Spark SQL, Data analytics on Hadoop Spark, Machine learning on Hadoop / Spark, Spark Streaming, Other Components of Hadoop Ecosystem

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

1. White, Tom. "Hadoop: The definitive guide." O'Reilly Media, Inc., 2012.
2. Karau, Holden, Andy Konwinski, Patrick Wendell, and Matei Zaharia. "Learning spark: lightning-fast big data analysis." O'Reilly Media, Inc., 2015.
3. Miner, Donald, and Adam Shook. "MapReduce design patterns: building effective algorithms and analytics for Hadoop and other systems." O'Reilly Media, Inc., 2012.

AIDC-6101 Computer Vision

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

Course Introduction:

With a single glance a human interprets the entire scene. How many objects are present in the scene and where they are located. Which person is present in the scene. What will happen next. However, computers lack this capability. We have seen only face detectors so far working in our mobile phones? What is the challenge in understanding the 3D scene, i.e., the identity, the location and the size of the objects present in the scene. In this course we will introduce the basic concepts related to 3D scene modelling from single view and multiple views.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understanding the single view geometry concepts	C2 (Understand)
CLO-2	Understanding the multiple view geometry concepts	C2 (Understand)
CLO-3	Apply concepts of CV for solving real world problems	C3 (Apply)

Course Outline:

Introduction to Computer Vision (Problems faced, History and Modern Advancements). Image Processing, Image filtering, Image pyramids and Fourier transform, Hough transform. Camera models, Setting up a camera model from parameters, Camera looking at a plane, Relationship of plane and horizon line, Rotation about camera center. Concatenation, Decomposition and Estimation of transformation from point correspondences, Points and planes in 2D/3D, Transformations in 2D/3D, Rotations in 2D/3D. Edge detection, corner detection. Feature descriptors and matching (HoG features, SIFT, SURF). Applications of Computer Vision Traditional Methods: Image Stitching: Making a bigger picture from smaller pictures Single View Geometry: Converting a single image into a 3D model. Applications of CV using Deep

Learning: Image Detection (Localization, Historical Techniques, RCNN, FRCNN, YOLO, Retina), Image Segmentation (UNet, SegNet,MaskRCNN), Image Generation (GANN)

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

1.Szeliski, R. (2022). *Computer vision: algorithms and applications*. Springer Nature.

2.Hartley, R., & Zisserman, A. (2003). *Multiple view geometry in computer vision*. Cambridge university press.

3.Forsyth, D. A., & Ponce, J. (2002). *Computer vision: a modern approach*. prentice hall professional technical reference.

4.Gonzalez, R. C. (2009). *Digital image processing*. Pearson education India.

CSDE-6501 MERN Stack Development

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

Course Introduction:

MERN stack stands out for its versatility, efficiency, and end-to-end JavaScript implementation when building web applications. It allows developers to leverage a single language, JavaScript, across the entire stack, enabling code reuse and streamlining the development process.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Build full stack development	C3 (Apply)
CLO-2	Master authentication and authorization	C2 (Understand)
CLO-3	Master Data Modelling in mongoose	C2 (Understand)

Course Outline:

React Project scaffolding, React functional and class components, React parent to child and child to parent communications, React Redux, React Hooks, React Context Api, React Routers, React Material UI, React project with fake JSON server, Nodejs, Npm package registry understanding with package.json, Nodejs HTTP server, Express Introduction, Express server, Creation of rest apis, Validation with YUP or JOI validator, Usage of Lodash, Mail configuration with SMTP nodemail, Job with queues, Schedule Commands with cron jobs, File uploads with Multer, File upload with GridFS, Rest APIs (Modern Technique for Web applications), Graphql Apis (Modern Technique for Web applications), Mongodb, Mongodb CRUD queries, Lookup queries, aggregation pipeline, Mogodb with reference and embedded relations, Mongodb indexing, Mongodb with Mongoose ORM, Mongodb schema creation with mongoose, Apis Integration with Frontend React project, Api calls with Axios and fetch on frontend, Dotenv on frontend react and backend nodejs express, React store creation with redux persistent, React service Layer for Apis

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

Text Book:

1. Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App by Greg Lim
2. MERN Projects for Beginners: Create Five Social Web Apps Using MongoDB, Express.js, React, and Node by Nabendu Biswas

CSDE-6502 Django Web Framework

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

Course Introduction:

Build & deploy rich web applications using Django. Learn the fundamentals of building a full-featured web site using Django.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Install and deploy a Django application	C3 (Apply)
CLO-2	Describe and build a data model in Django	C2 (Understand)
CLO-3	Apply built-in login functionality in Django	C3 (Apply)

Course Outline:

Installing Django, HTML, CSS, SML, SQL, Data Models, Django views, Django generic views, Forms in http and html, Django forms, User authentication, One to many data models, Many to many data models, Javascript, JSON, Ajax, File Uploading, Pagination, Writing URLs, Sending emails, Limiting query results in django, TinyMCE integration, creating blogs, Filters in Django, Pass data from Django views to template.

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

Text Book:

1. Django for beginners, Build websites with Python and Django by William S. Vincent
2. Django 4 By Example: Build powerful and reliable Python web applications from scratch 4th Edition by Antonio Melé

CSDE-6503 Introduction to DevOps

Credit Hours:	3 (3-0)
Contact Hours:	3-0
Pre-requisites:	N/A

Course Introduction:

This course covers best practices, tools, and techniques for automating tasks and collaborating with other engineers on projects.

CLO No.	Course Learning Outcomes	Bloom Taxonomy

CLO-1	Essential DevOps concepts: software engineering practices, cloud native microservices, automated continuous deployments	C2 (Understand)
CLO-2	impact of DevOps, including breaking down silos, working in cross functional teams, and sharing responsibilities.	C2 (Understand)

Course Outline:

DevOps Principles, DevOps Delivery Pipeline, DevOps on Cloud, Cloud & virtualization architecture, Cloud deployment architecture, Why we need DevOps on cloud?, Introduction to AWS, Introduction to version control, Git installation & setup, Git commands, Recording repository changes, Viewing commit history, Undoing things, Working with remotes, Branching & merging in git, Git workflows, Git cheatsheets, Jenkins tool management, Jenkins authentication, Jenkins authorization, Maven overview, Maven plugins, Maven build lifecycle, Maven test project, Introduction to docker, Working with container, Docker networking, Docker swarm, Kubernetes overview, Kubernetes cluster architecture, Design of pods

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

Text Book:

1. Learning DevOps: A Comprehensive Guide to Accelerating DevOps Culture Adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins by Mikael Krief, 2nd ed. Edition (2022).
2. Cloud Native DevOps with Kubernetes: Building, Deploying, and Scaling Modern Applications in the Cloud by John Arundel and Justin Domingus, ISBN: 9781098116828, 2nd ed. Edition (2022).

CSDE-6504 Software Testing & Quality Assurance

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

Course Introduction:

Software testing is indispensable for developers who want to ship high-quality software. After completing this course, you will have an understanding of the fundamental principles and processes of software testing.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Distinguish between verification and validation describing the key differences between them.	C2 (Understand)
CLO-2	Write automated functional tests for both front-end and back-end code.	C2 (Understand)

Course Outline:

Testing foundations, Testing in software development life cycle, Writing good unit tests, Black box testing, White box testing, Requirements based testing, Black box and white box testing using Cucumber, Introduction to Automated Analysis, Automated test generation, Static analysis, Effective automated verification, Web and mobile testing, Functional web testing, Nonfunctional web testing, Mobile testing, Penetration testing, Test design techniques and validation.

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

Text Book:

1. Effective Software Testing: A Developer's Guide by Maurizio Aniche, 2022, ISBN: 9781633439931
2. Automated Software Testing with Cypress by Narayanan Palani, 1st Edition (2021)
3. Leading Quality: How Great Leaders Deliver High Quality Software and Accelerate Growth by Ronald Cummings-John & Owais Peer (2019)

DSDE-5102 Database Administration and Management

Credit Hours:	3(2-1)
Contact Hours:	2-3
Pre-requisites:	

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 Dictionary Oracle Net Services, Administering User Access, Privileges & Roles, Resource Limitation Multitenancy: Creating PDBs from SEED, Clonning PDBs, creating Refreshable Clones, Unplug/Plug PDBs, Transparent Data Encryption (TDE), Creating and Managing Tablespaces Managing 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-5204	Advance Programming Lab
Credit Hours:	3 (0-3)
Contact Hours:	0-9
Pre-requisites:	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 2. "Effective Python" by Brett Slatkin 3. "Python Cookbook" by David Beazley and Brian K. Jones 4. "Python for Data Analysis" by Wes McKinney 5. "Programming Python" by Mark Lutz

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.

MATH-5103 Probability and Statistics

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

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:

Introduction to Statistics and Data Analysis, Statistical Inference, Samples, Populations, and the Role of Probability. Sampling Procedures. Discrete and Continuous Data. Statistical Modeling. Types of Statistical Studies. Probability: Sample Space, Events, Counting Sample

Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Rule. Random Variables and Probability Distributions. Mathematical Expectation: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev's Theorem. Discrete Probability Distributions. Continuous Probability Distributions. Fundamental Sampling Distributions and Data Descriptions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem. Sampling Distribution of S2, t-Distribution, FQuantile and Probability Plots. Single Sample & One- and Two-Sample Estimation Problems. Single Sample & One- and Two-Sample Tests of Hypotheses. The Use of PValues for Decision Making in Testing Hypotheses (Single Sample & One- and TwoSample Tests), Linear Regression and Correlation. Least Squares and the Fitted Model, Multiple Linear Regression and Certain, Nonlinear Regression Models, Linear Regression Model Using Matrices, Properties of the Least Squares Estimators.
Reference Materials (or use any other standard and latest books):
1. Probability and Statistics for Engineers and Scientists by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, Pearson; 9th Edition (January 6, 2011). ISBN-10: 0321629116 2. Probability and Statistics for Engineers and Scientists by Anthony J. Hayter, Duxbury Press; 3rd Edition (February 3, 2006), ISBN-10:0495107573 3. Schaum's Outline of Probability and Statistics, by John Schiller, R. Alu Srinivasan and Murray Spiegel, McGraw-Hill; 3rd Edition (2008). ISBN-10:0071544259

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:	**3 (2-1)**
Contact Hours:	3
Pre-requisites:	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 conveythe 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

ENGL-6101 Technical & Business Writing

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

Course Introduction:

Students in the senior level needs good technical writing skills not only for writing project report but also useful for them to communicate their resume and get place in the market. This is a high level course which provide useful knowledge to the students for writing proposals etc. Further, the course aims at augmenting students' proficiency in technical writing in order to sensitize them to the dynamics, challenges, and needs of the modern world characterized by technologically advanced social, cultural, and corporate settings. It will focus on students' ability to effectively convey and exchange information in cross-cultural, international, and

multinational milieu necessitated by the emergence of global society.		
CLO No.	**Course Learning Outcomes**	**Bloom Taxonomy**
CLO-1	-	-

Course Outline:

Overview of technical reporting, use of library and information gathering, administering questionnaires, reviewing the gathered information; Technical exposition; topical arrangement, exemplification, definition, classification and division, casual analysis, effective exposition, technical narration, description and argumentation, persuasive strategy, Organizing information and generation solution: brainstorming, organizing material, construction of the formal outline, outlining conventions, electronic communication, generation solutions. Polishing style: paragraphs, listening sentence structure, clarity, length and order, pomposity, empty words, pompous vocabulary, document design: document structure, preamble, summaries, abstracts, table of contents, footnotes, glossaries, crossreferencing, plagiarism, citation and bibliography, glossaries, index, appendices, typesetting systems, creating the professional report; elements, mechanical elements and graphical elements. Reports: Proposals, progress reports, Leaflets, brochures, handbooks, magazines articles, research papers, feasibility reports, project reports, technical research reports, manuals and documentation, thesis. Electronic documents, Linear verses hierarchical structure documents.

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.

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 : لقمن 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:

(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-5122	Ideology and Constitution of Pakistan
Credit Hours:	2 (2-0)
Contact Hours:	2
Pre-requisites:	-

Course Introduction:

This course focuses on ideological background of Pakistan. The course is designed to give a comprehensive insight about the constitutional developments of Pakistan. Starting from the Government of India Act, 1935 till to date, all important events leading to constitutional developments in Pakistan will be the focus of course. Failure of the constitutional machinery and leading constitutional cases on the subject. Moreover, students will study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. It will also cover the entire Constitution of Pakistan 1973. However, emphasis would be

on the fundamental rights, the nature of federalism under the constitution, distribution of powers, the rights and various remedies, the supremacy of parliament and the independence of judiciary

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	To educate students about the history of Pakistan.	
CLO-2	To understand the basic concept of Islam and Quran Pak.	
CLO-3	To educate student Government and politics	

Course Outline:

- **Ideology of Pakistan**
  - Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
  - Two Nation Theory and Factors leading to Muslim separatism.
- **Constitutional Developments**
  - Salient Feature of the Government of India Act 1935
  - Salient Feature of Indian Independence Act 1947
  - Objectives Resolution
  - Salient Feature of the 1956 Constitution
  - Developments leading to the abrogation of Constitution of 1956
  - Salient features of the 1962 Constitution
  - Causes of failure of the Constitution of 1962
  - Comparative study of significant features of the Constitution of 1956, 1962 and 1973
- **Fundamental rights**
- **Principles of policy**
- **Federation of Pakistan**
  - President
  - Parliament
  - The Federal Government
- **Provinces**
  - Governors
  - Provincial Assemblies
  - The Provincial Government
- **The Judicature**
  - Supreme Court
  - High Courts
  - Federal Shariat Courts
  - Supreme Judicial Council
  - Administrative Courts and tribunals
- **Islamic Provisions in Constitution**
- **Significant Amendments of Constitution of Pakistan 1973**

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

1. Constitutional and Political History of Pakistan by Hamid Khan
2. Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd re edn. Lahore: Legal Research Centre, 1996.
3. Munir, Muhammad. Constitution of the Islamic Republic of Pakistan: Being a

Commentary on the Constitution of Pakistan, 1973. Lahore, Law Pub., 1975.
4. Rizvi, Syed Shabbar Raza. Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary. 2nd re edn. Lahore: Vanguard, 2005.
5. The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).
6. Fundamental Laws of Pakistan by A.K. Brohi

URCA-5101 Introduction to Management

Credit Hours:	2 (2-0)
Contact Hours:	2
Pre-requisites:	None

Course Introduction:

Introduction to Marketing helps the students in exploring fundamental principles that drive successful business promotion and customer engagement. This course will delve into the core concepts of market research, product positioning, and strategic communication to provide a comprehensive foundation for understanding the ever-evolving world of marketing.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
-	-	

Course Outline:

Introduction to Managers and Management: What as Management and What Do Managers Do? Defining Management, Management Functions, Management Roles, Management Skills, History of Management. Organizational Culture and Environment: The Manager: Omnipotent or Symbolic? The Organization's Culture, The Environment - Defining Environment, The Specific Environment, The General Environment, Influence on Management Practice. Decision Making The Essence of Manager's Job: The Decision Making Process, The Rational Decision Maker, Decision Making Styles, Analyzing Decision Alternatives – Certainty, Risk, Uncertainty. Planning: The Foundations of Planning, The Definition of Planning, Purposes of Planning, Types of Plans, Contingency Factors on Planning, Objectives: The Foundation for Planning, Multiplicity of Objectives, Real Versus Stated Objectives, Traditional Objective Setting, Management by Objectives. Organization Structure and Design: Defining Organization Structure and Design, Building, The Vertical Dimension of Organizations, Building the Horizontal Dimension of Organizations, The Contingency Approach to Organization Design, Application of Organization Design. Motivation: Motivating Employees, What is Motivation? Contemporary Approaches to Motivation, Contemporary Issues in Motivation, From Theory to Practice: Suggestions for Motivating Employees. Leadership: Managers Verses Leaders, Trait Theories, Behavioural Theories, Contingency Theories, Emerging Approaches to Leadership, Contemporary Issues in Leadership. Communication: Communication and Interpersonal Skills, Understanding Communication, Communication

Styles of Men And Women, Feedback Skills, Delegation Skills', Conflict Management Skills, Negotiation Skills. Controlling - Foundations of Control: What is Control? The Importance of Control, The Control Process, Types of Control, Qualities of Effective Control, The Dysfunctional Side of Control, Ethical Issues in Control; Controlling Tools and Techniques: Information Controls, Financial Controls, Operations Controls, Behavioral Controls. The Personnel Function: Terminology, Who Does Personnel Work? Staff Role of The Personnel Department Personnel (Human Resource) Functions. Job Design and Analysis: Job Design, Job Information and Personnel Management, Analyzing Jobs-Obtaining Job Information, Functional Job Analysis, Administration of The Job Analysis Program. Human Resource Planning: Reasons for Human Resource Planning, The Planning Process. Recruitment and Selections/Testing and Interview: Labour Market Considerations, Recruitment and Selection Policy Issues, The Employment Process, Sources of People, The Selection Process, The Selection Procedure, Testing: Interview. Miscellaneous: Union and Management, Compensation Administration, Health And Safety.
Reference Materials (or use any other standard and latest books):
1. Management by Robbins, S.P. & Coulter, Mary, Prentice Hall; 10th Edition (November 3, 2008). ISBN-10: 0132090716 2. Fundamentals of Management by Robbins, S.P. &DeCenzo, David A, Prentice Hall; 7th Edition (January 13, 2010). ISBN-13: 978-0132090711 3. Human Resource Management by David A. DeCenzo and Stephen P. Robbins. Wiley; 7th Edition (October 10, 2001). ISBN-10: 0471397857

URCS-6101 Professional Practices		
Credit Hours: **Contact Hours:** **Pre-requisites:**	2 (2-0) 2 None	
Course Introduction:		
A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies.		
CLO No.	**Course Learning Outcomes**	**Bloom Taxonomy**
-	-	-
Course Outline:		
Historical, social, and economic context of Computing (software engineering, Computer Science, Information Technology); Definitions of Computing (software engineering, Computer Science,		

Information Technology) subject areas and professional activities; professional societies; professional ethics; professional competency and life-long learning; uses, misuses, and risks of software; information security and privacy; business practices and the economics of software; intellectual property and software law (cyber law); social responsibilities, software related contracts, Software house organization. Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.
Reference Materials (or use any other standard and latest books):
1. Boddington, P. (2023). AI ethics: a textbook. Springer Nature. 2. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513 3. Computer Ethics by Deborah G. Johnson, Pearson; 4th Edition (January 3, 2009). ISBN-10: 0131112414 4. A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet (3rd Edition) by Sara Baase, Prentice Hall; 3rd Edition (2008). ISBN-10: 0136008488 5. Applied Professional Ethics by Gregory R. Beabout, University Press of America (1993). 6. Noorman, M., & Johnson, D. G. (2014). Negotiating autonomy and responsibility in military robots. *Ethics and Information Technology*, *16*(1), 51-62.

URCG-5125	Civics and Community Engagement
Credit Hours: **Contact Hours:** **Pre-requisites:**	2 (2-0) 2 None

Course Introduction:

The Civics and Community Engagement course is designed to provide students with an understanding of the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities. The course aims at developing students' knowledge, skills and attitudes necessary for active and responsible citizenship.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Understand the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities.	C2 (Understand)
CLO-2	Develop students' knowledge, skills and attitudes necessary for active and responsible citizenship	C2 (Understand)

Learning outcomes

After completing this course, students will be able to

- Understand the concepts of civic engagement, community development, and social responsibility.
- Understand rights and responsibilities of citizenship
- Understand cultural diversity in local and global context
- Analyze the significance of civic participation in promoting social justice, equity, and
- democracy.
- Examine the historical and contemporary examples of successful civic and community engagement initiatives.
- Identify and assess community needs, assets, and challenges to develop effective strategies for community improvement.
- Explore the ethical implications and dilemmas associated with civic and community engagement.
- Develop practical skills for effective community organizing, advocacy, and leadership.
- Foster intercultural competence and respect for diversity in community engagement efforts.
- Collaborate with community organizations, stakeholders, and fellow students to design and implement community-based projects.
- Reflect on personal growth and learning through self-assessment and critical analysis of community engagement experiences.

Course Outline:

Introduction to Civics & Community Engagement

- Overview of the course: Civics & Community Engagement
- Definition and importance of civics
- Key concepts in civics: citizenship, democracy, governance, and the rule of law
- Rights and responsibilities of citizens

Citizenship and Community Engagement

- Introduction to Active Citizenship: Overview of the Ideas, Concepts, Philosophy and Skills
- Approaches and Methodology for Active Citizenship

Identity, Culture, and Social Harmony

- Concept and Development of Identity, Group identities
- Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity, Globalization and Culture, Social Harmony,
- Religious Diversity (Understanding and affirmation of similarities & differences)
- Understanding Socio-Political Polarization
- Minorities, Social Inclusion, Affirmative actions

Multi-cultural society and inter-cultural dialogue

- Inter-cultural dialogue (bridging the differences, promoting harmony)
- Promoting intergroup contact/ Dialogue
- Significance of diversity and its impact
- Importance and domains of Inter-cultural dialogue

Active Citizen: Locally Active, Globally Connected

- Importance of active citizenship at national and global level
- Understanding community
- Identification of resources (human, natural and others)
- Utilization of resources for development (community participation)
- Strategic planning, for development (community linkages and mobilization)

Human rights, constitutionalism and citizens' responsibilities

- Introduction to Human Rights
- Human rights in constitution of Pakistan
- Public duties and responsibilities
- Constitutionalism and democratic process

Social Institutions, Social Groups, Formal Organizations and Bureaucracy

- Types of Groups, Group identities, Organizations
- Bureaucracy, Weber's model of Bureaucracy
- Role of political parties, interest groups, and non-governmental organizations

Civic Engagement Strategies

- Grassroots organizing and community mobilization
- Advocacy and lobbying for policy change
- Volunteerism and service-learning opportunities

Social issues/Problems of Pakistan

- Overview of major social issues of Pakistani society

Social Action Project

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

1. Kennedy. J. K., &Brunold, A. (2016). Regional context and Citizenship education in Asia and Europe. New Yourk: Routledge, Falmer.
2. Henslin, James M. (2018). Essentials of Sociology: A Down to Earth Approach (13th ed.). New York: Pearson Education
3. Macionis, J. J., & Gerber, M.L. (2020). Sociology. New York: Pearson Education

Reference Books:

1. Glencoe McGraw-Hill. (n.d.). Civics Today: Citizenship, Economics, and Youth.
2. Magleby, D. B., Light, P. C., &Nemacheck, C. L. (2020). Government by the People (16th ed.). Pearson.
3. Sirianni, C., &Friedland, L. (2005). The Civic Renewal Movement: Community-Building and Democracy in the United States. Kettering Foundation Press.
4. Bloemraad, I. (2006). Becoming a Citizen: Incorporating Immigrants and Refugees in the United States and Canada. University of California Press.
5. Kuyek, J. (2007). Community Organizing: Theory and Practice. Fernwood Publishing.
6. DeKieffer, D. E. (2010). The Citizen's Guide to Lobbying Congress. TheCapitol.Net.
7. Rybacki, K. C., &Rybacki, D. J. (2021). Advocacy and Opposition: An Introduction to Argumentation (8th ed.). Routledge.
8. Kretzmann, J. P., & McKnight, J. L. (1993). Building Communities from the Inside Out: A Path Towards Finding and Mobilizing a Community's Assets. ACTA Publications.
9. Patterson, T. E. (2005). Engaging the Public: How Government and the Media Can Reinvigorate American Democracy. Oxford University Press.
10. Love, N. S., &Mattern, M. (2005). Doing Democracy: Activist Art and Cultural Politics. SUNY Press.

URCG-5124	Entrepreneurship
Credit Hours:	2 (2-0)
Contact Hours:	2
Pre-requisites:	None

Course Introduction:

This course addresses the unique entrepreneurial experience of conceiving, evaluating, creating, managing, and potentially selling a business idea. The goal is to provide a solid background with practical application of important concepts applicable to the entrepreneurial environment. Entrepreneurial discussions regarding the key business areas of finance, accounting, marketing and management include the creative aspects of entrepreneurship. The course relies on classroom discussion, participation, the creation of a feasibility plan, and building a business plan to develop a comprehensive strategy for launching and managing a new venture.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	The course gives students the tools necessary to think creatively, to plan out whether their idea is marketable to investors, guide them through the launch their own business, or to support an employer in launching and growing an entrepreneurial venture.	C2 (Understand)

Course Learning Objectives

1. To enhance the 'entrepreneurial intentions' of the students by improving their natural willingness to start a business.
2. To understand the process of entrepreneurship and learn the ways to manage it by working individually in the class and in the form of groups outside the class to conduct field assignments.
3. To educate the students about the practical underpinnings of the entrepreneurship with the aid of practical assignments and idea pitching.

Course Outline:

1. **Background:** What is an Organization, Organizational Resources, Management Functions, Kinds of Managers, Mintzberg's Managerial Roles.
2. **Forms of Business Ownership:** The Sole proprietorship, Partnership, Joint Stock Company
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits of Entrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding the Entrepreneurial Fire.
4. **The Challenges of Entrepreneurship:** The Cultural Diversity in Entrepreneurship, The Power of "Small" Business, Putting Failure into Perspective, The Ten Deadly Mistakes of Entrepreneurship, How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics of Entrepreneurship.
5. **Inside the Entrepreneurial Mind:** From Ideas to Reality: Creativity, Innovation, and Entrepreneurship, Creativity – Essential to Survival, Creative Thinking, Barriers to Creativity, How to Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process, Protecting Your Ideas, Idea Discussions & Selection of student Projects.
6. **Products and technology, identification opportunities**
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan:** Building a strategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulate strategic options and select the appropriate strategies, Discussion about execution of Students' Project.
8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:** Conducting a Feasibility Analysis, Industry and market feasibility, Porter's five forces model, Financial feasibility analysis. Why Develop a Business Plan, The Elements of a Business Plan, What Lenders and Investors Look for in a Business Plan, Making the Business Plan Presentation.
9. **Building a Powerful Marketing Plan:** Building a Guerrilla Marketing Plan, Pinpointing

the Target Market, Determining Customer Needs and Wants Through Market Research. Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics for Entrepreneurial Marketing

10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into E-Commerce, Ten Myths of E-Commerce, Strategies for E-Success, Designing a Killer Web Site, Tracking Web Results, Ensuring Web Privacy and Security, Feed Back & Suggestions on Student Project.
11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies and Tactics, Pricing Strategies and Methods for Retailers, The Impact of Credit on Pricing
12. **Attracting Venture Capitalist:** Projected Financial Statements, Basic Financial Statements, Ratio Analysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back &Suggestions on Student Project,
13. **Idea Pitching:** Formal presentation, 5-minutes pitch, funding negotiation and launching.

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

Recommended Texts:

1. Scarborough, N. M. (2011). Essentials of entrepreneurship and small business management. Publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458..

Suggested Readings:

1. Burstiner, I. (1989). Small business handbook. Prentice Hall Press.

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
  - شوہرکی 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)
- المائده(۵ ،۲ ،۸۲ ،۳۹ ،۱۹ ،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-5111	Translation of the Holy Quran - III
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 introduce ethics and highlight its importance, need and relevance for individual and collective life.	-
CLO-2	To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc.	-
CLO-3	To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc.	
CLO-4	To inculcate ethical and moral values in our youth.	-
CLO-5	To develop a balanced dynamic and wholesome personality.	-

CLO-6	To introduce the students to Quranic Arabic grammar in practical manner.	-

Objectives

- To introduce ethics and highlight its importance, need and relevance for individual and collective life.
- To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc.
- To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc.
- To inculcate ethical and moral values in our youth.
- To develop a balanced dynamic and wholesome personality.
- To introduce the students to Quranic Arabic grammar in practical manner.

Course Outline:

- اخلاق (تعارف،ضرورت واہمیت ،اقسام،معنویت)

اخلاق حسنہ:

- برائی کو نیکی سے مٹانا
- نیکی کے کاموں میں مسابقت
- لوگوں کے درمیان صلح
- عدل وانصاف
- سچائی
- ایثار
- سلیم قلب
- مہمان نوازی
- لغویات سے اعراض
- عاجزی و انکساری
- نگاہ اور آوازکو پست رکھنا
- چال میں میانہ روی
- شرمگاہوں کی حفاظت
- صبر
- شکر
- امور میں میانہ روی

اخلاق سئیہ :

- ظلم اور زیادتی
- غرور و تکبر
- نفسانی خواہشات کی پیروی
- بدگمانی
- جھوٹ
- چغلی اور تہمت
- تمسخر اور شیخی خوری
- لہو و لعب
- برے ناموں سے پکارنا
- احسان جتانا اور تکلیف دینا
- فضول خرچی اور حد سے بڑھنا
- حسد اور تنگ دل
- بے پردگی

Grammar:

- شجر و حجر
- زمین و آسمان کے اسرار
- ہوائیں اور طوفان
- بہائم اور مویشی
- حشرات الارض
- پہاڑ اور سمندر

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 (۲۷۱، ۲۷۴، ۲۶۲، ۲۸۲، ۲۷۵، ۱۶، ۲۶۵، ۱۷۷، ۲۶۵، ۱۸، ۲۷۵، ۲۶۴، ۲۱۹، ۲۶۵، ۲۲۱۵، ۲۶۱)
  ۸۳، ۱۷۷، ۲۱۵، ۲۷۶، ۲۷۸، ۱۶، ۲۷، ۲۲۳، ۲۹، ۲۵۵، ۱۶۴، ۲۶۶، ۱۶۴، ۱۶۴، ۵۰۰، ۶۰، ۱۶۴، ۵۷،
  (۹۳، ۹۲، ۷۱، ۲۶، ۱۹، ۲۱۰
- آل عمران(۵۹، ۲۷، ۱۹۰، ۱۳۰، ۱۳۴، ۱۱۷)
- النساء(۱۶۱، ۲۹، ۲، ۲۹)
- المائدہ(۶۰، ۶۹، ۷۵، ۹۵، ۸۹)
- التوبہ(۴، ۶۰، ۲۴، ۲۴، ۶۹، ۲۴، ۹۸)
- الاعراف(۱۶۶، ۱۷۶، ۱۳۳، ۴۰، ۱۶۰، ۱۶۳، ۱۶۳، ۵۸، ۵۷، ۱۸۵، ۱۷۲)
- الرعد(۴، ۱۷)
- الطور(۴۴)
- الانعام(۳۸، ۱۴۶، ۱۴۱، ۶۳، ۵۹)
- الانفال(۴۱، ۳۶، ۲۸)
- الکہف(۴۵، ۱۷، ۴۵، ۳۲، ۴۷، ۱۰۹، ۵۱)
- الجاثیہ(۵)
- فاطر(۱۳، ۱۲، ۲۷)
- العنکبوت(۴۱، ۶۳، ۲۰)
- الروم(۵۰)
- الاسراء(۹۹، ۷۰)
- الرعد(۲)
- السبا(۲۲، ۳، ۱۰)
- یونس(۲۲، ۵، ۲۴، ۲۴، ۱۰۱، ۸۸)
- یوسف(۱۴، ۹۴)
- الفرقان(۵۳، ۶۲)
- لقمان(۱۶، ۲۹)
- طہ(۵۳، ۱۱۴)
- النحل(۸، ۱۱۵، ۶۸، ۶۸، ۷۹، ۴۹، ۶۱، ۱۱، ۷۵)
- النمل(۱۸، ۱۷، ۱۶، ۸۲، ۶۰، ۸۸، ۶۴، ۶۴)
- السجدہ(۲۷)
- الحدید(۶)
- ھود(۶، ۴۳)
- یسین(۴۱، ۳۷)
- الروم(۴۶، ۲۴، ۱۹، ۵۰، ۳۹، ۳۹)
- فصلت(۳۹، ۳۹)
- الحج(۷۳، ۲۲، ۶۵، ۶۱)
- الحجر(۲۲، ۱۹)
- الانبیاء(۴۷، ۳۰، ۳۱)
- الزاریات(۴۷)
- الزلزلہ(۱)
- القصص(۸۲، ۸۱، ۸۰، ۷۹، ۷۶)

URCG-5111	Translation of the Holy Quran - IV
Credit Hours: **Contact Hours:** **Pre-requisites:**	Non-Credit - 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 with commandments of trade and inheritance mentioned in the Quranic text (with the help of Urdu translation).	-
CLO-2	To introduce the students to scientific facts and miracles of the Holy Quran and Quranic stress on deep study of Allah's explored universe.	-
CLO-3	To motivate the students for reading and exploring the last Holy Book revealed by Almighty Allah.	
CLO-4	Through memorization students will develop their relation with last revelation.	-

Objectives

- To familiarize the students with commandments of trade and inheritance mentioned in the Quranic text (with the help of Urdu translation).
- Students
- To introduce the students to scientific facts and miracles of the Holy Quran and Quranic stress on deep study of Allah's explored universe.
- To motivate the students for reading and exploring the last Holy Book revealed by Almighty Allah.
- Through memorization students will develop their relation with last revelation.

Course Outline:

- تجارت اور وراثت:
  - مال کی تقسیم
  - نادان کا مال
  - عوام الناس کا مال
  - عورتوں کا مال
  - یتیموں کا مال
  - کفار کا مال
  - جائز مال
  - معاہدے
  - ربن
  - قرض
- سائنسی حقائق:
  - تخلیقِ کائنات
  - اجرامِ فلکی

- شجر و حجر
- زمین و آسمان کے اسرار
- ہوائیں اور طوفان
- بہائم اور مویشی
- حشرات الارض
- پہاڑ اور سمندر

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 ،۲۷۱ ،۲۷۴ ،۲۶۲ ،۲۸۲ ،۲۷۵ ،۱۶ ،۲۶۵ ،۱۷۷ ،۲۶۵ ،۱۸ ،۲۷۵ ،۲۶۴ ،۲۱۹ ،۲۶۵ ،۲۲۱۵ ،۲۶۱) ۸۳ ،۱۷۷ ،۲۱۵ ،۲۷۶ ،۲۷۸ ،۱۶ ،۲۷ ،۲۲۳ ،۲۹ ،۲۵۵ ،۱۶۴ ،۲۶۶ ،۱۶۴ ،۱۶۴ ،۵۰ ،۶۰ ،۱۶۴ ،۵۷ ،۲۱۰ ،۱۹ ،۲۶ ،۷۱ ،۹۲ ،۹۳)
- آل عمران(۵۹ ،۲۷ ،۱۹۰ ،۱۳۰ ،۱۳۴ ،۱۱۷)
- النساء(۱۶۱ ،۲۹ ،۲ ،۲۹)
- المائدہ(۶۰ ،۶۹ ،۷۵ ،۹۵ ،۸۹)
- التوبہ(۴ ،۶۰ ،۲۴ ،۲۴ ،۶۹ ،۲۴ ،۹۸)
- الاعراف(۱۶۶ ،۱۷۶ ،۱۳۳ ،۴۰ ،۱۶۰ ،۱۶۳ ،۱۶۳ ،۵۸ ،۵۷ ،۱۸۵ ،۱۷۲)
- الرعد(۴ ،۱۷)
- الطور(۴۴)
- الانعام(۳۸ ،۱۴۶ ،۱۴۱ ،۶۳ ،۵۹)
- الانفال(۴۱ ،۳۶ ،۲۸)
- الکہف(۴۵ ،۱۷ ،۴۵ ،۳۲ ،۴۷ ،۱۰۹ ،۵۱)
- الجاثیہ(۵)
- فاطر(۱۳ ،۱۲ ،۲۷)
- العنکبوت(۴۱ ،۶۳ ،۲۰)
- الروم(۵۰)
- الاسراء(۹۹ ،۷۰)
- الرعد(۲)
- السبا(۲۲ ،۳ ،۱۰)
- یونس(۲۲ ،۵ ،۲۴ ،۲۴ ،۱۰۱ ،۸۸)
- یوسف(۱۴ ،۹۴)
- الفرقان(۵۳ ،۶۲)
- لقمان(۱۶ ،۲۹)
- طہ(۵۳ ،۱۱۴)
- النحل(۸ ،۸ ،۱۱۵ ،۶۸ ،۶۸ ،۷۹ ،۴۹ ،۶۱ ،۱۱ ،۷۵)
- النمل(۱۸ ،۱۷ ،۱۶ ،۸۲ ،۶۰ ،۸۸ ،۶۴ ،۶۴)
- السجدہ(۲۷)
- الحدید(۶)
- ھود(۶ ،۴۳)
- یسین(۴۱ ،۳۷)
- الروم(۴۶ ،۲۴ ،۱۹ ،۵۰ ،۳۹ ،۳۹)
- فصلت(۳۹ ،۳۹)
- الحج(۷۳ ،۲۲ ،۶۵ ،۶۱)
- الحجر(۲۲ ،۱۹)
- الانبیاء(۴۷ ،۳۰ ،۳۱)
- الزاریات(۴۷)
- الزلزلہ(۱)
- القصص(۸۲ ،۸۱ ،۸۰ ،۷۹ ،۷۶)

- النور(٤٣، ٤٥، ٤٠، ٢٢، ٢٢، ٣٧)
- الجمعه(٥، ١١، ١٠، ٦٢، ١١)
- القمر(٧)
- الواقعه(٦٩)
- الفاطر(١٣، ٢٠)
- الملک(١٩)
- الصف(١٠)
- الجن(١٣)
- الشوریٰ(٢٨)
- الزخرف(١١)
- الفیل(١)

URCG-5128	Pakistan Studies

PAKISTAN STUDIES

UGE POLICY V.1.1: GENERAL EDUCATION COURSE

Credits: 02
Pre-Requisite: Nil
Offering: Undergraduate Degrees
Placement: 1 - 8 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