



UNIVERSITY OF SARGODHA  
OFFICE OF THE REGISTRAR  
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 24<sup>th</sup> (1/2025) meeting held on 26.08.2025, the Syndicate in its 72<sup>nd</sup> (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 Information Technology                     | (Annex-'A') |
| II.  | BS in Information Technology                                   | (Annex-'B') |
| III. | BS in Information Technology (5 <sup>th</sup> Semester Intake) | (Annex-'C') |

  
(WAQAR AHMAD)  
Additional Registrar (General)

Dated: 05.11.2025

No. SU/Acad/25/ 1195

Distribution:

- Chairman, Department of Information Technology
- 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  
ADP Information Technology  
for  
Main Campus, and Affiliated Colleges



Department of Information Technology

University of Sargodha

(Applicable from Fall 2024)

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#### Guidelines for Affiliated Colleges

- ADP-(IT) program shall be offered under Term System observing University of Sargodha's Affiliation Rules & Regulation.
- There shall be two terms in a calendar academic year.
- The affiliated college(s)/institutions shall follow the prescribed curriculum and course matrix. Necessary modification/changes shall be communicated to the affiliated Colleges/Institutions, if any.
- For domain elective courses, the affiliated institution(s)/college(s) shall follow "Regular Track". However, the administration of any affiliated institution must get prior permission from the competent authority to offer any specialization tracks/courses approved by the BOS. For this purpose, the institution's administration needs to show/demonstrate the availability of appropriate human resource along with necessary educational provisions before the start of the term in which specialization track/course shall be offered. The recommendations of the Convener BOS shall be solicited to allow the Institution to offer the requested specialization track/course already approved by the BOS.

## **The Discipline of Information Technology**

The evolution of information technology (IT) has been marked by rapid and transformative changes, starting from the mechanical calculators of the 19th century to the sophisticated digital systems of the 21st century. Initially, IT was primarily focused on data processing and number crunching, but over time, it has expanded to include a wide range of functionalities, such as communication, data storage, and security. The advent of personal computing in the 1980s and the internet in the 1990s revolutionized the field, making technology more accessible and integral to daily life. This evolution continued with the development of mobile computing, cloud computing, and artificial intelligence, significantly impacting how individuals and organizations interact with technology and process information.

Information technology (IT) refers to the use of computers, networking devices, and software to process, store, retrieve, and send information. It encompasses a variety of activities, including computer programming, data management, networking, system administration, and hardware development. IT is fundamental to the operations of modern organizations, enabling them to manage their information resources efficiently, enhance communication, implement automation, and improve decision-making processes. Through IT, businesses and other entities can leverage technological advancements to optimize their operations, innovate services and products, and maintain competitiveness in the digital age.

The motivation to offer a Associate Degree Program in Information Technology ADP-(IT) stems from the critical role that IT plays in the contemporary world. As businesses and societies become increasingly reliant on technology, there is a growing demand for skilled professionals who can develop, implement, and manage IT systems. A ADP in Information Technology equips students with the necessary knowledge and skills to address complex technological challenges, meet the evolving needs of the digital economy, and contribute to the advancement of various sectors. This degree program is designed to provide a comprehensive understanding of fundamental and advanced IT concepts, preparing graduates for a range of careers in the tech industry, from systems analysis and network administration to cybersecurity and software development.

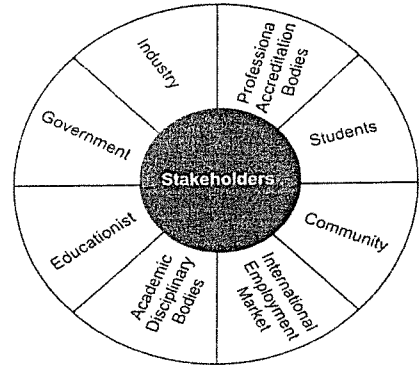
## **Information Technology Programs' Rationale**

The digital revolution not only reshaped the way scientists conduct their research but also expedite the pace of inventions. Consequently, the latest advancements in technologies for communication, computation, and delivery of information brought a paradigm shift in the business world - from data processing to information processing - converting computer technology into information technology (IT) and industrial society into an "information society". While this paradigm shift improves productivity, it also created new work place challenges regarding the development, operation, maintenance, and up-gradation of organizational IT infrastructure. Inventions like the Internet, the World Wide Web, email, bulletin board systems, virtual communities, E-business and other online technologies forced organizations to find IT based solutions to all kinds of business challenges. For this, organizations need appropriate systems that work properly and professionals who make these systems secured, upgraded, and maintained. In parallel, employees require support from these professionals to make technology effective for enhancing organizational productivity. This has created a huge demand of IT professionals both locally and globally. Meeting this demand is the key rationale behind the IT programs. In this regard, the IT programs offer a curriculum structure that can produce graduates who can meet above discussed challenges of the 21st century's knowledge driven complex work places. The curriculum structure will create,

expand, disseminate and teach the information technology body of knowledge through academics, applications and research which positively impact society (locally, nationally, and internationally). It will also provide an integration of all components that allow accessing all of the new knowledge and technologies for meeting the above discussed challenges.

## Underlying Principles of Information Technology Programs

Curriculum plays an important role within education as it outlines the planned and structured learning experiences that an academic program provides. For an effective academic program the curriculum must meet the needs of the stakeholders and face the emerging challenges. The Department of IT (UOS) realizes the rapidly changing needs of today's knowledge intensive technology driven complex work places and the changing patterns of 21st century universities' education which have removed the identity of place, the identity of time, the identity of the scholarly community; and the identity of the student community. To meet these challenges, the Department has revised the existing curriculum. The revised curriculum is based on following underlying principles:



- i. The curriculum should be a broad based and provides students with the flexibility to work across many disciplines & professions.
- ii. The curriculum should prepare graduates to succeed in a rapidly changing field.
- iii. The curriculum should provide guidance for the expected level of mastery of topics by graduates.
- iv. Should provide realistic, adoptable recommendations that provide guidance and flexibility, allowing curricular designs that are innovative and track recent developments in the field.
- v. The curriculum contents should be relevant and compatible with a variety of institutions.
- vi. The size of the essential knowledge must be managed.
- vii. The curriculum should identify the fundamental skills and knowledge that all graduates should possess.
- viii. The curriculum should provide the greatest flexibility in organizing topics into courses and curricula.

In the light of these principles, the curriculum of the program has adopted a balanced and multidisciplinary approach and presents a blend of study areas which spread across the boundaries of fundamental knowledge of traditional disciplines to advanced knowledge of the emerging disciplines: Body of knowledge (BOK) of the program covers knowledge areas which are required for the program's accreditation from the Accreditation Council and knowledge area which are required for professional certification and professional development.

It is universally accepted that each profession needs both a specific skill set and an appropriate mindset. Developing an appropriate mindset of the prospective computing graduates requires a body of knowledge which enriches students' experiences, thoughts, beliefs, assumptions, and attitudes about the special characteristics of that specific domain. Therefore, the course contents and related practical experiences are designed to meet the professional requirements of the respective domain. To achieve the curricula have focused on

following six (6) key areas:

- i. Knowledge: Theoretical learning of concepts and principles regarding a particular subject(s).
- ii. Skills: Capability of using learnt knowledge and applying it according to the context
- iii. Competencies: The ability to do things satisfactory- not necessarily outstandingly or even well, but rather to a minimum level of acceptable performance.
- iv. Expertise: Level of proficiency and innovative ways of applying learnt knowledge. (Competitive edge)
- v. Dispositions: Habits of mind or tendencies to respond to certain situations in certain ways. The role of dispositions in computing education is very important. For example, having the disposition to be a programmer is much better than just having programming skills.
- vi. Values: Moral, ethical and professional practices.

To strengthen the curriculum further, specialization tracks/courses have also been integrated within the curriculum's BOK. These specialization tracks/courses are designed according to what the industry is looking for in an employee and the learning interests of students. Furthermore, life skills including desired dispositions, soft skills, public speaking, critical thinking & reasoning, 21st Century literacies, personal attributes, entrepreneurship, attitude towards lifelong learning, professional practices and other social skills have not been considered discrete items, rather threaded into the entire fabric of the curriculum.

### **Vision Statement of University of Sargodha**

Our vision is to contribute to society through the pursuit of quality education, creative learning and productive research

### **Mission Statement of University of Sargodha**

- To provide students with a healthy learning experience based on critical thinking, innovation and leadership skills
- To ensure a collaborative work environment for faculty and staff to achieve professional excellence and institutional growth
- To contribute to knowledge economy and social transformation through advanced studies and research

### **Vision Statement of Department of Information Technology**

Department of Information Technology aspires to societal betterment through a commitment to quality education, technical skills, fostering creativity via analytical learning, and conducting impactful research in the ever-dynamic field of Information Technology.

### **Mission Statement of Department of Information Technology**

Our mission includes:

- Imparting students with an enriching learning experience in the field of Information Technology centered on in-depth knowledge, critical thinking, innovation, and technical proficiency.
- Cultivating a professional and collaborative work environment for faculty and staff of the department, fostering the attainment of professional excellence

Contributing to knowledge economy, drive social transformation and deliver community services through advanced studies and research in the field of Information Technology.

  
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# Curriculum for ADP-Information Technology Program

## Details of ADP-Information Technology

### Program Educational Objectives

The aim of the ADP-(IT) program is to produce entrepreneurs of great character, competence, vision and drive equip 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 information technology domain or proceed to further or higher education or training. One of the key objectives of the program is to equip students with skills and knowledge that enable them to take on appropriate professional positions in IT and grow into leading roles. The following are the PEOs for all BS degree programs being offered in the Department of Information Technology:

*PEO-1:* Provide in-depth knowledge, analytical skills, and creativity in the domain of Information Technology.

*PEO-2:* Attain the ability to adapt in an evolving technological environments, assimilate new information with a strong focus on application to solve real-world problems.

*PEO-3:* Instill moral and ethical values, along with the ability to communicate effectively.

*PEO-4:* Train graduates to contribute towards knowledge economy and socio-economic growth of the country.

### Program's Outcome

ADP-(IT) program will produce entrepreneurs of great character, competence, vision and drive equip 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 information technology domain or proceed to further or higher education or training.

### Program's Structure

The structure of ADP-(IT) program is very 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:

#### Specialization Tracks

Following specialization tracks are being offered:

1. Regular Track | Public-Private campuses and affiliated colleges will follow track|
2. General Track |Main and public sub campuses|



### Degree Requirement

To become eligible for award of ADP-(IT) degree, a student must satisfy the following requirements:

- a) Must have studied and passed the prescribed courses, totaling at least 74 credit hours.
- b) Must have earned CGPA (Cumulative Grade Point Average) of at least 2.0 on a scale of 4.0.

### Duration

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

### Eligibility Criteria

HISSC (Part-I) with least 50% Marks with one of the following combinations:

- I. Pre-Engineering
- II. Pre-Medical (Admitted candidates has to pass 6-credit hours courses of mathematics in first two semester.)

**Merit:** Basic criteria+20 marks of Hafiz-e-Quran (if applicable)

#### 1) General Science

- a) Math, Stat, Phy
- b) Math, Stat, Eco
- c) Math, Stat, Comp
- d) Math, Phy, Comp
- e) Math, Eco, Comp

- 2) A-Level (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

ADP-(IT)			
Taxonomy of Courses	Major Areas	Credit Hours	Courses
Major Courses	Computing Core	34	10
	Domain Core	06	02
Interdisciplinary	Mathematics & Supporting	09	03
	Elective Supporting	03	01
General Education	General Education	22	08
	<b>Total</b>	<b>74</b>	<b>24</b>

### Major Area Courses

Computing Core Courses – 34 Credit Hours - 10 Courses				
#	Code	Pre-Req	Course Title	Cr. Hrs. (Contact Hrs)
1	CMPC-5201	-	Programming Fundamentals ✓	4 (3-3)
2	CMPC-5202	CMPC-5201	Object Oriented Programming ✓	4 (3-3)
3	CMPC-5203	-	Database Systems ✓	4 (3-3)
4	CMPC-5204	-	Digital Logic Design ✓	3 (3-0)
5	CMPC-5205	CMPC-5201	Data Structures ✓	4 (3-3)
6	CMPC-5206	-	Information Security ✓	3 (2-3)
7	CMPC-5207	-	Artificial Intelligence ✓	3 (3-0)
8	CMPC-5208	-	Computer Networks ✓	3 (2-3)
9	CMPC-5101	-	Software Engineering ✓	3 (3-0)
10	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language ✓	3 (2-3)

Domain Core – 6 Credit Hours - 02 Courses				
#	Code	Pre-Req	Course Title	Cr. Hrs. (Contact Hrs)
1	ITDC-5201	-	Web Technologies ✓	3 (3-0)
2	ITDC-5202	-	Cyber Security ✓	3 (3-0)

Mathematics & Supporting Courses – 09 Credit Hours - 03 Courses				
#	Code	Pre-Req	Course Title	Cr. Hrs. (Contact Hrs)
1	MATH-5101	URCQ-5102	Multivariable Calculus ✓	3 (3-0)
2	MATH-5102	-	Linear Algebra ✓	3 (3-0)
3	MATH-5103	-	Probability & Statistics ✓	3 (3-0)

Elective Supporting Courses – 03 Credit Hours - 01 Courses				
#	Code	Pre-Req	Course Title	Cr. Hrs. (Contact Hrs)
1	BUSB-6101	-	Introduction to Marketing ✓	3 (3-0)

General Education – 22 Credit Hours - 08 Courses				
#	Code	Pre-Req	Course Title	Cr. Hrs. (Contact Hrs)
1	URCG-5118	-	Functional English ✓	3 (3-0)
2	URCG-5119	-	Expository Writing ✓	3 (3-0)
3	URCQ-5101	-	Quantitative Reasoning I (Discrete Structures) ✓	3 (3-0)
4	URCG-5105	-	Islamic Studies ✓	2 (2-0)

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5	URCG-5126	-	Ethics**	2 (2-0)
6	URCG-5123	-	Applications of Information & Communication Technologies ✓	3 (2-1)
7	URCQ-5102	-	Calculus & Analytical Geometry* ✓	3 (3-0)
8	URCW-5201	-	Applied Physics ✓	3 (3-0)
9	URCG-5128	-	Pakistan Studies ✓	2 (2-0)
10	URCG-5111	-	Translation of Holy Quran-I ✓	Non-Credit
11	URCG-5111	-	Translation of Holy Quran-II ✓	Non-Credit

\*A pre-medical student can only study Calculus & Analytical Geometry after passing 6-credit hours courses of mathematics.

\*\*Non-Muslims students will study Ethics instead of Islamic Studies

### Course Coding Scheme

Discipline Code	Course Level	Course Type	Course Number
4 Letters	1 Digit	1 Digit	2 Digits
Xxxx	5-6	1-2	01-99

### Discipline Code

Code	Discipline
CMPC	Computing Core
ITDC	Information Technology Domain Core
ITDE	Information Technology Domain Elective
CSDC	Computer Science Domain Core
CSDE	Computer Science 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
MATH	Mathematics
ENGL	English
URCG	General Education
URCC	
URCQ	
URCS	
URCE	
URCA	
URCF	
URCW	
URCT	

**Course Level**

Level	Course Type
5	Semester 1-4
6	Semester 5-8

**Course Type**

Level	Course Type
1	Non-lab Course
2	Lab Course

**Scheme of Studies for ADP-(IT)****For Main Campus**

2-Year Program (4 Regular Semesters)

**Semester – I**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
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	SS	3 (3-0)
7	URCM-5107	-	Mathematics-I*	MATH	Non-Credit
<b>Total Credit Hours</b>					<b>19 (17-6)</b>

\*Applicable only for Pre-medical students

**Semester - II**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
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 (3-0)
4	MATH-5101	URCQ-5102	Multivariable Calculus	MATH	3 (3-0)
5	MATH-5102	-	Linear Algebra	MATH	3 (3-0)
6	URCG-5111	-	Translation of Holy Quran-I	GER	0 (0-0)
7	URCM-5108	-	Mathematics- II*	MATH	Non-Credit
8	URCG-5128	-	Pakistan Studies	GER	2(2-0)
<b>Total Credit Hours</b>					<b>19 (17-6)</b>

\*Applicable only for Pre-medical students

**Semester – III**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
1	CMPC-5205	CMPC-5201	Data Structures	Core	4 (3-3)
2	CMPC-5206	-	Information Security	Core	3 (2-3)
3	CMPC-5207	-	Artificial Intelligence	Core	3 (3-0)
4	CMPC-5208	-	Computer Networks	Core	3 (2-3)
5	CMPC-5101	-	Software Engineering	Core	3 (3-0)
6	MATH-5103	-	Probability & Statistics	MATH	3 (3-0)
<b>Total Credit Hours</b>					<b>19 (16-9)</b>

**Semester – IV**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
1	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	Core	3 (2-3)
2	ITDC-5201	-	Web Technologies	Domain Core	3 (3-0)
3	ITDC-5202	-	Cyber Security	Domain Core	3 (3-0)
4	URCG-5105	-	Islamic Studies	GER	2 (2-0)
5	URCG-5126	-	Ethics*	GER	2 (2-0)
6	URCW-5201	-	Applied Physics	GER	3 (3-0)
7	URCG-5119	-	Expository Writing	GER	3 (3-0)
8	URCG-5111	-	Translation of Holy Quran-II	GER	Non-Credit
<b>Total Credit Hours</b>					<b>17 (16-3)</b>

\*Non-Muslims students will study Ethics instead of Islamic Studies

**Scheme of Studies for ADP-(IT)**

**For Affiliated Colleges**

2-Year Program (4 Regular Semesters)

**Semester – I**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
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	SS	3 (3-0)
7	URCM-5107	-	Mathematics-I*	MATH	Non-Credit
<b>Total Credit Hours</b>					<b>19 (17-6)</b>

\*Applicable only for Pre-medical students

**Semester - II**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
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-5111	-	Translation of Holy Quran-I	GER	0 (0-0)
7	URCM-5108	-	Mathematics-II*	MATH	Non-Credit
8	URCG-5128	-	Pakistan Studies	GER	2(2-0)
<b>Total Credit Hours</b>					<b>19 (17-6)</b>

\*Applicable only for Pre-medical students

**Semester - III**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
1	CMPC-5205	CMPC-5201	Data Structures	Core	4 (3-3)
2	CMPC-5206	-	Information Security	Core	3 (2-3)
3	CMPC-5207	-	Artificial Intelligence	Core	3 (2-3)
4	CMPC-5208	-	Computer Networks	Core	3 (2-3)
5	CMPC-5101	-	Software Engineering	Core	3 (3-0)
6	MATH-5103	-	Probability & Statistics	MATH	3 (3-0)
<b>Total Credit Hours</b>					<b>19 (16-9)</b>

**Semester - IV**

S#	Code	Pre-requisite	Course Title	Domain	CH (Cont Hrs)
1	CMPC-5209	CMPC-5204	Computer Organization & Assembly Language	Core	3 (2-3)
2	ITDC-5201	-	Web Technologies	Domain Core	3 (2-3)
3	ITDC-5202	-	Cyber Security	Domain Core	3 (2-3)
4	URCG-5105	-	Islamic Studies	GER	2 (2-0)
5	URCG-5126	-	Ethics*	GER	2 (2-0)
6	URCW-5201	-	Applied Physics	GER	3 (2-3)
7	URCG-5119	-	Expository Writing	GER	3 (3-0)
8	URCG-5111	-	Translation of Holy Quran-II	GER	Non-Credit
<b>Total Credit Hours</b>					<b>17 (16-3)</b>

\*Non-Muslims students will study Ethics instead of Islamic Studies

## Contents of Computing Core Courses

CMPC-5201 Programming Fundamentals		
<b>Credit Hours:</b>	4 (3-3)	
<b>Contact Hours:</b>	3-3	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
<p>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.</p>		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
<b>Course Outline:</b>		
<p>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.</p>		
<b>Reference Materials (or use any other standard and latest books):</b>		
<ol style="list-style-type: none"> <li>1. Starting Out with Programming Logic and Design: latest edition by Tony Gaddis.</li> <li>2. Object Oriented Programming in C++ latest edition by Robert Lafore.</li> <li>3. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel</li> <li>4. Problem Solving and Program Design in C++, latest Edition by Jeri R. Hanly &amp; Elliot B. Koffman.</li> </ol>		
CMPC-5202 Object Oriented Programming		
<b>Credit Hours:</b>	4 (3-3)	
<b>Contact Hours:</b>	3-3	
<b>Pre-requisites:</b>	Programming Fundamentals	

<b>Course Introduction:</b>		
The course aims to focus on object-oriented concepts, analysis and software development. The basic concept of OOP is covered in this course.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
<b>Course Outline:</b>		
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.		
<b>Reference Materials (or use any other standard and latest books):</b>		
<ol style="list-style-type: none"> <li>1. Java: How to Program, 9th Edition by Paul Deitel</li> <li>2. Beginning Java 2, 7th Edition by Ivor Horton</li> <li>3. An Introduction to Object Oriented Programming with Java, 5th Edition by C. Thomas Wu</li> <li>4. Starting Out with C++ from Control Structures to Objects, 9th Edition, Tony Gaddis</li> <li>5. C++ How to Program, 10th Edition, Deitel &amp; Deitel.</li> <li>6. Object Oriented Programming in C++, 3rd Edition by Robert Lafore</li> </ol>		

CMPC-5203 Database Systems ✓		
<b>Credit Hours:</b>	4 (3-3)	
<b>Contact Hours:</b>	3-3	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
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**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. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition by Thomas Connolly and Carolyn Begg
2. Database Systems: The Complete Book, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom
3. Database System Concepts, 6th Edition by Avi Silberschatz, Henry F. Korth and S. Sudarshan.
4. Database Management Systems, 3rd Edition by Raghu Ramakrishnan, Johannes Gehrke

CMPC-5204 Digital Logic Design ✓

<b>Credit Hours:</b>	3 (3-0)
<b>Contact Hours:</b>	3-0
<b>Pre-requisites:</b>	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	-
CLO-2	Demonstrate the skills to design and analyze both combinational and sequential circuits using a variety of techniques	-
CLO-3	Apply the acquired knowledge to simulate and implement small-scale digital circuits	-
CLO-4	Understand the relationship between abstract logic characterizations and practical electrical implementations.	-

**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, 11/e.
2. Fundamental of Digital Logic with Verilog Design, Stephen Brown, 2/e

CMPC-5205 Data Structures ✓

<b>Credit Hours:</b>	4 (3-3)
<b>Contact Hours:</b>	3-3
<b>Pre-requisites:</b>	Programming Fundamentals

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

CMPC-5206 Information Security ✓

<b>Credit Hours:</b>	3 (2-3)
<b>Contact Hours:</b>	2-3
<b>Pre-requisites:</b>	None

**Course Introduction:**

  
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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. Official (ISC)2 Guide to the CISSP CBK, 3rd edition

CMPC-5207 Artificial Intelligence ✓

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

**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, Maccs; 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., 2015.
2. Norvig, P. "Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp", Morgan Kaufman Publishers, Inc., 1992.
3. Luger, G.F. and Stubblefield, W.A., "AI algorithms, data structures, and idioms in Prolog, Lisp, and Java", Pearson Addison-Wesley, 2009.
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., 2017. "Artificial intelligence with python." Packt Publishing Ltd.

## CMPC-5208 Computer Networks ✓

**Credit Hours:** 3 (2-3)  
**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:** 3 (3-0)  
**Contact Hours:** 3-0  
**Pre-requisites:** 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. Software Engineering, Sommerville I., 10th Edition, Pearson Inc., 2014
2. Software Engineering, A Practitioner's Approach, Pressman R. S.& Maxim B. R., 8<sup>th</sup> Edition, McGraw-Hill, 2015.

  
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CMPC-5209 Computer Organization & Assembly Language ✓		
<b>Credit Hours:</b>	3 (2-3)	
<b>Contact Hours:</b>	2-3	
<b>Pre-requisites:</b>	Digital Logic Design	
<b>Course Introduction:</b>		
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.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
<b>Course Outline:</b>		
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		
<b>Reference Materials (or use any other standard and latest books):</b>		
<ol style="list-style-type: none"> <li>1. Assembly Language for x86 Processors by Kip R. Irvine, Prentice Hall; 6thEdition (March 7, 2010). ISBN-10: 013602212X</li> <li>2. The 8088 and 8086 Microprocessors: Programming, Interfacing. Software, Hardware, and Applications by Walter A. Triebel &amp; Avtar Singh, Prentice Hall; 4thEdition (September 8, 2002). ISBN-10: 0130930814.</li> <li>3. Lab Manual to Accompany - The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel &amp; Avtar Singh, Pearson; 4thEdition (2003). ASIN: B000Q652KQ</li> <li>4. Principles of Computer Organization and Assembly Language by Patrick Juola, Prentice Hall; 1stEdition (January 11, 2011). ASIN: B009TGB11Q</li> <li>5. The Art of Assembly Language by Randall Hyde, No Starch Press; 2ndEdition (March 22, 2010). ISBN-10: 1593272073.</li> </ol>		

### Contents of Domain Core Courses

ITDC-5201 Web Technologies ✓	
<b>Credit Hours:</b>	3 (3-0)
<b>Contact Hours:</b>	3-0
<b>Pre-requisites:</b>	None


<b>Course Introduction:</b>		
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.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
<b>Course Outline:</b>		
Introduction; role of algorithms in computing, Analysis on nature of input and size of input Asymptotic notations: Big-O, Big $\Omega$ , Big $\Theta$ , little-o, little- $\omega$ . 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.		
<b>Reference Materials (or use any other standard and latest books):</b>		
1. Learning PHP, MySQL, JavaScript, and CSS, A Step-by-Step Guide to Creating Dynamic Websites By Robin Nixon, O'Reilly Media; latest edition		
2. Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall; 1st Edition (August 27, 2006). ISBN-10: 0131856030		
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		

ITDC-5202 Cyber Security ✓		
<b>Credit Hours:</b>	3 (3-0)	
<b>Contact Hours:</b>	3-0	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
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)
<b>Course Outline:</b>		
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; Software security; Mobile device security; Mobile app security; Cyber Terrorism and Information Warfare; Introduction to Digital Forensics; Digital Forensics Categories.		
<b>Reference Materials (or use any other standard and latest books):</b>		
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		

### Preliminary Courses for Pre-Medical Students

URCM-5107 Mathematics I	
<b>Credit Hours:</b>	Non-Credit
<b>Contact Hours:</b>	3
<b>Pre-requisites:</b>	None
<b>Course Introduction:</b>	
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, and are 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.	
<b>Course Contents</b>	
<ol style="list-style-type: none"> <li>1. Preliminaries</li> <li>2. Real-number system, complex numbers</li> <li>3. Introduction to sets, set operations, functions, types of functions.</li> <li>4. Matrices Introduction to matrices, types, matrix inverse, determinants, system of lin Cramer's rule.</li> <li>5. Quadratic Equations</li> <li>6. Solution of quadratic equations, qualitative analysis of roots of a quadratic</li> <li>7. Equations reducible to quadratic equations</li> <li>8. Cube roots of unity, relation between roots and coefficients of quadratic</li> <li>9. Sequences and Series</li> <li>10. Arithmetic progression</li> </ol>	

  
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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:**

**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 geomerry. Boston: PWS-Kent Company.
3. Thomas. G. B. & Finney, A. R. (2005). Calculus (11th ed.), Reading: Addison-Wesley

URCM-5108 Mathematics II ✓

<b>Credit Hours:</b>	Non-Credit
<b>Contact Hours:</b>	3
<b>Pre-requisites:</b>	None

**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 Contents:**

1. Preliminaries
2. Real-number line
3. Functions and their graphs
4. Solution of equations involving absolute values, inequalities.
5. Limits and Continuity
6. Limit of a function
7. Left-hand and right-hand limits
8. Continuity
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.
<b>Reference Materials:</b>
<b>Recommended Text</b>
3. Thomas. G. B.. & Finney, A. R. (2005). Calculus. Reading: Addison-Wesley.
4. Anton. H., Bevens. L., & Davis. S. (2005). Calculus: A new horizon (8th ed.). New York: Joll Wiley.
<b>Suggested Readings</b>
4. Stewart. J. (1995). Calculus (3rd ed.). Pacific Grove, California: Brooks/Cole.
5. Swokowski, E. W. (1983). Calculus and analytic geomerry. Boston: PWS-Kent Company.
6. Thomas. G. B. & Finney, A. R. (2005). Calculus (11th ed.), Reading: Addison-Wesley

### Mathematics & Supporting Courses

MATH-5101 Multivariable Calculus ✓		
<b>Credit Hours:</b>	3 (3-0)	
<b>Contact Hours:</b>	3	
<b>Pre-requisites:</b>	Calculus and Analytical Geometry	
<b>Course Introduction:</b>		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
CLO-1	Develop the skills to have ground knowledge of multivariate calculus and appreciation for their further computer science courses.	C2 (Understand)
<b>Course Outline:</b>		
<p>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</p>		

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:** 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:**

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

  
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<b>Course Introduction:</b>		
To provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
CLO-1	Develops students fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems	C2(Understand)
<b>Course Outline:</b>		
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 $S^2$ , $t$ -Distribution, F-Quantile and Probability Plots. Single Sample & One- and Two-Sample Estimation Problems. Single Sample & One- and Two-Sample Tests of Hypotheses. The Use of P-Values for Decision Making in Testing Hypotheses (Single Sample & One- and Two-Sample 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.		
<b>Reference Materials (or use any other standard and latest books):</b>		
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		

**Content of Supporting Elective Courses**

BUSB-6101 Introduction to Marketing ✓	
<b>Credit Hours:</b>	3 (3-0)
<b>Contact Hours:</b>	3
<b>Pre-requisites:</b>	None
<b>Course Introduction:</b>	

  
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CLO No.	Course Learning Outcomes	Bloom Taxonomy
CLO-1	-	-
<b>Course Outline:</b>		
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		
<b>Reference Materials (or use any other standard and latest books):</b>		
1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company, 8 <sup>th</sup> Edition. 2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.		

### General Education Courses

URCG-5123 Applications of Information Communication Technologies (ICT)		
<b>Credit Hours:</b>	3 (2-3)	
<b>Contact Hours:</b>	2-3	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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)
<b>Course Outline:</b>		
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; 17<sup>th</sup> edition.

**Suggested Books**

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

**URCG-5118 Functional English**

<b>Credit Hours:</b>	3 (3-0)
<b>Contact Hours:</b>	3
<b>Pre-requisites:</b>	None

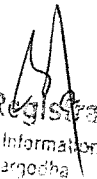
**Course Introduction:**

The course aims at providing understanding of a writer's goal of writing (i.e. clear, organized and effective content and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the grammatical academic writing skills. The course would enable the students to develop argumentative writing techniques. The students would be able to logically add specific details on the topics such as facts, examples and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in an objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation, plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

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

**Course Outline:**

1. Developing Analytical Skills
2. Transitional devices (word, phrase and expressions)

  
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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 (3<sup>rd</sup> ed.). Ann Arbor: The University of Michigan Press.
4. Swan, M. (2018). Practical English usage (8<sup>th</sup> ed.). Oxford: Oxford University Press.

**Suggested Readings**

1. Biber, D., Johansson, S., Lecch, 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:** None

**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 21<sup>st</sup> 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 LI)
  - 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 (3<sup>rd</sup> 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:** None

**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 Johnsonbaugh, 2007

URCQ-5102 Calculus and Analytic Geometry ✓		
<b>Credit Hours:</b>	3 (3-0)	
<b>Contact Hours:</b>	3	
<b>Pre-requisites:</b>	-	
<b>Course Introduction:</b>		
To provide foundation and basic ground for calculus and analytical geometry background.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
-	-	
<b>Course Outline:</b>		
Limits and Continuity; Introduction to functions, Introduction to limits, Techniques of finding 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 R <sup>3</sup> , Equations for planes.		
<b>Reference Materials (or use any other standard and latest books):</b>		
<ol style="list-style-type: none"> <li>1. Calculus and Analytic Geometry by Kenneth W. Thomas.</li> <li>2. Calculus by Stewart, James.</li> <li>3. Calculus by Earl William Swokowski; Michael Olinick; Dennis Pence; Jeffery A. Cole</li> </ol>		

  
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URCG-5105 Islamic Studies (Compulsory)

<b>Credit Hours:</b>	2 (2-0)
<b>Contact Hours:</b>	2
<b>Pre-requisites:</b>	-

**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 Scerah 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 Haqooq ul ibad 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 سورة البقرہ آیات 1-5-284-286 سورة الحجرات آیات 1-18 - سورة الفرقان آیات 77-63؛ سورة المومنون آیات 1-11 سورة الاحزاب آیات 6، 21-32 33-5640 59 سورة		

الانعام آیات 151-153، سورة الصف آیات 1 - 14: الحشر آیات 18 - 20 آل عمران آیات 190 - 192 النحل آیات 12-14 53 : لقم آیت 20 ، حم السجده آیت

- |   |                |
|---|----------------|
| 2. Introduction to Hadith               | تعارف حدیث     |
| 1) Legal Status of Hadith               | حدیث کی قانونی |
| 2) History of the compilation of Hadith | حدیث کی قانونی |
| 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 و سنت گمراہی سے بچنے کا ذریعہ ہیں 4- ارکان اسلام 5- اسلام، ایمان، احسان اور قیامت کی نشانیوں 6- بچوں کو نماز کی تلقین 7- دین کا گہرا فہم اللہ کی خاص عنایت 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 کا لحاظ 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- بلاک 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 و اہمیت     |
| 2. Prophetic principles of Character building | تعمیر سیرت و شخصیت کا نبوی منہاج |

اقامت دین کا نبوی طریق کار اقامت دین بعید خلافت راشدہ، ميثاق 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 تمدن 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، تہذیبی 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 Shahbaz Manj, Teleccmat-e-Islam

URCG-5126 Ethics

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

CLO No.	Course Learning Outcomes	Bloom Taxonomy
-	-	

**Course Outline:**

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

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

1. William Lillie. 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. Calcutta: 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, Karachi University of

  
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✓

URCW-5201 Applied Physics

<b>Credit Hours:</b>	3 (3-0)
<b>Contact Hours:</b>	3-0
<b>Pre-requisites:</b>	None

**Course Introduction:**

The course introduces students with the basic concept of Physics and electronics. Students are also taught Physics laws and other associate topics to prepare them for the advanced level courses in this area. The focus of the course on electric force and its applications and related problems, conservation of charge, charge quantization, Electric fields due to point charge and lines of force and many other useful topics.

CLO No.	Course Learning Outcomes	Bloom Taxonomy
-	-	

**Course Outline:**

Electric force and its applications and related problems, conservation of charge, charge quantization, Electric fields due to point charge and lines of force. Ring of charge, Disk of charge, A point charge in an electric field, Dipole in a n electric field, The flux of vector field, The flux of electric field, Gauss' Law, Application of Gauss' Law, Spherically symmetric charge distribution, A charge isolated conductor, Electric potential energy, Electric potentials, Calculating the potential from the field and related problem Potential due to point and continuous charge distribution, Potential due to dipole, equipotential surfaces. Calculating the field from the potential, Electric current, Current density, Resistance, Resistivity and conductivity, Ohm's law and its applications, The Hall effect, The magnetic force on a current, The Biot-Savart law, Line of B, Two parallel conductors, Amperes' s Law, Solenoid, Toroids, Faraday's experiments, Faraday's Law of Induction, Lenz's law, Motional emf, Induced electric field, Induced electric fields, The basic equation of electromagnetism, Induced Magnetic field, The displacement current, Reflection and Refraction of light waves, Total internal reflection, Two source interference, Double Slit interference, related problems, Interference from thin films, Diffraction and the wave theory, related problems, Single-Slit Diffraction, related problems, Polarization of electromagnetic waves, Polarizing sheets, related problems.

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

1. Fundamentals of Physics (Extended), 10th edition, Resnick and Walker
2. Narciso Garcia, Arthur Damask, Steven Schwarz., "Physics for Computer Science Students". Springer Verlag, 1998.

URCS-6101 Professional Practices		
<b>Credit Hours:</b>	2 (2-0)	
<b>Contact Hours:</b>	2	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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.		
<b>CLO No.</b>	<b>Course Learning Outcomes</b>	<b>Bloom Taxonomy</b>
-	-	-
<b>Course Outline:</b>		
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.		
<b>Reference Materials (or use any other standard and latest books):</b>		
<ol style="list-style-type: none"> <li>1. Boddington, P. (2023). AI ethics: a textbook. Springer Nature.</li> <li>2. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513</li> <li>3. Computer Ethics by Deborah G. Johnson, Pearson; 4th Edition (January 3, 2009). ISBN-10: 0131112414</li> <li>4. A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet (3<sup>rd</sup> Edition) by Sara Baase, Prentice Hall; 3rd Edition (2008). ISBN-10: 0136008488</li> <li>5. Applied Professional Ethics by Gregory R. Beabout, University Press of America (1993).</li> <li>6. Noorman, M., &amp; Johnson, D. G. (2014). Negotiating autonomy and responsibility in military robots. <i>Ethics and Information Technology</i>, 16(1), 51-62.</li> </ol>		

URCG-5124 Entrepreneurship		
<b>Credit Hours:</b>	2 (2-0)	
<b>Contact Hours:</b>	2	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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-5128 Pakistan Studies

### PAKISTAN STUDIES

#### URCG 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.

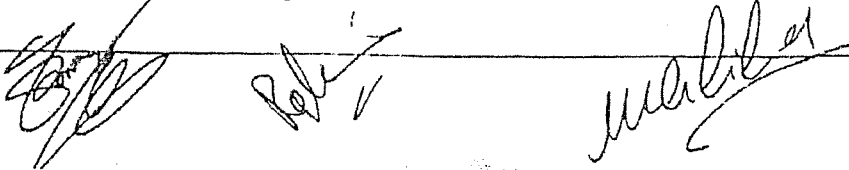
#### COURSE LEARNING OUTCOMES

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.



URCG-5111 Translation of the Holy Quran - I		
<b>Credit Hours:</b>	Non-Credit	
<b>Contact Hours:</b>	-	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
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.	-
<b>Objectives</b>		
<ul style="list-style-type: none"> <li>● To familiarize the students to keys and fundamentals of recitation of the holy Quran.</li> <li>● To develop the skill of the students of recitation the last revelation.</li> <li>● Students will learn the basic Arabic grammar in a practical way.</li> <li>● To develop an eagerness among the students to explore the last divine Book.</li> </ul>		
<b>Course Outline:</b>		
<ul style="list-style-type: none"> <li>● تیسواں پارہ - ناظرہ مع تجوید</li> <li>● بنیادی عربی گرامر</li> <li>● اسم اور اس کے متعلقات : اسم فاعل ، مفعول ، تفضیل ، مبالغہ</li> <li>● فعل اور اس کی اقسام : ماضی ، مضارع ، امر ، نہی</li> <li>● حرف اور اس کی اقسام : حروف علت ، حروف جارہ ، مشبہ بالفعل</li> </ul>		
<b>Memorization:</b>		
( تیسویں پارے کی آخری بیس سورتیں ) حفظ مع ترجمہ		

URCG-5111 Translation of the Holy Quran - II		
<b>Credit Hours:</b>	Non-Credit	
<b>Contact Hours:</b>	-	
<b>Pre-requisites:</b>	None	
<b>Course Introduction:</b>		
In some discipline 3 <sup>rd</sup> semester and in some discipline 4 <sup>th</sup> Semester/ ADP Program 2 <sup>nd</sup> 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، زکوٰۃ، حج، جہاد
- معاشرے کے حقوق
- خاندان کی تکوین
- حق مہر
- رضاعت و حمل
- اولاد کو قتل کرنے کے ممانعت

• شوہر کی نافرمانی
• طلاق
• بیوہ کی عدت کے احکام
• نکاح کا پیغام بھیجنا
• عورت کی وراثت (اس کے شوہر کی طرف سے)
• والدین کے حقوق
• بیویوں اور اولاد کے بیچ عداوت
• خاندان کے حقوق
• مہمان کی عزت
• اجازت طلب کرنے کے اصول
• مجلس کے آداب
• تعاون اور بھائی چارہ
• گروہ بندی
• محبت
• لوگوں کے درمیان صلح
• عفو و درگزر، غصہ پر قابو اور معاف کرنا
• شعوب و قبائل
• لوگوں کے بیچ اختلافات
• حمایت و نگیبانی

Grammar:

قرآنی عربی گرامر کے اصول اور ان کے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)

Details of Chapters and verse Numbers:

منتخب آیات مع ترجمہ و تجوید

• البقرہ (۱۷۷، ۲۳۸، ۴۵، ۲۷۷، ۲۱۹، ۱۱۰، ۴۵، ۱۵۳، ۲۴۷، ۲۰۱، ۲۸۵، ۳۴، ۲۸۵، ۱۵، ۱۲۹، ۱۲۹، ۲۵۳، ۹۸، ۶۲، ۱۲۶، ۲۸۵، ۲۵۶، ۱۷۷، ۱۳۶، ۱۸۹، ۲۰۰، ۱۸۴، ۱۸۳، ۲۱۸، ۱۵۸، ۱۹۹، ۲۴۱، ۲۲۷، ۲۲۶، ۲۳۷، ۲۲۹، ۲۲۸، ۲۳۱، ۲۳۷، ۲۳۵، ۲۳۰، ۸۲، ۱۸۴، ۲۳۳، ۱۸۲، ۱۶۰، ۸۳)
• النساء (۹۵، ۹۲، ۵۹، ۱۳۶، ۶۹، ۸۰، ۱۳، ۶۹، ۸۰، ۸۶، ۸۰، ۳۶، ۱۷۶، ۱۲، ۳۵، ۱۲۸، ۳۴، ۱۱، ۴، ۱۷۶، ۲۴، ۲۵، ۱۱، ۱۱، ۱۲۸، ۱۹۱، ۳۵، ۲۰، ۳۵، ۱۹۱، ۶، ۱، ۲۰، ۱، ۱۶، ۱۴۶، ۵۴، ۱۲۸، ۸۱)
• الانعام (۲۲، ۱۳۷، ۱۴، ۹۲، ۱۵۱، ۴۸، ۵۴)
• آل عمران (۹۷، ۳۹، ۸۵، ۱۲۵، ۸۴، ۱۴۴، ۱۹، ۱)
• المائدہ (۵۴، ۲، ۹۲، ۳۹، ۱۹، ۸۲، ۲، ۵)
• الاعراف (۳۵، ۱۸۹، ۱۸۹)
• التوبہ (۲۰، ۷۱، ۱۶)
• ہود (۱۲)
• الزمر (۶)
• النور (۵۴، ۲۸، ۵۲، ۲۷، ۶۰، ۲۹)

- محمد (٣٣)
- انفال (٨٢، ٢٠)
- الرعد (٣)
- الطلاق (٤)
- الحج (٥)
- ابراهيم (٢٣، ٤٤)
- الاسراء (٢٣، ٢٤)
- الاحقاف (١٥)
- المومنون (٢٧)
- العنكبوت (٢٥، ٤٨، ٨)
- النحل (٢٢)
- لقمان (١٥، ٤، ١٤)
- الاحزاب (٣٥، ٥٠، ٣٨، ٤٩)
- الشعراء (٧)
- الروم (٢١)
- مريم (١٤، ٢٦)
- المجادلة (١٢، ١١)