**UNIVERSITY OF SARGODHA**
**OFFICE OF THE REGISTRAR**
**(ACAD BRANCH)**

## NOTIFICATION

On the recommendations of Academic Council made in its 24th (1/2025) meeting held on 26.08.2025, the Syndicate in its 72nd (4/2025) meeting held on 12.09.2025 has approved the revised curriculum of Associate Degree in Software Engineering for implementation w.e.f. **Fall 2025** (Annex-'A').

**(WAQAR AHMAD)**
Additional Registrar (General)

No. SU/Acad/25/1201

Dated: 06.11.2025

Distribution:

- Chairman, Department of Software Engineering
- Controller of Examinations
- Director Academics

C.C:

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

Notification File

# Curriculum

# of

# Associate Degree in Software Engineering

# for

# Main Campus and Affiliated Colleges

Department of Software Engineering
University of Sargodha

(Applicable from Fall 2025)

Chairman
Department of Software Engineering
University of Sargodha

# Table of Contents

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Department of Software Engineering
University of Sargodha, Sargodha

## 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

Our mission is:

- 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 Software Engineering

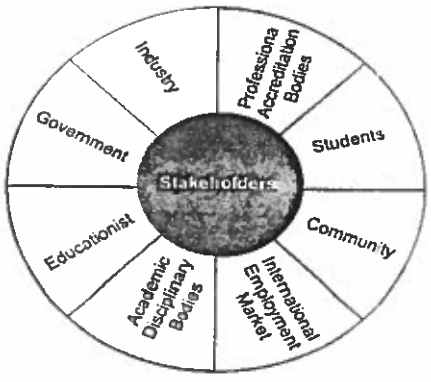
Our vision is to enable sustainable development of society by providing quality education, creative learning, and productive research in the field of software engineering.

## Mission Statement of the Department of Software Engineering

Our mission is to:

- Prepare software engineering graduates to have strong knowledge, critical thinking, research, and leadership skills by providing a healthy learning environment.
- Bridge the gap and enhance the productive interaction with the national and international level academia and software industry for mutual benefits.
- Contribute to the knowledge economy, social transformation, and community services through advanced software studies and interdisciplinary research.

## Underlying Principles of SE Degree Programs




Curriculum plays an important role within education as it outline 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 Software Engineering (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 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.

The curriculum has been developed using top-down curriculum development approach. It has adopted a balanced and multidisciplinary approach and presents a blend of study areas which spreads across the boundaries of fundamental knowledge of traditional disciplines to advanced knowledge of the emerging disciplines. Body of knowledge (BOK) of AI 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. For this the revised curriculum mainly focuses 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 that just having programming skills.
vi. Values: Moral, ethical and professional practices.

To strengthen the curriculum further, specialization tracks have also been integrated within the curriculum's BOK. These specialization tracks 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 considered discrete items, rather threaded into the entire fabric of the curriculum.

# Curriculum

## For
## Associate Degree in Software Engineering

## Programs' Rationale

The 21st century is loaded with a large number of challenges. These challenges include globalized business environment, keeping pace with innovative technologies, the availability of information with respect to time, speed, volume, mode, nature and management of this exponentially growing information, keeping control on international and inter-organizational business processes in real time, optimization of business processes across multiple sites, highly uncertain and chaotic business environments, a new level of national & international competition (hyper-competition), social & cultural diversity, rapidly changing products and processes, government regulations, increasing importance of skills, qualities, productivity and other stresses. To face these challenges and to bring a high level of agility, control and transparency organizations now increasingly focus on maximizing their existing technology and human infrastructure through automating various processes that can free human resource to add value elsewhere within the organization. Accordingly, the software industry looks for graduates who are not only equipped with conventional computing skills but also have the capability to develop complex software that can provide verifiable insight into underlying business processes.

Software Engineering is the discipline of developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them. Software engineering is different in character from other engineering disciplines due to both the intangible nature of software and the related operations. It seeks to integrate the principles of mathematics and computer science with the engineering practices developed for tangible, physical artifacts. Software engineering students learn more about software reliability and maintenance and focus more on developing and maintaining software techniques while Computer Science students just acquire abstract knowledge of these aspects.

Software Engineering is a bridge connecting the basic concepts and principles of Computer Science with a variety of users who can benefit from technologies based upon those principles. It includes the design and development of software systems which are effective, efficient, robust, maintainable, and maximally useful and usable. It also includes the design and development of techniques, processes and higher level tools by which these applications can be developed in a timely, cost effective and sustainable manner. At both levels, it requires a systematic approach which deals with quantifiable measures of quality and effectiveness, as well as attention to the critical nature of various products of the process. Software Engineering, therefore, requires familiarity with the basic needs and processes in the various application domains, with the principles of good engineering practices and with the underlying concepts and principles of computer science. It requires facility in problem analysis, solution design, program development and documentation. It also requires a basic understanding of ways in which humans interact with technological systems and necessary skills to create high-quality software systems in a systematic, controlled and efficient manner. It involves the application of engineering concepts, techniques, and methods to the design, development, deployment and maintenance of software systems.

The key rationale behind Associate Degree in Software Engineering is to produce graduates who have mastery in the above discussed aspects. The program intends to impart knowledge and training which enable students to harmonize a theory with practice, a concept with an application, and a problem with a solution. It will prepare them to apply ably engineering principles, practices, and processes to design,

develop, deploy, and maintain software systems. The program will lead to development of students' professional and interpersonal skills. It will help them to enhance their ability in oral and written communication, and their adaptability to team environments. The program will inculcate among students a strong sense of civic, professional and ethical responsibility. The program will also strive to develop a capacity for innovation and a passion for lifelong learning.

## Curricula Consideration

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

## Association of Computing Machinery (ACM) - Guidelines

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

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

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

## Knowledge Areas in ACM CS 2013 Curriculum

| | Knowledge Area | CS 2013 | | ACM 2013 Subjects Taught in Various Universities | NCEAC Revised 2023 Subjects in Core |
|---|---|---|---|---|---|
| | | Tier-1 | Tier-2 | | |
| 1 | AL-Algorithms and Complexity | 19 | 9 | Algorithms; Algorithms and Data Structures; Algorithm Design and Analysis | Data structures, Analysis of Algorithms, Theory of Automata |
| 2 | AR-Architecture and Organization | 0 | 16 | Intro to Computer Architecture; DLD; Computer Engineering | DLD, Computer Org & Assembly Language, Computer Architecture |
| 3 | CN-Computational Science | 1 | 0 | eScience; Modeling and Simulation; Computer Graphics | HCI & Computer Graphics; (Elective: Numerical Analysis) |
| 4 | DS-Discrete Structures | 37 | 4 | Discrete Mathematics; Mathematical Foundations of CS; Probability for CS; Discrete Structures 1; Discrete Str 2 | Discrete Structures, Probability & Statistics |
| 5 | GV-Graphics and Visualization | 2 | 1 | Computer Graphics; Computer Graphics | HCI & Computer Graphics; (Elective: Computer Graphics) |
| 6 | HC-Human-Computer Interaction | 4 | 4 | Human Computer Interaction | HCI & Computer Graphics |
| 7 | IAS-Information Assurance and Security | 3 | 6 | Computer Systems Security | Information Security; (Elective: Cyber Security) |
| 8 | IM-Information Management | 1 | 9 | Database Systems | Database Systems; Adv Database Management Sys |
| 9 | IS-Intelligent Systems | 0 | 10 | Artificial Intelligence Programming; Artificial Intelligence | Artificial Intelligence |



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| | | | | | |
|---|---|---|---|---|---|
| 10 | NC-Networking and Communication | 3 | 7 | Introduction to Computer Networking; Computer Networks | Computer Networks |

## Outcome Based Education (OBE) System and Seoul Accord:

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

| S# | Program Learning Outcomes (PLOs) | Computing Professional Graduate |
|---|---|---|
| 1 | Academic Education | To prepare graduates as computing professionals |
| 2 | Knowledge for Solving Computing Problems | Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements. |
| 3 | Problem Analysis | Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines. |
| 4 | Design/ Development of Solutions | Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. |
| 5 | Modern Tool Usage | Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations. |
| 6 | Individual and Team Work | Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings. |

| | | |
|---|---|---|
| 7 | Communication | Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions. |
| 8 | Computing Professionalism and Society | Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice |
| 9 | Ethics | Understand and commit to professional ethics, responsibilities, and norms of professional computing practice |
| 10 | Life-long Learning | Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional |

## Bloom's Taxonomy

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



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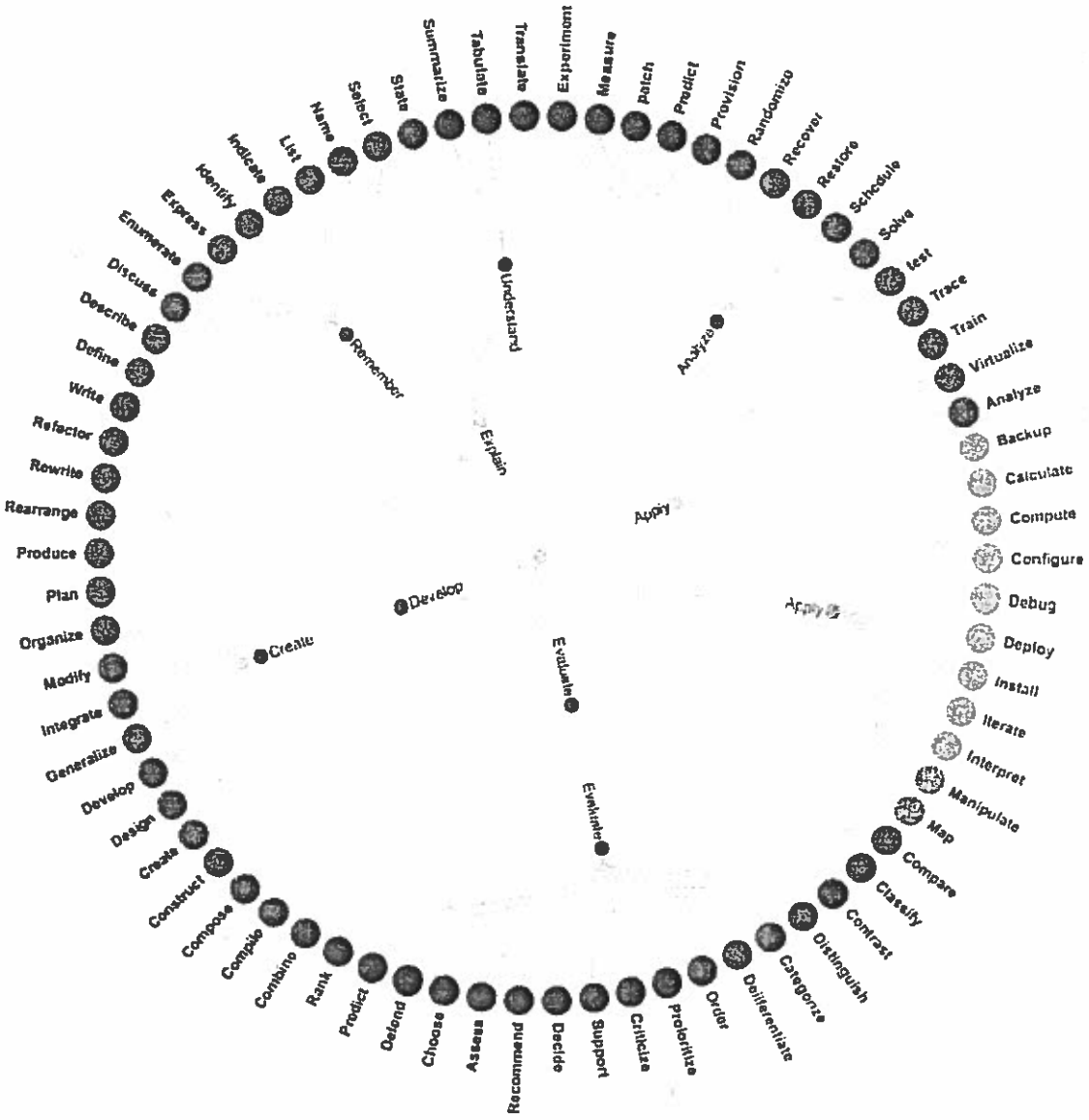


## Program Educational Objectives (PEOs)

BSSE Program aims to create, expand, disseminate and teach the Software Engineering body of knowledge through academics, applications and research which positively impact society locally, nationally, and internationally.

The objective of the program is to prepare students for professional careers and graduate studies with a balance between computing theory and practical application of software engineering concepts, methodologies, tools and technologies in the modern software development environments. The curriculum is designed to ensure breadth across allied disciplines and supporting subjects; and depth in most areas of the software engineering body of knowledge. Various components have been included in the curriculum to ensure that the graduates:



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**PEO-1:** Have the ability to effectively apply Software Engineering principles and best practices throughout different stages of Software Development Life Cycle (SDLC) to develop quality software applications.

**PEO-2:** Have an awareness of current industry standards and practices.

**PEO-3:** Are able to understand and apply software project management skills

**PEO-4:** Have strong communication, team management and interpersonal skills.

**PEO-5:** Understand professional responsibility and application of ethical principles.

**PEO-6:** Are able to translate their skills to knowledge economy and socio-economic growth of the country.

## Program's Outcome

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

## Program's Structure

1. Associate Degree in Software Engineering comprises of 04 semesters / 02 years duration.
2. Associate Degree in Software Engineering may only be offered under semester system.
3. Semester duration is 18 weeks, including two weeks for examinations and results
4. The minimum credits for award of Associate Degree Computing are 74 Credit Hours
5. Normal load per semester will be five to six courses and maximum up to 8 courses under special circumstances as per the university/DAI rules and regulations.
6. Courses will be described through Credit Hours (CrHr) system.
7. 1 (one) Theory CrHr is equivalent to 1 (one) contact hour per week in a normal semester of 15/16 weeks teaching so a 3 CrHr course means 45 contact hours for the whole semester.
8. 1 Lab CrHr is equivalent to 3 contact hours per week for 15/16 weeks

## Eligibility Criteria

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

1. Pre-Engineering
2. Pre-Medical (Admitted candidates are required to study 6-credit hours courses of mathematics (Mathematics-I and Mathematics-II) in first two semesters.)

3. General Science
    a. Mathematics, Statistics, Physics
    b. Mathematics, Statistics, Economics
    c. Mathematics, Statistics, Computer
    d. Mathematics, Physics, Computer
    e. Mathematics, Economics, Computer
4. A-Levels (with equivalence of mentioned above by IBCC) with at-least 50% obtained marks

## Degree Requirement

To become eligible for award of Associate 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

Associate Degree in Software Engineering comprises of 04 semesters / 02 years duration.

## Degree Title

Degree title will be "Associate Degree in Software Engineering".

## Assessment & Evaluation

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

## Curriculum AD in Software Engineering

Students will be required to complete the following courses to obtain Associate Degree in SE.

**Generic Structure for Computing Disciplines:**

| Areas | Credit Hours | Courses |
|---|---|---|
| Computing Core | 34 | 10 |
| Elective Supporting | 3 | 1 |
| Mathematics & Supporting Courses | 6 | 4 |
| General Education Requirement | 25 | 11 |
| Domain Core | 6 | 2 |
| **Totals** | **74** | **28** |

## Major Area Courses

| Computing Core (46/130) 14 Courses | | | | | | |
|---|---|---|---|---|---|---|
| **Sr. No** | **Sem. No** | **Code** | **Pre- Reqs** | **Course Title** | **Dom** | **Cr. Hr. (Cont Hr)** |
| 1 | 1 | CMPC-5201 | | Programming Fundamentals | Core | 4 (3-3) |
| 2 | 2 | CMPC-5202 | CMPC-5201 | Object Oriented Programming | Core | 4 (3-3) |



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| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 2 | CMPC-5203 | | Database Systems | Core | 4 (3-3) |
| 4 | 2 | CMPC-5204 | | Digital Logic Design | Core | 3 (2-3) |
| 5 | 3 | CMPC-5205 | CMPC-5201 | Data Structures | Core | 4 (3-3) |
| 6 | 3 | CMPC-5206 | | Information Security | Core | 3 (2-3) |
| 7 | 3 | CMPC-5207 | | Artificial Intelligence | Core | 3 (2-3) |
| 8 | 3 | CMPC-5208 | | Computer Networks | Core | 3 (2-3) |
| 9 | 3 | CMPC-5101 | | Software Engineering | Core | 3 (3-0) |
| 10 | 4 | CMPC-5209 | CMPC-5204 | Computer Organization & Assembly Language | Core | 3 (2-3) |
| 11 | 5 | CMPC-6201 | | Operating Systems | Core | 3 (2-3) |
| 12 | 7 | CMPC-6101 | | Analysis of Algorithms | Core | 3 (3-0) |
| 13 | 7 | CMPC-6702 | | Final Year Project – I | Core | 2 (0-6) |
| 14 | 8 | CMPC-6703 | CMPC-6702 | Final Year Project – II | Core | 4 (0-12) |

| Domain Core (18/130) 6 Courses | | | | | | |
|---|---|---|---|---|---|---|
| **Sr. No** | **Sem. No.** | **Code** | **Pre-Reqs** | **Course Title** | **Domain** | **Cr Hr (Cont Hr)** |
| 15 | 4 | SEDC-5101 | - | Software Design & Architecture | Domain Core | 3(3-0) |
| 16 | 4 | SEDC-5201 | - | Software Construction & Development | Domain Core | 3(3-0) |
| 17 | 5 | SEDC-6201 | - | Software Quality Engineering | Domain Core | 3(3-0) |
| 18 | 5 | SEDC-6202 | - | Software Project Management | Domain Core | 3(3-0) |
| 19 | 6 | ITDC-6204 | - | Parallel and Distributed Computing | Domain Core | 3(3-0) |
| 20 | 6 | SEDC-6204 | - | Software Requirement Engineering | Domain Core | 3(3-0) |

| Domain Elective (21/130) 7 Courses | | | | | | |
|---|---|---|---|---|---|---|
| **Sr. N.** | **Sem. No** | **Code** | **Pre-Reqs** | **Course Title** | **Domain** | **Cr Hr (Cont Hr)** |
| 21 | 5 | SEDE-6201 | - | Software Verification and Validation | Domain Elective | 3(3-0) |
| 22 | 5 | SEDE-6202 | - | Object Oriented Analysis & Design | Domain Elective | 3(3-0) |
| 23 | 6 | CSDC-6201 | - | HCI & Computer Graphics | Domain Elective | 3(3-0) |
| 24 | 6 | ITDC-5201 | - | Web Technologies | Domain Elective | 3(3-0) |
| 25 | 7 | CSDC-5102 | - | Advanced Database Management Systems | Domain Elective | 3(3-0) |
| 26 | 6 | DSDC-5201 | - | Introduction to Data Science | Domain Elective | 3(3-0) |
| 27 | 6 | SEDE-6206 | - | Software Re-Engineering | Domain Elective | 3(3-0) |
| . | 6 | CSDE-6202 | - | Mobile Application Development I | Domain Elective | 3(3-0) |
| . | 7 | CSDC-5101 | - | Theory of Automata | Domain Elective | 3(3-0) |
| . | 7 | DSDC-6201 | - | Data Mining | Domain Elective | 3(3-0) |
| | 6 | CSDC-6202 | - | Computer Architecture | Domain Elective | 3(3-0) |
| - | 7 | CSDE-6205 | - | Web Engineering | Domain Elective | 3(3-0) |



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| Preliminary Courses – (For Pre-Medical Students Non-Credit Hour Courses) Students have to pass these courses in first and second semester. | | | | | | |
|---|---|---|---|---|---|---|
| Sr. N. | Sem. No | Code | Pre- Reqs | Course Title | Domain | Cr Hr (Cont Hr) |
| | 1 | URCM-5107 | - | Mathematics I | | Non-Crd hr |
| | 2 | URCM-5108 | URCM-5107 | Mathematics II | | Non-Crd hr |

| Mathematics & Supporting Courses (12/130) 4 Courses | | | | | | |
|---|---|---|---|---|---|---|
| Sr. N. | Sem. No | Code | Pre- Reqs | Course Title | Domain | Cr Hr (Cont Hr) |
| 28 | 2 | MATH-5101 | URCQ-5102 | Multivariable Calculus | MATH | 3 (3-0) |
| 29 | 2 | MATH-5102 | | Linear Algebra | MATH | 3 (3-0) |
| 30 | 3 | MATH-5103 | | Probability & Statistics | MATH | 3 (3-0) |
| 31 | 7 | ENGL-6101 | | Technical & Business Writing | ENGL | 3 (3-0) |

| Elective Supporting Courses (Social Science) (3/130) 1 Course | | | | | | |
|---|---|---|---|---|---|---|
| Sr. N. | Sem. No | Code | Pre- Reqs | Course Title | Domain | Cr Hr (Cont Hr) |
| 32 | | BUSB-6101 | | Introduction to Marketing | Social Science | 3 (3-0) |
| 33 | | BUSB-6102 | | Human Resource Management | Social Science | 3 (3-0) |

| General Education Requirement as per HEC UG Education Policy (30/130) 12 Courses | | | | | | |
|---|---|---|---|---|---|---|
| Sr. N. | Sem. No | Code | Pre- Reqs | Course Title | Domain | Cr Hr (Cont Hr) |
| 34 | 1 | URCG-5123 | | Application of Information & Communication Technologies | GER | 3 (2-3) |
| 35 | 1 | URCG-5118 | | Functional English | GER | 3 (3-0) |
| 36 | 2 | URCG-5119 | | Expository Writing | GER | 3 (3-0) |
| 37 | 1 | URCQ-5101 | | Discrete Structures | GER | 3 (3-0) |
| 38 | 1 | URCQ-5102 | | Calculus and Analytic Geometry | GER | 3 (3-0) |
| 39 | 4 | URCG-5105 | | Islamic Studies | GER | 2 (2-0) |
| | | URCG-5126 | | Ethics (for non-Muslims) | | |
| 40 | 8 | URCG-5122 | | Ideology and Constitution of Pakistan | GER | 2 (2-0) |
| 41 | 4 | URCA-5101 | | Introduction to Management | GER | 2 (2-0) |
| 42 | 4 | URCW-5201 | | Applied Physics | GER | 3 (3-0) |
| 43 | 8 | URCS-6101 | | Professional Practices | GER | 2 (2-0) |
| 44 | 8 | URCG-5125 | | Civics and Community Engagement | GER | 2 (2-0) |
| 45 | 7 | URCG-5124 | | Entrepreneurship | GER | 2 (2-0) |
| 46 | | URCG-5129 | | Understanding of Holy Quran-I | GER | 1 (0-3) |
| 47 | | URCG-5130 | | Understanding of Holy Quran-II | GER | 1 (0-3) |



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## Course Coding Scheme

| Discipline Code | |
|---|---|
| CMPC | Computing Core |
| CSCC | Computer Science Core |
| SEDC | Software Engineering Core |
| SEDE | Software Engineering Elective |
| URCP | Pakistan Studies |
| URCI | General Science |
| MATH | |
| ENGL | |
| URCC | |
| URCQ | |
| URCS | |
| URCE | |
| URCA | |
| URCF | |
| URCW | |
| URCT | |



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## Mapping of ADSE Program on the Generic Structure (Affiliated Colleges):

| Sr.# | Code | Pre-Reqs | Course Title | Domain | Cr Hrs (Cont Hr) |
|---|---|---|---|---|---|
| | | | **Semester 1** | | |
| 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 | - | Elective Supporting Course (Example: Introduction to Marketing) | Elective Supporting | 3 (3-0) |
| 7 | URCM-5107 | - | Mathematics I* | MATH | NC |
| | | | | **Total Cr Hrs.** | **19 (17-6)** |
| | | | **Semester 2** | | |
| 8 | CMPC-5202 | CMPC-5201 | Object Oriented Programming | Core | 4 (3-3) |
| 9 | CMPC-5203 | - | Database Systems | Core | 4 (3-3) |
| 10 | CMPC-5204 | - | Digital Logic Design | Core | 3 (2-3) |
| 11 | MATH-5101 | URCQ-5102 | Multivariable Calculus | MATH & Supporting | 3 (3-0) |
| 12 | MATH-5102 | - | Linear Algebra | MATH & Supporting | 3 (3-0) |
| 13 | URCG-5128 | - | Pakistan Studies | GER | 2 (2-0) |
| 14 | URCG-5129 | | Understanding of Holy Quran-I | GER | 1 (0-3) |
| 15 | URCM-5108 | URCM-5107 | Mathematics II* | MATH | NC |
| | | | | **Total Cr Hrs.** | **20 (16-12)** |
| | | | **Semester 3** | | |
| 16 | CMPC-5205 | CMPC-5201 | Data Structures | Core | 4 (3-3) |
| 17 | CMPC-5206 | - | Information Security | Core | 3 (2-3) |
| 18 | CMPC-5207 | - | Artificial Intelligence | Core | 3 (2-3) |
| 19 | CMPC-5208 | - | Computer Networks | Core | 3 (2-3) |
| 20 | CMPC-5101 | - | Software Engineering | Core | 3 (3-0) |
| 21 | URCG-5119 | - | Expository Writing | GER | 3 (3-0) |
| | | | | **Total Cr Hrs.** | **19 (15-12)** |
| | | | **Semester 4** | | |
| 22 | CMPC-5209 | CMPC-5204 | Computer Organization & Assembly Language | Core | 3 (2-3) |
| 23 | SEDC-5101 | - | Domain Core 1 (Example: Software Design & Architecture) | Domain Core | 3 (3-0) |
| 24 | SEDC-5201 | - | Domain Core 2 (Example: Software Construction & Development) | Domain Core | 3 (3-0) |
| 25 | URCG-5124 | - | Entrepreneurship | GER | 2 (2-0) |
| 26 | URCG-5122 | - | Ideology and Constitution of Pakistan | GER | 2 (2-0) |
| 27 | URCG-5105 | - | Islamic Studies | GER | 2 (2-0) |
| | URCG-5126 | | Ethics** | | |
| 28 | URCG-5130 | | Understanding of Holy Quran-II | GER | 1 (0-3) |
| | | | | **Total Cr Hrs.** | **16 (14-6)** |



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* For Medical students only ** For Non-Muslim students

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## Course Contents

# Computing Core Courses

| CMPC-5201 Programming Fundamentals | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 4 (3-1)<br>3-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

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

1. Object Oriented Programming in C++ latest edition by Robert Lafore.
2. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel



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3. Starting Out with Programming Logic and Design: latest edition by Tony Gaddis.
4. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel
5. Problem Solving and Program Design in C++, latest Edition by Jeri R. Hanly& Elliot B. Koffman.

| CMPC-5202 Object Oriented Programming | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 4 (3-1)<br>3-3<br>Programming Fundamentals |

**Course Introduction:**

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

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

**Course Outline:**

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

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



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|---|
| 1. Object Oriented Programming in C++ latest edition by Robert Lafore.<br>2. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel<br>3. Starting Out with Programming Logic and Design: latest edition by Tony Gaddis.<br>4. C++ How to Program latest Edition by Paul Deitel and Harvey Deitel<br>5. Problem Solving and Program Design in C++, latest Edition by Jeri R. Hanly& Elliot B. |

| CMPC-5203 Database Systems | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 4 (3-1)<br>3-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

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

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

## CMPC-5204 Digital Logic Design

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

**Course Introduction:**

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

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

**Course Outline:**

Number Systems, Logic Gates, Boolean Algebra, Combination logic circuits and designs,



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|---|
| Simplification Methods (K-Map, Quinn Mc-Cluskey method), Flip Flops and Latches, Asynchronous and Synchronous circuits, Counters, Shift Registers, Counters, Triggered devices & its types. Mealy machines and Moore machines. Binary Arithmetic and Arithmetic Circuits, Memory Elements, State Machines. Introduction Programmable Logic Devices (CPLD, FPGA) Lab Assignments using tools such as Verilog HDL/VHDL, MultiSim. |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Digital Fundamentals by Floyd, Global Edition.<br>2. Fundamental of Digital Logic with Verilog Design, Stephen Brown, 2/e<br>3. DIGITAL DESIGN, GLOBAL EDITION, 6th/e by M. Morris Mano and Michael Ciletti |

| CMPC-5205 Data Structures | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | <br>4 (3-1)<br>3-3<br>Object Oriented Programming |

**Course Introduction:**

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

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

**Course Outline:**

Abstract data types, complexity analysis, Big Oh notation, Stacks (linked lists and array implementations), Recursion and analyzing recursive algorithms, divide and conquer algorithms,

| |
|---|
| Sorting algorithms (selection, insertion, merge, quick, bubble, heap, shell, radix, bucket), queue, dequeuer, priority queues (linked and array implementations of queues), linked list & its various types, sorted linked list, searching an unsorted array, binary search for sorted arrays, hashing and indexing, open addressing and chaining, trees and tree traversals, binary search trees, heaps, M-way tress, balanced trees, graphs, breadth-first and depth-first traversal, topological order, shortest path, adjacency matrix and adjacency list implementations, memory management and garbage collection. |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Data Structures and Algorithm Analysis in Java latest Edition by Mark A. Weiss<br>2. Data Structures and Abstractions with Java Latest Eidition by Frank M. Carrano& Timothy M. Henry<br>3. Data Structures and Algorithms in C++ 4th Edition by by Adam Drozdek<br>4. Data Structures and Algorithm Analysis in C++ Latest Edition by Mark Allen Weiss Java Software Structures: Designing and Using Data Structures by John Lewis and Joseph Chase |

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

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Explain key concepts of information security such as design principles, cryptography, risk management, and ethics | C2 (Explain) |
| CLO-2 | Discuss legal, ethical, and professional issues in information security | A2 (Discuss) |
| CLO-3 | Apply various security and risk management tools for achieving information security and privacy | C3 (Apply) |



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|---|---|---|
| CLO-4 | Identify appropriate techniques to tackle and solve problems in the discipline of information security | C4 (Identify) |

**Course Outline:**

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

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

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

## CMPC-5207 Artificial Intelligence

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



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| | | |
|---|---|---|
| CLO-3 | Implement artificial intelligence techniques and case studies | C3 (Apply) |

**Course Outline:**

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

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


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


## CMPC-5208 Computer Networks

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

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Describe the key terminologies and technologies of computer networks | C2 (Describe) |

| | | |
|---|---|---|
| CLO-2 | Explain the services and functions provided by each layer in the Internet protocol stack. | C2 (Explain) |
| CLO-3 | Identify various internetworking devices and protocols and their functions in a networking | C4 (Identify) |
| CLO-4 | Analyze working and performance of key technologies, algorithms and protocols | C4 (Analyze) |
| CLO-5 | Build Computer Network on various Topologies | P3 (Build) |

**Course Outline:**

Introduction and protocols architecture, basic concepts of networking, network topologies, layered architecture, physical layer functionality, data link layer functionality, multiple access techniques, circuit switching and packet switching, LAN technologies, wireless networks, MAC addressing, networking devices, network layer protocols, IPv4 and IPv6, IP addressing, sub netting, CIDR, routing protocols, transport layer protocols, ports and sockets, connection establishment, flow and congestion control, application layer protocols, latest trends in computer networks.

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

1. Computer Networking: A Top-Down Approach Featuring the Internet, 6th edition by James F. Kurose and Keith W. Ross
2. Computer Networks, 5th Edition by Andrew S. Tanenbaum
3. Data and Computer Communications, 10th Edition by William Stallings
4. Data Communication and Computer Networks, 5th Edition by Behrouz A. Forouzan

## CMPC-5101 Software Engineering

| | |
|---|---|
| **Credit Hours:** | 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.



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

**Course Outline:**

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

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


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


| CMPC-5209 Computer Organization & Assembly Language | |
|---|---|
| **Credit Hours:** | 3 (2-1) |
| **Contact Hours:** | 2-3 |
| **Pre-requisites:** | Digital Logic Design |

**Course Introduction:**



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

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

**Course Outline:**

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

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


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




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| CMPC-6201 Operating Systems | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-1)<br>2-3<br>None |

**Course Introduction:**

To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Understand the characteristics of different structures of the Operating Systems and identify the core functions of the Operating Systems | C2 (Understand) |
| CLO-2 | Analyze and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues with regard to the core functions | C5 (Evaluate) |
| CLO-3 | Demonstrate the knowledge in applying system software and tools available in modern operating systems. | C3 (Demonstrate) |

**Course Outline:**

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

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


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




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4. Operating Systems, Internals and Design Principles, 9th edition by William Stallings, 2017

| CMPC-6101 Analysis of Algorithms | |
|---|---|
| **Credit Hours:** | 3 (3-0) |
| **Contact Hours:** | 3-0 |
| **Pre-requisites:** | Data Structures |

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Explain what is meant by "best", "expected", and "worst" case behavior of an algorithm | C2 (Understand) |
| CLO-2 | Identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors. | C3 (Apply) |
| CLO-3 | Determine informally the time and space complexity of simple algorithms | C3 (Solve) |
| CLO-4 | List and contrast standard complexity classes | C4 (Examine) |
| CLO-5 | Use big O, Omega, Theta notation formally to give asymptotic upper bounds on time and space complexity of algorithms | |
| CLO-6 | Use of the strategies(brute-force, greedy, divide-andconquer, and dynamic programming) to solve an appropriate problem | |
| CLO-7 | Solve problems using graph algorithms, including single source and all-pairs shortest paths, and at least one minimum spanning tree algorithm | |
| CLO-8 | Trace and/or implement a string-matching algorithm | |

**Course Outline:**

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



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| Reference Materials (or use any other standard and latest books): |
|---|
| 1. Introduction to Algorithms (3rd edition) by Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein<br>2. Algorithm Design, (1st edition, 2013/2014), Jon Kleinberg, Eva Tardos,<br>3. Algorithms, (4th edition, 2011), Robert Sedgewick, Kevin Wayne |

| CMPC-6702 Final Year Project-I | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 2 (0-6)<br>0-6<br>None |

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Undertake problem identification, formulation and solution. | C2 (Understand) |
| CLO-2 | Define project scope and set milestones. | C3 (Apply) |
| CLO-3 | Attain proficiency in creating comprehensive project documentation. | C3 (Apply) |
| CLO-4 | Cultivate effective teamwork and collaboration skills, fostering ability to work with team members towards shared objectives. | - |

**Course Outline:**

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



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

**Course Introduction:**

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

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

**Course Outline:**

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



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## Domain Core Courses

| SEDC-5101 Software Design & Architecture | |
|---|---|
| **Credit Hours:** | **4 (3-3)** |
| **Contact Hours:** | **3-3** |
| **Pre-requisites:** | **None** |

**Course Introduction:**

Software Design & Architecture course! In this course, we will explore the fundamental principles, methodologies, and practices involved in designing and architecting software systems. Software design and architecture are crucial aspects of software development, influencing the structure, scalability, and maintainability of software applications. Let's dive into the course overview:

**Course Outline:**

Introduction to Software Design & Architecture, Overview of architectural styles (e.g., client-server, microservices), Case studies of real-world architectural implementations, Common architectural patterns (e.g., MVC, Observer, Singleton), SOLID principles (Single Responsibility, Open-Closed, Liskov Substitution, Interface Segregation, Dependency Inversion), Applying design patterns in software development, Decomposition of complex systems, Modularity and encapsulation, Component-based and service-oriented architecture, Understanding and prioritizing software quality attributes (performance, reliability, scalability), Designing for maintainability and extensibility, Trade-offs in software design, Scalability considerations in software design, Caching, load balancing, and distributed systems architecture, Cloud-native architectures, Ethical considerations in software design and architecture

| Sr. # | Course Learning Outcomes | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand the Principles of Software Design & Architecture. Demonstrate an understanding of the fundamental principles and concepts of software design and architecture. | C2 (Understand) | CLO_1 |
| CLO_2 | Apply Design Patterns and Architectural Styles. Apply design patterns and architectural styles to design scalable and maintainable software solutions. | C3 (Apply) | CLO_2 |
| CLO_3 | Evaluate and Justify Software Architectural Decisions. Assess and evaluate software architectural decisions, and justify choices based on design principles, performance, and maintainability. | C4 (Analyze) | CLO_3 |

**Reference Materials:**

1. Domain-Driven Design: Tackling Complexity in the Heart of Software by Eric Evans: Refactoring: Improving the Design of Existing Code" by Martin Fowler:

| SEDC-5201 Software Construction & Development | |
|---|---|
| **Credit Hours:** | **3 (2-3)** |
| **Contact Hours:** | **2-3** |
| **Pre-requisites:** | **None** |

**Course Introduction:**

Software Construction and Development course! In this course, we will explore the principles, practices, and methodologies involved in constructing and developing high-quality software. Software construction involves the actual coding and implementation of software systems, and this course will cover the entire software development life cycle, from requirements analysis to testing and deployment. Let's dive into the course overview:

**Course Outline:**

Introduction to Software Construction & Development, Gathering and analyzing software requirements, Design principles and methodologies, UML (Unified Modeling Language) for software design, Programming languages and paradigms, Version control systems (e.g., Git), Object-oriented programming (OOP) concepts, Design patterns and anti-patterns, Refactoring and code optimization, Testing methodologies (unit testing, integration testing, etc.), Test-driven development (TDD) and behavior-driven development (BDD), Code reviews and quality assurance practices, Importance of documentation in software development, Tools and best practices for documentation, Agile and other software development methodologies, Collaboration and communication in software development teams

| Sr. # | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand the Fundamentals of Software Construction & Development. Demonstrate an understanding of the fundamental principles and concepts of software construction and development. | C2 (Understand) | PLO-1 |
| CLO_2 | Apply Software Construction Practices. Apply effective software construction practices and methodologies during the development process, ensuring the creation of reliable and maintainable software. | C3 (Apply) | PLO-2 |
| CLO_3 | Evaluate and Optimize Software Development Processes. Assess and evaluate software development processes, identifying areas for optimization and improvement in efficiency and quality. | C4 (Analyze) | PLO-4 |

**Reference Materials:**

1. Code Complete: A Practical Handbook of Software Construction by Steve McConnell:
2. Clean Code: A Handbook of Agile Software Craftsmanship by Robert C. Martin:

| SEDC-6201 Software Quality Engineering | |
|---|---|
| **Credit Hours:** | 3 (2-3) |
| **Contact Hours:** | 3-3 |
| **Pre-requisites:** | None |

**Course Introduction:**

In this course, we will explore the principles, methodologies, and practices involved in ensuring the quality of software throughout its development life cycle. Quality engineering plays a crucial role in delivering reliable, efficient, and defect-free software products. Let's dive into the course overview:

**Course Outline:**

Introduction to Software Quality Engineering, Fundamentals of software testing, Types of testing (unit testing, integration testing, system testing, etc.), Test planning, execution, and reporting, Principles and benefits of test automation, Creating and maintaining automated test scripts, Importance of performance testing, Types of performance testing (load testing, stress testing, etc.), Performance optimization strategies, CI/CD principles and benefits, Integrating testing into CI/CD pipelines, Automated deployment and continuous testing practices, Key quality metrics in software engineering, Using metrics for process improvement, Industry trends in software quality engineering, Continuous learning and adaptation in a dynamic quality engineering landscape.

| Sr. # | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand the Principles of Software Quality Engineering. Demonstrate an understanding of the fundamental principles and concepts of software quality engineering. | C2 (Understand) | PLO-1 |
| CLO_2 | Apply Software Testing and Quality Assurance Techniques. Apply software testing and quality assurance techniques to ensure the delivery of high-quality software products. | C3 (Apply) | PLO-2 |
| CLO_3 | Analyze and Improve Software Quality Processes. Analyze software quality processes, identify areas for improvement, and propose strategies for enhancing overall software quality. | C4 (Analyze) | PLO-3 |

**Reference Materials:**


1. Foundations of Software Testing by Dorothy Graham and Erik Van Veenendaal:
2. Agile Testing: A Practical Guide for Testers and Agile Teams by Lisa Crispin and Janet Gregory:




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| SEDC-6204 Software Requirement Engineering | |
|---|---|
| **Credit Hours:** | **3 (2-3)** |
| **Contact Hours:** | **2-3** |
| **Pre-requisites:** | **None** |

**Course Introduction:**

Welcome to the Software Requirement Engineering course! This course emphasizes the systematic approach to defining, documenting, and managing software requirements. Students will explore the processes and best practices involved in effective requirement elicitation, analysis, specification, validation, and management, which are vital for successful software development projects.

**Course Outline:**

Requirements Engineering (RE): Essential Software Requirements, Bad Requirements, Characteristics and Benefits of Requirement Engineering, Requirements from the Customer's Perspective. RE Processes: Requirements Elicitation, Requirements Analysis, Requirements Specification, Requirements Validation, Requirements Management, and Requirements Development Process. The Requirements Analyst Role, Tasks, Essential Skills & Knowledge, Defining the Vision through Business Requirements, Vision and Scope Document. Dealing with Customers: Elicitation Techniques, Interviews, Surveys, Workshops, Classifying Customer Input, Incomplete Requirements (Finding Missing Requirements). Prototype Categories (Throwaway, Evolutionary, Paper, and Electronic), Evaluation, Risks, Validating the Requirements: Requirements Review and Inspection, Requirements Review Challenges, Acceptance Criteria. Documenting the Requirements: The Software Requirements Specification, Labelling, Dealing with Incompleteness, User Interfaces and the SRS, A Software Requirements Specification Template, The Data Dictionary. Non-Functional Requirements: Software Quality Attributes: Defining, Performance Requirements, Defining Non-functional Requirements Using Planguage, Attribute Tradeoffs, Implementing Non-functional Requirements. Setting Requirements Priorities: Why Prioritize Requirements? Play with Priorities, A Prioritization Scale, Prioritizing Based on Value, Cost, and Risk. Special Requirements Challenges: Requirements for Maintenance Projects, Begin Capturing Information, New Requirements Techniques, Follow the Traceability Chain, Consider Business Rules, Requirements for Outsourced Projects, Requirements for Emergent Projects. Requirements Development Plans, Estimation, Scheduling, From Requirements to Designs, Code, Tests, and Success. Requirements Management Principles and Practices, Baseline, Procedures, Requirements Version Control, Tracking Requirements Status. Requirements Creeping, Managing Scope Creep, The Change Control Process, The Change Control Board, Change-Control Tools, Measuring Change Activity, Impact Analysis. Tracing Requirements: The Requirements Traceability Matrix, Tools for Requirements Traceability, Requirements Traceability Procedure, Is Requirements Traceability Feasible? Tools for Requirements Management: Benefits and Capabilities of Tools for Requirements Management, Requirements Management Automation, Selecting a Tool, Changing the Culture. Software Requirements Risk Management: Fundamentals, Elements, Documenting Project Risks, Planning for Risk Management, Requirements-Related Risks.

| Sr. # | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|



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| | | | |
|---|---|---|---|
| CLO_1 | Understand Issues in Requirements Engineering, to understand and apply Requirements Engineering Process. | C2 (Understand) | PLO-2 |
| CLO_2 | To understand and use Requirements Elicitation and Specification. | C2 (Understand) | PLO-4 |
| CLO_3 | To understand and use Formal Techniques. | C2 (Understand) | PLO-2 |
| CLO_4 | To understand modeling and analysis of Non-Functional Requirements. | C2 (Understand) | PLO-2 |
| CLO_5 | Manage and control changes in Requirement. | C2 (Understand) | PLO-6 |

**Reference Materials:**


1. Software Requirements 2 by Karl Wiegers, 2nd Edition (2003), Microsoft Press; ISBN-10: 0735618798.
   "Requirements Engineering: Processes and Techniques" by Kotonya and Sommerville, John Wiley Sons (1998); ISBN-10: 0471972088.
2. Software Requirements Engineering, 2nd Edition" by Richard H. Thayer and Merlin Dorfman, Wiley-IEEE Computer Society Press (1997); ISBN-10: 0818677384.
3. Requirements Engineering: From System Goals to UML Models to Software Specifications" by A. van Lamsweerde, Wiley (2009); ISBN-10: 0470012706.
4. Requirements Engineering: Fundamentals, Principles, and Techniques" by Klaus Pohl, Springer (2010); ISBN-10: 3642125778.
5. Requirements Engineering by Hull, Jackson, and Dick, Springer (2010); ISBN-10: 1849964041.


## SEDC-6202 Software Project Management

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

**Course Introduction:**

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

| CLO | Course Learning Outcomes | Bloom |
|---|---|---|



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

**Course Outline:**

Introduction: Software Project Versus Other Type of Projects Dimensions of a Software Project, Activities in SPM, Setting Goals & Objectives, Business Case, Significance of Processes, Project Vs. Program Management. Introduction of PM Tools, PMI's Knowledge Areas, Technical Fundamentals in SPM, Lifecycle Relationships, Classic Mistakes Product-Process-Peoples-Technology Mistakes PMI Framework, PMI Process Groups: Process Initiating Process Group, Planning Process Group, Executing Process, Process Monitoring and controlling, Closing Process Group, Project Charter, Statement of Work. Understanding Organizations, Organizational Structures, Functional -Project –Matrix, Organizational Impact on Projects, Identifying stakeholders: Define Responsibilities, Authority Relationships, Position Qualifications. Project Planning: Project Selection, Project Scope, Project Infrastructure, Analyze Project Characteristics, Identify Project & Product Activities, Work Break Down Structure. Project Evaluation: Strategic Assessment, Technical Assessment, Economic Assessment, Project Portfolio Management, Cost-Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Procurement Management, Procurement Tools &Techniques, Types of Contracts. Selection of an Appropriate Approach in Project: Choosing Technologies, Technical Plan, Waterfall Model, V-Model, Spiral Model, Software Prototyping, Incremental Delivery, Agile Process Model: Dynamic Systems Development Method, Extreme Programming, Selection of Most Appropriate Process Model. Software Effort Estimation: Work Breakdown Structure (WBS) and Its Types, Estimation Problems, Software Estimation Techniques: Expert Judgment, Estimating By Analogy, LOC, Function Point Estimation, and COCOMO. Activity Planning: Project and Activities, Sequencings and Scheduling Activities, Network Planning Models, Formulation of Network Model, Adding the Time Dimensions, The Forward Pass, The Backward Pass, Identifying the Critical Path, Identifying the Critical Activities Project, AOA, GanttChart, (Installation & Configuration of Software Tools like MS-Project). Risk Management: Categories of Risks, A Framework for Dealing with Risks, Evaluating the Risks to the Schedule: PERT, Importance of Risk, Types Of Risks Risk

| |
|---|
| Identification Techniques, Project Risk and Change Management. Risk Control, RMMM, Configuration Management & Maintenance, Environment for Configuration Control, Configuration Control vs. Version Control. Resource Allocation: Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Resource Scheduling Techniques. Monitoring & Control: Creating Framework, Collecting Data, Visualizing Progress, Cost Monitoring, Earned Value, Change Control. Review and Evaluation: Determining Satisfaction of Requirements, Reviewing And Evaluating Performance, Project Closure: Project Documentation, Cutover/Migration, Quality Standards, Project Closing. Challenges of Outsourcing in Project Management, Presentations |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Software Project Management by Bob Hughes and Mike Cotterell, McGraw-Hill Education; 5th Edition. ISBN-10: 0077122798<br>2. Information Technology Project Management with MindTap by Kathy Schwalbe, 9E ISBN: 9789355736130, Edition: 9th, Year : 2019<br>3. A Guide to the Project Management Body of Knowledge, Seventh Edition (PMBOK Guide) (2021)<br>4. Applied Software Project Management by Andrew Stellman and Jennifer Greene, O'Reilly Media; 1st Edition (2005). ISBN-10: 0596009488<br>5. Mastering Software Project Management: Best Practices, Tools and Techniques by Murali K. Chemuturi and Thomas M. Cagley Jr., J. Ross Publishing (2010). ISBN-10: 1604270349<br>6. Effective Project Management: Traditional, Agile, Extreme by Robert K. Wysocki, Wiley; (2019). ISBN:9781119562801<br>7. The Software Project Manager's Handbook - Principles that work at work by Dwayne Phillips, 2ndEdition, IEEE Computer Society Press and Wiley Inter-science, . ISBN 0-471-67420-6 |

| ITDC-6204 Parallel and Distributed Computing | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None |
| **Course Introduction:** | |
| The Parallel and Distributed Computing course explores advanced computing paradigms, covering parallel processing and distributed systems. Participants gain expertise in designing and optimizing algorithms for parallel execution, addressing challenges in distributed computing environments. | |

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



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| | | |
|---|---|---|
| CLO-1 | Learn about parallel and distributed computers. | C2 (Understand) |
| CLO-2 | Write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library | C3 (Apply) |
| CLO-3 | Analyze complex problems with shared memory programming with openMP. | C4 (Analyze) |

**Course Outline:**

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

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


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


## Software Engineering Domain Elective Courses

| SEDE-6201 Software Verification and Validation | |
|---|---|
| **Credit Hours:** | **3 (2-3)** |
| **Contact Hours:** | **2-3** |
| **Pre-requisites:** | **None** |

**Course Introduction:**

This course focuses on the principles, methods, and techniques of software verification and validation (V&V). Students will explore concepts such as testing methodologies, automated testing tools, and strategies for identifying and mitigating software defects to ensure the reliability and quality of software systems.

**Course Outline:**

Fault-Based Testing, Validation and Verification of Software Systems using Virtual Reality and Coloured Petri Nets, Integrating Usability, Semiotic, and Software Engineering into a Method for Evaluating User Interfaces, Automated Software Testing, A Formal Verification and Validation Approach for Real-Time Databases, Requirements for Testable Specifications and Test Case Derivation in Conformance Testing, Test-Case Mutation, Discrete Event Simulation Process Validation, Verification, and Testing, The STECC Framework: An Architecture for Self-Testable Components, Certifying Properties of Programs using Theorem Provers, Static Type Systems: From Specification to Implementation, Generic Model of the Business Model and Its Formalization in Object-Z.

| Sr. | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand the fundamental concepts and principles of software verification and validation. | C2 (Understand) | PLO-1 |
| CLO_2 | Apply effective software testing techniques to identify and mitigate defects. | C3 (Apply) | PLO-2 |
| CLO_3 | Develop comprehensive test plans and execute them to validate software functionality. | C3 (Apply) | PLO-3 |
| CLO_4 | Utilize automated testing tools to improve efficiency and accuracy in software verification. | P3 (Build) | PLO-4 |
| CLO_5 | Evaluate the effectiveness of software verification and validation activities and suggest improvements. | C4 (Evaluate) | PLO-5 |

**Reference Materials:**


1. *Verification, Validation, and Testing in Software Engineering* by Aristides Dasso and Ana Funes, IGI Global, 2006. ISBN: 1591408512, 9781591408512, 9781591408536.
2. Software Verification and Validation: An Engineering and Scientific Approach by Marcus S. Fisher, Springer US, 2007.


## CSDC-6201 HCI & Computer Graphics

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

**Course Introduction:**

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

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

**Course Outline:**

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

**Reference Materials**

1. Kunigk, J., Buss, I., Wilkinson, P., & George, L. (2018). *Architecting modern data platforms: a guide to enterprise hadoop at scale*. O'Reilly Media.

2. Marcus, A. (2015). HCI and user-experience design. *Human–Computer Interaction Series*, 265-269.
3. Grudin, J. (2006). The GUI shock: computer graphics and human-computer interaction. *Interactions*, *13*(2), 46-ff.
4. Jacko, J. A. (Ed.). (2012). Human computer interaction handbook: Fundamentals, evolving technologies, and emerging applications.

| SEDE-6202 Object-Oriented Analysis & Design | |
|---|---|
| **Credit Hours:** | **3 (2-3)** |
| **Contact Hours:** | **2-3** |
| **Pre-requisites:** | **None** |

**Course Introduction:**

Object-Oriented Analysis & Design introduces the foundational principles of object-oriented methodologies used for designing and analyzing systems. This course provides an in-depth understanding of Unified Modeling Language (UML), Rational Unified Process (RUP), and essential design patterns, enabling students to model, analyze, and create robust software designs.

**Course Outline:**

Principles of Object-Oriented Technology, Introduction to UML, Unified Process (UP), Rational Unified Process (RUP), Use Case Modeling and Vision Documents, System Sequence Diagrams, Domain Models, Collaboration and Sequence Diagrams, State Chart Diagrams, GRASP Patterns (e.g., Creator, Controller), Design Patterns (Adapter, Singleton, Factory, Strategy), Design Class Diagrams and Code Mapping, Software Architecture Principles (Modularity, Encapsulation), Testing and Validation of Object-Oriented Designs, Tools for OOAD (e.g., Rational Rose, Visual Paradigm).

| Sr. # | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand the principles and methodologies of object-oriented modeling and design. | C2 (Understand) | PLO-1 |
| CLO_2 | Apply UML and object-oriented techniques to design software systems. | C3 (Apply) | PLO-2 |
| CLO_3 | Analyze system requirements to create object-oriented designs ready for implementation. | C4 (Analyze) | PLO-3 |

**Reference Materials:**

1. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development" by Craig Larman.
2. The Unified Modeling Language User Guide" by Grady Booch, James Rumbaugh, and Ivar Jacobson.
3. Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides.



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| ITDC-5201 Web Technologies | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

Overview of WWW, Web Pages, Web Sites, Web Applications, TCP/IP, TCP/IP Application. Services, Web Servers, WAMP, LAMP,WAMP Configuration. Introduction to HTTP, HTML & HTML5 Tags, and Dynamic Web Content. CSS and CSS3. Client Side Programming: Programing in JavaScript: Basics, Expressions and Control Flow. Javascript Functions, Objects, and Arrays, Accessing CSS from JavaScript. Form Handling. Server Side Programing: Programing in PHP. PHP functions and objects, PHP arrays. Introduction MySQL, MySQL Functions, Normalization, Relationships. Accessing MySQL via PHP. Cookies, Sessions, and Authentication. Introduction to Ajax. Introduction to JQuery. Browsers and the DOM [W3 Schools Tutorial]. Designing a Social Networking Site

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


1. Learning PHP, MySQL, JavaScript, and CSS, A Step-by-Step Guide to Creating Dy-namic Websites By Robin Nixon, O'Reilly Media; 6th Edition
2. WEB TECHNOLOGIES A Computer Science Perspective Kindle Edition by Jeffrey C. Jackson, Prentice Hall; (September06, 2022).
3. Web Technologies by Uttam Kumar Roy, Oxford University Press, USA (June 13, 2011).

ISBN-10: 0198066228

4. Web Application Architecture: Principles, protocols and practices by Leon Shklar and Richard Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10: 047051860X

| CSDC-5102 Advanced Database Management | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-1)<br>2-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

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

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

| DSDC-5201 Introduction to Data Science | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-1)<br>2-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

| |
|---|
| Introduction: What is Data Science? Big Data and Data Science hype, Datafication, Current landscape of perspectives, Skill sets needed; Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, Intro to Python; Exploratory Data Analysis and the Data Science Process; Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes; Feature Generation and Feature Selection; Dimensionality Reduction: Singular Value Decomposition, Principal Component Analysis; Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs; Data Visualization: Basic principles, ideas and tools for data visualization; Data Science and Ethical Issues: Discussions on privacy, security, ethics, Next-generation data scientists. |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Foundations of data science, Blum, A., Hopcroft, J., & Kannan, R., VorabversioneinesLehrbuchs, 2016.<br>2. An Introduction to Data Science, Jeffrey S. Saltz, Jeffrey M. Stanton, SAGE Publications, 2017.<br>3. Python for everybody: Exploring data using Python 3, Severance, C.R., CreateSpace Independent Pub Platform. 2016.<br>1. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly. 2014.<br>2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, John Wiley & Sons, 2015. |

| SEDE-6206 Software Re-Engineering | |
|---|---|
| **Credit Hours:** | **3 (2-3)** |
| **Contact Hours:** | **2-3** |
| **Pre-requisites:** | **None** |
| **Course Introduction:** | |
| This course explores the key concepts, techniques, and models involved in software maintenance and re-engineering. It emphasizes understanding legacy systems, software cost modeling, and re-engineering practices to support the maintainability and evolution of software systems. | |
| **Course Outline:** | |
| Software Maintenance: The nature of Software maintenance, Software Maintenance types, Characteristics of maintainable software, Software Maintenance Process Models: The Software Maintenance Process Lifecycle, Evolution Process, Change Request and Change Requests Management, Software Maintenance Process Models: Impact Analysis, System Release Planning, Change Implementation, Regression Testing and System Testing, Acceptance Testing, Quality Assurance, System Release, Version and Release management issues, Software Maintenance Process Models: Quick-and-Fix Model, Bohem's Model, Osborne Model, Iterative | |

Model, SW Maintenance difficulties, Legacy Systems: Software Types: S-Type, P-Type, Lehman's laws, Legacy Systems Structure and definitions, Legacy System Design, Legacy replacement strategies, Legacy System Assessment, Software Cost Modeling: Maintenance Cost issues using COCOMO II model, Bohem's Maintenance Cost Model, Software Cost Computing: Application Scenario, Software Scale Drivers, Software Cost Drivers, Function Points, System Evolution: Program evolution dynamics, Architectural evolution (n-tire), Architectural evolution (VMC, SC, Web services), Software Re-engineering in Maintenance: The Re-Engineering Process Definition, Advantages, Re-engineering Process: Source code translation, Reverse engineering, Reverse Engineering v/s Forward Engineering, Reverse Engineering Process, Program structure improvement, Program modularization, Data Re-engineering in Maintenance: Data re-engineering Process, Data Migration, Data Restructuring, Software Reuse and Reuse Landscape: Software Reusability Definition, Problems, Benefits, Approaches to Reuse, Software Reuse and Maintainability Issues, Design Patterns, Frameworks, Program Generators, COTS, Reuse, Aspect-Oriented Development, Product Lines, Web-Services, Software Metrics: Software Quality Measures, Types of measures: Size-Oriented Metrics, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance, Metrics for Design, Metrics for Specification.

| Sr. # | CLOs | Bloom's Taxonomy | PLO Mapping |
|---|---|---|---|
| CLO_1 | Understand basic software maintenance terminologies | C2 (Understand) | PLO-2 |
| CLO_2 | Understand concept of maintenance effort using COCOMO model, analyzing software scale drivers and cost drivers | C2 (Understand) | PLO-3 |
| CLO_3 | Explain legacy systems, legacy system components, and the concept of software reuse in supporting software maintainability | C2 (Understand) | PLO-4 |
| CLO_4 | List the concept of architectural evolution | C2 (Understand) | PLO-2 |
| CLO_5 | Understand reusability techniques and software metrics | C2 (Understand) | PLO-5 |

**Reference Materials:**


1. P. i Tripathy & K. Naik, Software Evolution and Maintenance: A Practitioner's Approach, Wiley, 2015.
2. I. Sommerville, *Software Engineering*, 10th Edition, Addison Wesley, 2016.
3. Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, 2010.
4. Penny Grubb & Armstrong A Takang, *Software Maintenance: Concepts and Practice*, 2nd Edition, World Scientific Publishing Co. Pte. Ltd, 2003.
5. Ian Sommerville, *Software Engineering*, 8th Edition, Addison Wesley, 2007.


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| CSDE-6202 Mobile Application Development I | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

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



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1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips and Chris Stewart - A comprehensive guide for Android app development with hands-on examples and practical insights 2022, 5th Edition ISBN-10: 0137645546
2. Professional Android application development, Reto Meier, Wrox Programmer to Programmer, 2012, 3rd Edition, ISBN-10: 1118102274.
3. React Native in Action: Developing iOS and Android apps with JavaScript 1st Edition, Kindle Edition, 2019, ISBN-13 978-1617294051
4. Flutter in Action by Eric Windmill, 2019, .ISBN-10: 1617296147

| CSDC-5101 Theory of Automata | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

Introduction to Automata: The Methods and the Madness, Introduction to Formal Proof, Inductive Proofs, the Central Concepts of Automata Theory. Finite Automata: Introduction of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata with Epsilon Transitions. Regular Expressions and Languages, Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions. Properties of Regular Languages, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata. Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Pushdown Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata. Properties of Context-Free Languages: Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages, Decision Properties of CFLs. Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing



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Machine, Restricted Turing Machines, Turing Machines and Computers. Un-decidability: A Language That Is Not Recursively Enumerable, Un-decidable Problem That Is RE, Un-decidable Problems About Turing Machines, Posts Correspondence Problem, Other Un-decidable Problems. Intractable Problems: The Classes P and NP, an NP-Complete Problem, A Restricted Satisfiability Problem.

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


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


## DSDC-6201 Data Mining

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

**Course Introduction:**

The Data Mining has emerged at the confluence of artificial intelligence, statistics, and databases as a technique for automatically discovering hidden patterns in large datasets. The main purpose of this course is the ability to analyze and construct knowledge from data.
The aims of this course are to:

- Expand on the student's understanding and awareness of the concepts of data mining basics, techniques, and application.
- Introduce the concepts of ***Data Pre-processing and Summary Statistics.***
- Introduce the concepts of ***Frequent Item Set Generation, Associations and Correlations measures.***
- Introduce the concepts of ***Classification, Prediction, and Clustering algorithms.***

Build on the programming and problem-solving skills developed in previous subjects studied by the student, to achieve an understanding of the development of Classification, Prediction, and Clustering applications..

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | Apply preprocessing techniques on any given raw data. | C3 (Apply) |
| CLO-2 | Select and apply proper data mining algorithm to discover interesting patterns | C3 (Apply) |
| CLO-3 | Analyze and extract patterns to solve problems and point out how to deploy solution | C4 (Analyze) |
| CLO-4 | Evaluate systematically supervised, semi supervised and unsupervised models and algorithms with respect to their accuracy | C4 (Analyze) |

**Course Outline:**

| |
|---|
| Introduction to data mining and basic concepts, Pre-Processing Techniques & Summary Statistics, Association Rule mining using Apriori Algorithm and Frequent Pattern Trees, Introduction to Classification Types, Supervised Classification (Decision trees, Naïve Bae Classification, K-Nearest Neighbors, Support Vector Machines etc.), Unsupervised Classification (K Means, K Median, Hieratical and Divisive Clustering, Kohonan Self Organizing maps), outlier & anomaly detection, Web and Social Network Mining, Data Mining Trends and Research Frontiers. Implementing concepts using Python |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Jiawei Han & Micheline Kamber, Jian Pei (2011). Data Mining: Concepts and Techniques, 3rd Edition.<br>2. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar (2005). Introduction to Data Mining.<br>3. Charu C. Aggarwal (2015). Data Mining: The Textbook<br>4. D. Hand, H. Mannila, P. Smyth (2001). Principles of Data Mining. MIT Press. |

| CSDC-6202 Computer Architecture | | |
|---|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None | |
| **Course Introduction:** | | |
| This course in computer architecture will take you from an understanding of digital design using combinational logic and synchronous sequential building blocks to building your own single-cycle multicycle, and pipelined microprocessors. | | |
| **CLO No.** | **Course Learning Outcomes** | **Bloom Taxonomy** |
| CLO-1 | Understand structure and behavior of the various functional modules of the computer | C2 (Understand) |
| CLO-2 | How these structure and behavior interact to provide the processing needs of the user. | C3 (Apply) |
| **Course Outline:** | | |



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|---|
| Introduction to a Simple Computer: CPU Basics and Organization, The Bus, Clock, The Input/Output Subsystem, Memory Organization and Addressing, Interrupts, MARIE, Instruction Processing, Hardware vs Micro-programmed Control, Real-World Examples of Computer. Architectures: Intel & MIPs Architecture. Instruction Set Architecture: Instruction Format, Instruction Types, Addressing, Instruction Pipelining, ISAs – Intel, MIPS, Java Virtual Machine. Micro-architecture: Single-Cycle Processor, Multicycle Processor, Pipeline Processors, DDL Representation, Exceptions. Advanced Micro-architecture: Deep Pipelines, Branch Prediction, Superscalar Processor, Out-of-Order Processor, Register Renaming, Single Instruction Multiple Data, Multithreading, Homogeneous Multiprocessing, Heterogeneous Multiprocessor. Memory: Types of Memory, The Memory Hierarchy, Cache Memory, Virtual Memory, Memory Management. Input/Output and Storage System: I/O and Performance, Amdahl's Law, I/O architectures, Data Transmission Modes, Magnetic Disk Technology, Optical Disk Technology, Magnatic Tape, RAID, Future of Data Storage. Alternative Architectures: RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architecture, Alternative Parallel Processing Approaches, Quantum Computing. Embedded Systems: Embedded Hardware & Embedded Software. |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Harris, S., & Harris, D. (2015). Digital design and computer architecture. Morgan Kaufmann.<br>2. Null, L. (2023). Essentials of Computer Organization and Architecture. Jones & Bartlett Learning.<br>3. Hennessy, J. L., & Patterson, D. A. (2011). *Computer architecture: a quantitative approach*. Elsevier.<br>4. Harris, D., & Harris, S. (2010). *Digital design and computer architecture*. Morgan Kaufmann. |
| |

| CSDE-6205 Web Engineering | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (2-3)<br>2-3<br>None |
| **Course Introduction:** | |
| In this course students will dive into the world of "Web Engineering," where creativity meets technology in crafting dynamic and responsive web solutions. This course will guide them through the intricacies of designing, developing, and deploying websites, covering essential technologies, frameworks, and best practices. They will learn the art of building robust and user-friendly web applications for the modern digital landscape | |

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

| | | |
|---|---|---|
| CLO-1 | Discuss how web standards impact software development. | C1 |
| CLO-2 | Describe the constraints that the web puts on developers. | C2 |
| CLO-3 | Design and Implement a simple web application. | C4 |
| CLO-4 | Review an existing web application against a current web standard. | C4 |

**Course Outline:**

Web programming languages (e.g., HTML5, CSS 3, Java Script, PHP/JSP/ASP.Net), Design principles of Web based applications, Web platform constraints, Software as a Service (SaaS), Web standards, Responsive Web Design, Web Applications, Browser/Server Communication, Storage Tier, Cookies and Sessions, Input Validation, Full stack state management, Web App Security - Browser Isolation, Network Attacks, Session Attacks, Large scale applications, Performance of Web Applications, Data Centers, Web Testing and Web Maintenance.

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


1. Web Engineering, Rajiv Chopra, Prentice-Hall of India, 2016
2. Web Engineering, Emilia Mendes and Nile Mosley, Springer Verlag, 2010.
3. Web Engineering: A Practitioners' Approach, Roger S. Pressman, McGraw Hill, 2008.
4. Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript 3rd Edition, O'Reilly Media 2007.
5. JavaScript: The Definitive Guide, 8th Edition, David Flanagan. O'Reilly Media. 2014.


## URCM-5107 Mathematics I

| | |
|---|---|
| **Credit Hours:** | Non-Credit Hour |
| **Contact Hours:** | 3 |
| **Pre-requisites:** | None |

**Course Introduction:**

The goal of Mathematics I is to prepare students for first-year Calculus. Helping students gain proficiency in their understanding and ability to utilize real-valued functions, the primary tool in Calculus, accomplishes this goal. Students are presented a broad set of 'function tools', including a general understanding of function properties together with a 'library' of commonly used functions. It is intended that students become skilled at recognizing the different families



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| 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. |
| **Course Content:** |
| 1. Preliminaries<br>2. Real-number system, complex numbers<br>3. Introduction to sets, set operations, functions, types of functions.<br>4. Matrices Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.<br>5. Quadratic Equations<br>6. Solution of quadratic equations, qualitative analysis of roots of a quadratice<br>7. Equations reducible to quadratic equations<br>8. Cube roots of unity, relation between roots and coefficients of quadratic<br>9. Sequences and Series<br>10. Arithmetic progression<br>11. Geometric progression<br>12. Harmonic progression<br>13. Binomial Theorem<br>14. Introduction to mathematical induction<br>15. Binomial theorem with rational and irrational indices.<br>16. Trigonometry, Fundamentals of trigonometry, Trigonometric identities. |
| **Reference Materials:** |
| 1. Thomas, G. B., & Finney, A. R. (2005). Calculus. Reading: Addison-Wesley.<br>2. Anton, H., Bevens. I., & Davis, S. (2005). Calculus: A new horizon (8th ed.). New York: John Wiley.<br>3. Stewart, J. (1995). Calculus (3rd ed.). Pacific Grove, California: Brooks/Cole.<br>4. Swokowski, E. W. (1983). Calculus and analytic geometry. Boston: PWS-Kent Company.<br>5. Thomas, G. B., & Finney, A. R. (2005). Calculus (11th ed.). Reading: Addison-Wesley. |

| URCM-5108 Mathematics II | |
|---|---|
| **Credit Hours:** | Non-Credit Hour |
| **Contact Hours:** | 3 |
| **Pre-requisites:** | Mathematics I |

**Course Introduction:**

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

**Course Content:**

1. Preliminaries
2. Real-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.

**Reference Materials:**


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


## Mathematics & Supporting Courses

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

**Course Introduction:**

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

**Course Outline:**

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

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


1. Calculus & Analytic Geometry by Thomas, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364

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


## MATH-5102 Linear Algebra

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

**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:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (3-0)<br>3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

Introduction to Statistics and Data Analysis, Statistical Inference, Samples, Populations, and the Role of Probability. Sampling Procedures. Discrete and Continuous Data. Statistical Modeling. Types of Statistical Studies. Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Rule. Random Variables and Probability Distributions. Mathematical Expectation: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev's Theorem. Discrete Probability Distributions. Continuous Probability Distributions. Fundamental Sampling Distributions and Data Descriptions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem. Sampling Distribution of S2, t-Distribution, FQuantile and Probability Plots. Single Sample & One- and Two-Sample Estimation Problems. Single Sample & One- and Two-Sample Tests of Hypotheses. The Use of PValues for Decision Making in Testing Hypotheses (Single Sample & One- and TwoSample Tests), Linear Regression and Correlation. Least Squares and the Fitted Model, Multiple Linear Regression and Certain, Nonlinear Regression Models, Linear Regression Model Using Matrices, Properties of the Least Squares Estimators.

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


1. Probability and Statistics for Engineers and Scientists by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, Pearson; 9th Edition (January 6, 2011). ISBN-10: 0321629116
2. Probability and Statistics for Engineers and Scientists by Anthony J. Hayter, Duxbury Press; 3rd Edition (February 3, 2006), ISBN-10:0495107573

3. Schaum's Outline of Probability and Statistics, by John Schiller, R. Alu Srinivasan and Murray Spiegel, McGraw-Hill; 3rd Edition (2008). ISBN-10:0071544259

| ENGL-6101 Technical & Business Writing | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (3-0)<br>3<br>Functional English |

**Course Introduction:**

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

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

**Course Outline:**

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

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| structure documents. |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company, 8th Edition.<br>2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill. |

## Elective Supporting Courses

| BUSB-6101 Introduction to Marketing | | |
|---|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (3-0)<br>3<br>None | |
| **CLO No.** | **Course Learning Outcomes** | **Bloom Taxonomy** |
| CLO-1 | - | - |
| **Course Outline:** | | |
| Defining Marketing and the Marketing Process, Marketing: Creating and Capturing, Customer Value, Company and Marketing Strategy: Partnering to Build Customer Relationships, Analyzing the Marketing Environment, Managing Marketing Information to Gain Customer Insights, Consumer Markets and Consumer Buyer Behavior, Customer-Driven Marketing Strategy: Creating Value for Target Customers, New Product Development and Product Life-Cycle Strategies, New Product Development and Product Life-Cycle Strategies, Pricing: Understanding and Capturing Customer Value, Pricing Strategies, Marketing Channels: Delivering Customer Value, Retailing and Wholesaling, Advertising and Public Relations | | |
| **Reference Materials (or use any other standard and latest books):** | | |
| 1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company, 8th Edition.<br>2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill. | | |

# General Education Courses

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

**Course Introduction:**

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

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

**Course Outline:**

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

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

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

**Suggested Books**

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

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

**Course Introduction:**

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

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

**Course Outline:**

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

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

**Recommended Texts**


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


**Suggested Readings**


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


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

**Course Introduction:**

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

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

**Course Outline:**

1. Self-Reflection
   - Introduction to the basics of the writing process
   - Introduction to the steps of essay writing
   - Prewriting activities: Brainstorming, listing, clustering and freewriting
   - Practicing Outlining of the essay



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

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


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


**Suggested Readings**


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


## URCQ-5101 Discrete Structures

| | |
|---|---|
| **Credit Hours:** | 3 (3-0) |
| **Contact Hours:** | 3 |
| **Pre-requisites:** | 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<br>2. Discrete Mathematics and Its Applications, 8th edition by Kenneth H. Rosen, 2018<br>3. Discrete Mathematics with Applications, 5th Edition by Susanna S. Epp, 2019<br>4. Discrete Mathematics, 7th edition by Richard Johnson Baugh, 2007 | | |
| | | |



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| URCQ-5102 Calculus and Analytic Geometry | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (3-0)<br>3<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

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

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

| URCG-5105 Islamic Studies | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 2 (2-0)<br>2<br>None |

**Course Introduction:**

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

- To make students understand the relevance and pragmatic significance of Islam in their lives.
- To make learners comprehend the true spirit of Islam with reference to modern world.
- To generate a sense of Islamic principles as a code of living that guarantee the effective solutions to the current challenges of being.
- To provide Basic information about Islamic Studies
- To enhance understanding of the students regarding Islamic Civilization
- To improve Students skill to perform prayers and other worships
- To enhance the skill of the students for understanding the issues related to faith and religious life.

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

**Course Outline:**

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

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

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

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

متن حدیث: درج ذیل موضوعات پر احادیث کا مطالعہ

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

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

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

اقامت دین کا نبوی طریق کار ا قامت دین بعید خلافت را شدہ، میثاق مدینہ ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ ، قرآن مجید میں سیرت سرور عالم کا بیان، غردات نبوی ﷺ کے مقاصد و حکمتیں

4. Islamic Culture & Civilization اسلامی تہذیب و تمدن
1) Basic Concepts of Islamic Civilization اسلامی تہذیب کا مفہوم
2) Historical evaluation of Islamic Civilization اسلامی تہذیب کا تاریخی ارتقاء
3) Salient feature of Islamic Civilization اسلامی تہذیب کی نمایاں خصوصیات
4) Islamic Civilization and Contemporary Issues اسلامی تہذیب و تمد ن اور معاصر مسائل

اسلامی تہذیب کے عوامل و عناصر ، اسلامی تہذیب کے علمی، معاشرتی اور سماجی اثرات، تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ، تہزیبی تصادم کے اثرات و نتائج ، طبیعی، حیاتیاتی اور معاشرتی علوم میں مسلمانوں کا کردار، نامور مسلمان سائنسدان

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


1) Hameed Ullah Muhammad, -Emergence of Islam, IRI, Islamabad
2) Hameed Ullah Muhammad, Muslim Conduct of State
3) Hameed Ullah Muhammad, Introduction to Islam
4) Ahmad Hasan, -Principles of Islamic Jurisprudence, Islamic Research Institute, International Islamic University, Islamabad (1993)
5) Dr. Muhammad Zia-ul-Haq,-Introduction to Al Sharia Al Islamia, Allama Iqbal Open University, Islamabad(2001)
6) Dr. Muhammad ShahbazManj, Teleecmat-e-Islam


## UQCG-5126 ETHICS

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

**Course Introduction:**

**Course Outline:**

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

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


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


| URCG-5122 Ideology and Constitution of Pakistan | |
|---|---|
| **Credit Hours:** | 2 (2-0) |
| **Contact Hours:** | 2 |
| **Pre-requisites:** | None |

**Course Introduction:**

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

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

**Course Outline:**

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

| |
|---|
| High Courts<br>Federal Shariat Courts<br>Supreme Judicial Council<br>Administrative Courts and tribunals<br>• **Islamic Provisions in Constitution**<br>• **Significant Amendments of Constitution of Pakistan 1973** |
| **Reference Materials (or use any other standard and latest books):** |
| 1. Constitutional and Political History of Pakistan by Hamid Khan<br>2. Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd re edn. Lahore: Legal Research Centre, 1996.<br>3. Munir, Muhammad. Constitution of the Islamic Republic of Pakistan: Being a Commentary on the Constitution of Pakistan, 1973. Lahore, Law Pub., 1975.<br>4. Rizvi, Syed Shabbar Raza. Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary. 2nd re edn. Lahore: Vanguard, 2005.<br>5. The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).<br>6. Fundamental Laws of Pakistan by A.K. Brohi |

| URCA-5101 Introduction to Management | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 2 (2-0)<br>2<br>None |

**Course Introduction:**

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

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

**Course Outline:**

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

Controls, Behavioral Controls. The Personnel Function: Terminology, Who Does Personnel Work? Staff Role of The Personnel Department Personnel (Human Resource) Functions. Job Design and Analysis: Job Design, Job Information and Personnel Management, Analyzing Jobs-Obtaining Job Information, Functional Job Analysis, Administration of The Job Analysis Program. Human Resource Planning: Reasons for Human Resource Planning, The Planning Process. Recruitment and Selections/Testing and Interview: Labour Market Considerations, Recruitment and Selection Policy Issues, The Employment Process, Sources of People, The Selection Process, The Selection Procedure, Testing: Interview. Miscellaneous: Union and Management, Compensation Administration, Health And Safety.

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


1. Management by Robbins, S.P. & Coulter, Mary, Prentice Hall; 10th Edition (November 3, 2008). ISBN-10: 0132090716
2. Fundamentals of Management by Robbins, S.P. &DeCenzo, David A, Prentice Hall; 7th Edition (January 13, 2010). ISBN-13: 978-0132090711
3. Human Resource Management by David A. DeCenzo and Stephen P. Robbins. Wiley; 7th Edition (October 10, 2001). ISBN-10: 0471397857


## URCS-6101 Professional Practices

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

**Course Introduction:**

A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies.

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

**Course Outline:**

Historical, social, and economic context of Computing (software engineering, Computer Science, Information Technology); Definitions of Computing (software engineering, Computer Science, Information Technology) subject areas and professional activities; professional societies; professional ethics; professional competency and life-long learning; uses, misuses, and risks of software; information

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

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

**Course Introduction:**

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

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



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**Learning outcomes**

After completing this course, students will be able to

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

**Course Outline:**

**Introduction to Civics & Community Engagement**

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

**Citizenship and Community Engagement**

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

**Identity, Culture, and Social Harmony**

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

**Multi-cultural society and inter-cultural dialogue**

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

**Active Citizen: Locally Active, Globally Connected**

- Importance of active citizenship at national and global level
- Understanding community

- Identification of resources (human, natural and others)
- Utilization of resources for development (community participation)
- Strategic planning, for development (community linkages and mobilization)

**Human rights, constitutionalism and citizens' responsibilities**

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

**Social Institutions, Social Groups, Formal Organizations and Bureaucracy**

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

**Civic Engagement Strategies**

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

**Social issues/Problems of Pakistan**

- Overview of major social issues of Pakistani society

**Social Action Project**

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


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


**Reference Books:**


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




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| URCW-5201 Applied Physics | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 3 (3-0)<br>3<br>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.

| URCG-5124 Entrepreneurship | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | 2 (2-0)<br>2<br>None |

**Course Introduction:**

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

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

**Course Learning Objectives**

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

**Course Outline:**

1. **Background:** What is an Organization, Organizational Resources, Management Functions, Kinds of Managers, Mintzberg's Managerial Roles.
2. **Forms of Business Ownership:** The Sole proprietorship, Partnership, Joint Stock Company
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits of Entrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding the Entrepreneurial Fire.
4. **The Challenges of Entrepreneurship:** The Cultural Diversity in Entrepreneurship, The Power of "Small" Business, Putting Failure into Perspective, The Ten Deadly Mistakes of Entrepreneurship, How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics of Entrepreneurship.
5. **Inside the Entrepreneurial Mind:** From Ideas to Reality: Creativity, Innovation, and Entrepreneurship, Creativity – Essential to Survival, Creative Thinking, Barriers to Creativity, How to Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process, Protecting Your Ideas, Idea Discussions & Selection of student Projects.
6. **Products and technology, identification opportunities**
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan:** Building

a strategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulate strategic options and select the appropriate strategies, Discussion about execution of Students' Project.

8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:** Conducting a Feasibility Analysis, Industry and market feasibility, Porter's five forces model, Financial feasibility analysis. Why Develop a Business Plan, The Elements of a Business Plan, What Lenders and Investors Look for in a Business Plan, Making the Business Plan Presentation.
9. **Building a Powerful Marketing Plan:** Building a Guerrilla Marketing Plan, Pinpointing the Target Market, Determining Customer Needs and Wants Through Market Research. Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics for Entrepreneurial Marketing
10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into E-Commerce, Ten Myths of E-Commerce, Strategies for E-Success, Designing a Killer Web Site, Tracking Web Results, Ensuring Web Privacy and Security, Feed Back & Suggestions on Student Project.
11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies and Tactics, Pricing Strategies and Methods for Retailers, The Impact of Credit on Pricing
12. **Attracting Venture Capitalist:** Projected Financial Statements, Basic Financial Statements, Ratio Analysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back &Suggestions on Student Project,
13. **Idea Pitching:** Formal presentation, 5-minutes pitch, funding negotiation and launching.

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

**Recommended Texts:**

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

**Suggested Readings:**

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

URCG-5111 Translation of the Holy Quran - I

| | |
|---|---|
| **Credit Hours:** | Non-Credit |
| **Contact Hours:** | - |
| **Pre-requisites:** | None |

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | To familiarize the students to keys and fundamentals of recitation of the holy Quran. | - |
| CLO-2 | To develop the skill of the students of recitation the last revelation. | - |

| | | |
|---|---|---|
| CLO-3 | Students will learn the basic Arabic grammar in a practical way. | - |
| CLO-4 | To develop an eagerness among the students to explore the last divine Book. | - |

**Objectives**

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

**Course Outline:**

- تیسواں پارہ - ناظرہ مع تجوید
- بنیادی عربی گرامر
  اسم اور اسکے متعلقات : اسم فاعل ،مفعول ،تفضیل ،مبالغہ
  فعل اور اسکی اقسام : ماضی ،مضارع ،امر ، نہی
- حرف اور اسکی اقسام : حروف علت ،حروف جارہ ،مشبہ بالفعل

**Memorization:**

تیسویں پارے کی آخری بیس سورتیں ( حفظ مع ترجمہ )

URCG-5111 Translation of the Holy Quran - II

| | |
|---|---|
| **Credit Hours:** | Non-Credit |
| **Contact Hours:** | - |
| **Pre-requisites:** | None |

**Course Introduction:**

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

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



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

Objectives

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

**Course Outline:**

- ایمانیات اور عبادات .

اللہ پر ایمان ،فرشتوں پر ایمان ،رسولوں پر ایمان ،آسمانی کتابوں پر ایمان
یوم آخرت پر ایمان ، تقدیر پر ایمان
نماز ،روزہ ،زکوۃ،حج ،جہاد

- معاشرے کے حقوق

- خاندان کی تکوین
- حق مہر
- رضاعت و حمل
- اولاد کو قتل کرنے کے ممانعت
- شوہرکی نافرمانی
- طلاق
- بیوہ کی عدت کے احکام
- نکاح کا پیغام بھیجنا
- عورت کی وراثت (اس کے شوہر کی طرف سے)
- والدین کے حقوق
- بیویوں اور اولاد کے بیچ عداوت

- خاندان کے حقوق

- مہمان کی عزت
- اجازت طلب کرنے کے اصول
- مجلس کے آداب
- تعاون اور بہائی چارہ
- گروہ بندی

- محبت
- لوگوں کے درمیان صلح
- عفو ودرگزر، غصہ پر قابو اور معاف کرنا
- شعوب و قبائل
- لوگوں کے بیچ اختلافات
- حمایت و نگہبانی

Grammar:

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

Details of Chapters and verse Numbers:

منتخب آیات مع ترجمہ وتجوید

- البقرہ ((۱۷۷، ۲۳۸، ۴۵، ۲۷۷، ۲۱۹، ۱۱۰، ۴۵، ۱۵۳، ۲۴۷، ۲۰۱، ۲۸۵، ۳۴، ۲۸۵، ۱۵، ۱۲۹، ۲۵۳، ۹۸، ۶۲، ۱۲۶، ۲۸۵، ۲۵۶، ۱۷۷، ۱۳۶، ۱۸۹، ۲۰۰، ۱۸۴، ۱۸۳، ۲۱۸، ۱۵۸، ۲۴۱،۱۹۹، ۲۲۷، ۲۲۶، ۲۳۷، ۲۲۸، ۲۲۹، ۲۳۱، ۲۳۷، ۲۳۵، ۲۳۰ ، ۸۲ ، ۱۸۴، ۲۳۳، ۱۸۲، ۱۶۰، ۸۳)
- النساء (۹۵، ۹۲، ۵۹، ۱۳۶، ۶۹، ۸۰، ۱۳، ۶۹، 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 (۳۳)
- انفال (۸۲، ۲۰)
- الرعد (۳)
- الطلاق (۴)
- الحج(۵)
- ابراہیم ((۴۴،۲۳)
- الاسراء (۲۳، ۲۴)
- الاحقاف (۱۵)
- المومنون (۲۷)
- العنکبوت (۲۵،۴۸، ۸)
- النحل (۲۲)
- لقمان (۱۵،۴، ۱۴)
- الاحزاب ((۳۵، ۵۰،۳۸، ۴۹)
- الشعراء (۷)
- الروم (۲۱)
- مریم (۱۴،۲۶ )
- المجادلہ (۱۲، ۱۱)



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| URCG-5111 Translation of the Holy Quran - III | |
|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | Non-Credit<br>-<br>None |

**Course Introduction:**

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

| CLO No. | Course Learning Outcomes | Bloom Taxonomy |
|---|---|---|
| CLO-1 | To introduce ethics and highlight its importance, need and relevance for individual and collective life. | - |
| CLO-2 | To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc. | - |
| CLO-3 | To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc. | |
| CLO-4 | To inculcate ethical and moral values in our youth. | - |
| CLO-5 | To develop a balanced dynamic and wholesome personality. | - |
| CLO-6 | To introduce the students to Quranic Arabic grammar in practical manner. | - |

**Objectives**

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

**Course Outline:**

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

اخلاق حسنہ :

- برائی کو نیکی سے مٹانا
- نیکی کے کاموں میں مسابقت
- لوگوں کے درمیان صلح
- عدل وانصاف
- سچائی
- ایثار
- سلیم قلب

- مہمان نوازی
- لغویات سے اعراض
- عاجزی و انکساری
- نگاہ اور آوازکو پست رکھنا
- چال میں میانہ روی
- شرمگاہوں کی حفاظت
- صبر
- شکر
- امور میں میانہ روی

اخلاق سئیہ :

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

Grammar:

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

Details of Chapters and verse Numbers:

- منتخب آیات مع ترجمہ وتجوید
- البقرہ (۱۱۲، ۲۴۵، ۸۳، ۱۸۲، ۱۷۲، ۱۵۲، ۱۷۲، ۵۲، ۱۵۳، ۱۷۷، ۲۵۰، ۱۲۵، ۲۲۲، ۲۷، ۷۷، ۱۸۲، ۱۴۸، ۱۸۷، ۱۰۹، ۲۶۴، ۲۶۳، ۲۶۲، ۲۱۲، ۶۷، ۲۳۱، ۱۰، ۳۴، ۱۲۴، ۲۵۸، ۲۷، ۷۱، ۸۳، ۲۲۶، ۱۹۵، ۷۶)
- آل عمران (۱۵۴، ۱۴، ۲۴، ۱۸۵، ۱۳۲، ۱۴۸، ۱۳۴، ۱۴۵، ۱۷، ۲۰۰، ۱۲۵، ۱۳۳، ۱۱۴، ۱۰۴، ۱۰۴، ۲۶، ۷۸، ۱۴۱، ۱۴۷، ۱۵۹)
- النساء (۱۳۵، ۲۳، ۲۲، ۱۰۸، ۱۰۷، ۱۰۵، ۵۴، ۲۰، ۲۷، ۱۷۳، ۳۶، ۲۵، ۲۴، ۴۷، ۵۷، ۲۴)
- المائدۃ (۵۸، ۵۷، ۹۳، ۱۳، ۶، ۴۱، ۱۹)
- النحل (۱۲۶، ۹۰، ۱۰۵، ۱۱۳، ۳۰، ۱۲۶، ۱۲۵)
- الرعد ( ۲۵، ۲۰، ۲۴، ۲۲، ۶)
- الاعراف (۳۱، ۶۶، ۵۱، ۱۴۶، ۴۰، ۴، ۲۰، ۱۴۴، ۱۹۹، ۹۵، ۸۱)
- القصص (۵۴، ۸۴)
- فصلت (۳۴)
- الانعام (۳۲، ۷۰، ۷۰، ۱۳۰، ۱۵۵، ۱۶۰)
- النمل (۹۰، ۴۶)
- الحج (۳۰، ۵۸، ۶۰، ۸۸، ۷۷)
- الحجرات (۹، ۱۱، ۶، ۱۱، ۳، ۱۲، ۱۵، ۱۰)
- الاحزاب (۲۳، ۵۰، ۵۸، ۵۸، ۵۲، ۵۵، ۵۹، ۳۵، ۲۴، ۳۵)

- الحشر (٩)
- طه (٧٢)
- الانعام (١٦٤، ١٤١، ١١٦، ١٥١، ٦٣، ١٢٧)
- ق (٣٤)
- الانفال (٢٧، ٤٦، ٤١)
- الفتح (١٥)
- يونس (١٠، ١٩، ١٢، ٦٦، ٢٢، ٢٢)
- الفرقان (٦٣، ٢١، ٦٧، ٦٣)
- النور (٢٣، ٦، ٤، ٣٠، ٣١، ٣٣، ٣٣، ٦١، ٣١، ٢٢)
- لقمان (٦، ٣٣، ١٩، ٣٢، ١٨)
- الاسرا ء( ٣٧، ١١٠، ٥، ٣٧)
- المزمل (١٨)
- المدثر (٦، ٤)
- المدثر (٧٤)
- فاطر (٣٢)
- الفتح (٢٩)
- البلد (١٧)
- الزمر (٣، ١٠)
- الحجر (٨٥)
- النجم (٣١)
- الرحمٰن (٦٠)
- هود (٨، ١٠٢، ٣)
- الكهف (٢، ٥٦)
- الشورى (٣٧)
- غافر (٢٨، ٢٧)
- الحديد (٢٠، ٢٠)
- مريم (٥٩)
- النازعات (٤١)
- التوبہ (٦٥، ٦٤، ٧٧)
- الهمزه (١)

| URCG-5111 Translation of the Holy Quran - IV | | |
|---|---|---|
| **Credit Hours:**<br>**Contact Hours:**<br>**Pre-requisites:** | Non-Credit<br>-<br>None | |
| **Course Introduction:** | | |
| This course is designed to develop the recitation skills in students. | | |
| **CLO No.** | **Course Learning Outcomes** | **Bloom Taxonomy** |
| CLO-1 | To familiarize the students with commandments of trade and inheritance mentioned in the Quranic text (with the help of Urdu translation). | - |
| CLO-2 | To introduce the students to scientific facts and miracles of the Holy | - |

| | | |
|---|---|---|
| | Quran and Quranic stress on deep study of Allah's explored universe. | |
| CLO-3 | To motivate the students for reading and exploring the last Holy Book revealed by Almighty Allah. | |
| CLO-4 | Through memorization students will develop their relation with last revelation. | - |

**Objectives**

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

**Course Outline:**

- تجارت اور وراثت:
  - مال کی تقسیم
  - نادان کا مال
  - عوام الناس کا مال
  - عورتوں کا مال
  - یتیموں کا مال
  - کفار کا مال
  - جائز مال
  - معاہدے
  - رہن
  - قرض
- سائنسی حقائق:
  - تخلیق کائنات
  - اجرامِ فلکی
  - شجر و حجر
  - زمین و آسمان کے اسرار
  - ہوائیں اور طوفان
  - بہائم اور مویشی
  - حشرات الارض
  - پہاڑ اور سمندر

Grammar :

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

Details of Chapters and verse Numbers:

- منتخب آیات مع ترجمہ وتجوید
- البقرہ (۲۶۱، ۲۲۱۵، ۲۶۵، ۲۱۹، ۲۶۴، ۲۷۵، ۱۸، ۲۶۵، ۱۷۷، ۲۶۵، ۱۶، ۲۷۵، ۲۸۲، ۲۶۲، ۲۷۴، ۲۷۱، ۸۳، ۱۷۷، ۲۱۵، ۲۷۶، ۲۷۸، ۱۶، ۲۷، ۲۲۳، ۲۹، ۲۵۵، ۱۶۴، ۲۶۶، ۱۶۴، ۱۶۴، ۵۰، ۶۰، ۱۶۴، ۵۷، ۲۱۰، ۱۹، ۲۶، ۷۱، ۹۲، ۹۳)

- آل عمران (١١٧، ١٣٤، ١٣٠، ١٩٠، ٢٧، ٥٩)
- النساء (٢٩، ٢، ٢٩، ١٦١)
- المائده (٨٩، ٩٥، ٧٥، ٦٩، ٦٠)
- التوبه (٩٨، ٢٤، ٦٩، ٢٤، ٢٤، ٦٠، ٤)
- الاعراف (١٧٢، ١٨٥، ٥٧، ٥٨، ١٦٣، ١٦٣، ١٦٠، ٤٠، ١٣٣، ١٧٦، ١٦٦)
- الرعد (١٧، ٤)
- الطور (٤٤)
- الانعام (٥٩، ٦٣، ١٤١، ١٤٦، ٣٨)
- الانفال (٢٨، ٣٦، ٤١)
- الكهف (٥١، ١٠٩، ٤٧، ٣٢، ٤٥، ١٧، ٤٥)
- الجاثيه (٥)
- فاطر (٢٧، ١٢، ١٣)
- العنكبوت (٢٠، ٦٣، ٤١)
- الروم (٥٠)
- الاسراء (٧٠، ٩٩)
- الرعد (٢)
- السبا(١٠، ٣، ٢٢)
- يونس (٨٨، ١٠١، ٢٤، ٢٤، ٥، ٢٢)
- يوسف (٩٤، ١٤)
- الفرقان (٦٢، ٥٣)
- لقمان (٢٩، ١٦)
- طه (١١٤، ٥٣)
- النحل (٧٥، ١١، ٦١، ٤٩، ٧٩، ٦٨، ٦٨، ١١٥، ٨، ٨)
- النمل (٦٤، ٦٤، ٨٨، ٦٠، ٨٢، ١٦، ١٧، ١٨)
- السجده (٢٧)
- الحديد (٦)
- هود (٤٣، ٦)
- يسين (٣٧، ٤١)
- الروم (٣٩، ٣٩، ٥٠، ١٩، ٢٤، ٤٦)
- فصلت (٣٩، ٣٩)
- الحج (٦١، ٦٥، ٢٢، ٧٣)
- الحجر (١٩، ٢٢)
- الانبياء (٣١، ٣٠، ٤٧)
- الزاريات (٤٧)
- الزلزله (١)
- القصص (٧٦، ٧٩، ٨٠، ٨١، ٨٢)
- النور (٣٧، ٢٢، ٢٢، ٤٠، ٤٥، ٤٣)
- الجمعه (١١، ٦٢، ١٠، ١١، ٥)
- القمر (٧)
- الواقعه (٦٩)
- الفاطر (٢٠، ١٣)
- الملک (١٩)
- الصف (١٠)
- الجن (١٣)
- الشورى (٢٨)
- الزخرف (١١)
- الفيل (١)

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| URCG-XXXX | Understanding of the Holy Quran – I |
| URCG-XXXX | Understanding of the Holy Quran - I I |
| URCG-5128 | Pakistan Studies |



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# Model Course Outline
# for the Course Understanding of Quran – I

**Course Title:** Understanding of Quran – I
**Course Book:** Muallim ul Quran (Volume 1, 2 & 3) by Dr Ubaid ur Rahman
**Credit Hours:** 1 (0-1)
**Contact Hours:** 3 per week
**Weeks:** 15-16 (45-48 hours)

## Course Learning Outcomes:

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

1. Develop the ability to understand basic words of the Quran, phrases and sentences that do not contain verbs (unit 1 to 5 of Muallim ul Quran Book) and then sentences having present tense (first half of unit 6 of Muallim ul Quran Book).
2. Acquire a strong foundation for understanding long verses of the Quran with clarity.
3. Comprehend Quranic vocabulary, particles (operative & non operative particles) , compounds (Adjective & Possessive compound), pronouns (singular & plural) and types of plural through hundreds of Quranic sentences.
4. Recognize and understand different styles of Quranic sentences, including nominal sentence, emphatic sentence, double emphatic sentence, negative sentence, interrogative sentence, oath –based sentences.
5. Strengthen understanding of fundamental Quranic linguistic styles, expressions and idioms.
6. Understand at least 30 to 40 % of each page of the holy Quran.

## Provision of material, content and books:

- **Paper book:** All volumes are available in printed book form.
- **Tutorial videos:** Teaching video of each lesson available on YouTube.
- **Confirmation Videos:** A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
- **A flipbook:** A flipbook edition is also accessible.
- **Helping material:** Helping material for the teachers like quizzes, question papers and images is available on website.



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**Course Outline:**

| Weeks | Lectures (1.5 hrs) | Units | Lessons | Assignments/Home Task | Linguistic Rules |
|---|---|---|---|---|---|
| 1. | 1. | 1 | 1-6 | Writing the meaning of Quranic words Lesson 1-8 | Proper Noun Masculine & Feminine |
| | 2. | 1 | 9-14 | Writing the meaning of Quranic words 9-14 | Two kinds of plural Concept of (و) "And" Common Noun |
| 2. | 1. | 1 | 15-17 | Writing the meaning of Quranic words, phrases & translation of Sentences 15-17 | Demonstrative Noun (This & That for Masculine (هذا- هذه) Demonstrative Noun (This & That for Feminine) (ذلك- تلك) |
| | 2. | 1 | 18-19 & Revision (Unit 1) | Writing the meaning of Quranic words , phrases & translation of Sentences 17-19 Quiz | Laam for emphasis (لام التأكيد) Superlative Degree like أكبر Revision of all Quranic Sentences |
| 3. | 1. | Unit 2 | 1-3 | Writing the meaning of Quranic words, phrases & translation of Sentences 1-3 | Emphatic Particle إن Preposition "For" ( اللام) Preposition (في) |
| | 2. | 2 | 4-6 | Writing the meaning of Quranic words, phrases & translation of Sentences 4-6 | Preposition (على- من- إلى) |
| 4. | 1. | 2 | 7- 9 | Writing the meaning of Quranic words & translation of Sentences 7-9 | Preposition (الباء) Absolute Negation Particle Exceptive Particle ( لا النافية للجنس)( ما النافية) (إلا) |
| | 2. | 2 | 10-13 & Revision (Unit 2) | Writing the meaning of Quranic words, phrases & translation of Sentences 10-13 Quiz | Subordinating Conjunction(أن), Was (كان), Vocative Particle(حرف النداء) |

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| 5. | 1. | Unit 3 | 1-2 | Writing the meaning of Quranic phrases 1-2 | Quranic Adjective Compounds (صفة ومرصوف) |
| | 2. | 3 | 3-5 | Writing the meaning of Quranic phrases & translation of sentences 3-5 | Quranic Possessive Construction (مضاف ومضاف إليه) |
| 6. | 1. | 3 | 6 -7 | Writing the meaning of Quranic phrase translation of sentences 6-7 | Quranic Possessive Construction (مضاف ومضاف إليه) |
| | 2. | 3 | 8-10 & Revision (Unit 3) | Writing the meaning of Quranic phrase & translation of sentences 8-10 Quiz | Active Participle (اسم الفاعل), Passive Participle (اسم المفعول), Dual (مثنى) |
| 7. | 1. | Unit 4 | 1-2 | Writing the meaning of Quranic phrase & translation of sentences 1-2 | Personal Pronoun He( هو المنفصل) Possessive Pronoun His ـه المتصل) |
| | 2. | 4 | 3-4 | Writing the meaning of Quranic phrase & translation of sentences 3 -4 | Possessive Pronoun with prepositions like في بيته Pronoun "His" with prepositions like له، منه، فيه |
| 8. | 1. | 4 | 5-8 | Writing the meaning of Quranic sentences 5-8 | Personal Pronoun You( أنت المنفصل) Possessive Pronoun Your ك المتصل) Possessive Pronoun with prepositions like في بيتك Pronoun "your" with prepositions like لك، منك، فيك |
| | 2. | | | | |

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| 9. | 1. | 4 | 9-12 | Writing the meaning of Quranic phrases & sentences 9-12 | Personal Pronoun She( هي المنفصل)<br>Possessive Pronoun Her ها المتصل)<br>Possessive Pronoun with prepositions like في بيتها<br>Pronoun "Her" with prepositions like لها، |
| | 2. | 4 | 13-16 | Writing the meaning of Quranic phrases & sentences 13-16 | Personal Pronoun I ( أنا المنفصل)<br>Possessive Pronoun Her ي المتصل)<br>Possessive Pronoun with prepositions like في بيتيPronoun "My" with prepositions like لي |
| 10. | 1 | 4 | 17 & Revision Unit 4 | Revision of all Quranic sentences of Unit 4 Quiz | Adverb (حال) |
| | 2. | Unit 5 | 1-2 | Writing the meaning of Quranic phrases & sentences 1-2 | Masculine Plural جمع المذكر السالم و جمع المذكر السالم المسبوق بحرف الجر |
| 11. | 1. | 5 | 3-4 | Writing the meaning of Quranic phrases & sentences 3-4 | Possessive Construction with Plurals جمع المذكر السالم المسبوق بالإضافة |
| | 2. | 5 | 5-6 | Writing the meaning of Quranic phrases, sentences & verses 5-6 | Personal Pronoun They ( هم المنفصل)<br>Possessive Pronoun Their هم المتصل) |
| 12. | 1. | 5 | 7-8 | Writing the meaning of Quranic phrases, sentences & verses 7-8 | Possessive Pronoun with prepositions like في بيتهمPronoun "Their" with prepositions like لهم |
| | 2. | 5 | 9-11 | Writing the meaning of Quranic phrases, sentences & verses 9-11 | Personal Pronoun You ( أنتم المنفصل)<br>Possessive Pronoun Your كم المتصل)<br>Possessive Pronoun with prepositions |

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| | | | | | like في بيتكم |
| 13. | 1. | 5 | 12-14 | Writing the meaning of Quranic phrases & sentences & verses 12-14 | Pronoun "Your" with prepositions like لكم<br>Personal Pronoun We ( نحن المنفصل)<br>Possessive Pronoun Our نا المتصل) |
| | 2. | 5 | 15-16 | Writing the meaning of Quranic sentences & verses 15-16 | Possessive Pronoun with prepositions like في بيتنا<br>Pronoun "Our" with prepositions like لنا |
| 14. | 1. | 5 | 17-18 | Writing the meaning of Quranic sentences & Verses 17-18 | Demonstrative Pronoun These, Those ( هؤلاء- أولئك) |
| | 2. | 5 | 19-23 | Writing the meaning of Quranic sentences & Verses 19-23 | ( ما / إلا، إن / إلا، إنما، ليس، ما ، أم/أم، ان، بل، كان<br>( ألا، اليس، اليوم، يومئذ، سبحان، مابينهما، قل، إذن، بئس، نعم، كلا، ما ادراك، حسب، أعلم ب، مصير، مرجع، دينا(تمييز) |
| 15. | 1. | 5 | Revision Unit 5 | Quiz | |
| | 2. | 5 | 1-3 (till Page 16) | Writing the meaning of Quranic Verbs &Translation of Quranic Sentences & Verses (1-3) | Introduction of Present Tense(فعل مضارع) & Verbal Sentence ( جملة فعلية)<br>Present Tense<br>الفعل المضارع صيغة المفرد يعلم |
| 16. | 1. | 6 | 3 (From Page 17) & 4 -5 | Translation of Quranic Sentences & Verses 3-5 | Present Tense<br>الفعل المضارع صيغة المفرد يعلم |
| | 2. | 6 | 6 | Translation of Quranic Sentences & Verses | Present Tense<br>الفعل المضارع صيغة الجمع يعلمون |



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# Model Course Outline
# for the Course Understanding of Quran – II

**Course Title:** Understanding of Quran – II
**Course Book:** Muallim ul Quran (Volume 3, 4 & 5) by Dr Ubaid ur Rahman
**Credit Hours:** 1 (0-1)
**Contact Hours:** 3 per week
**Weeks:** 15-16 (45-48 hours)

## Course Learning Outcomes:

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

1. Directly comprehend hundreds of Quranic sentences & verses.
2. Understand at least 80 to 85 % of each page of the holy Quran.
3. Understand common verses across different Quranic topics.
4. Achieve proficiency in the basic and advance linguistic aspects of the Arabic language.
5. Understand the difference between Quranic verbs in various forms, such as present, past and imperative.
6. Develop the ability to understand long verses of the holy Quran independently and then comprehend their interpretation.

## Provision of material, content and books:

- **Paper book:** All volumes are available in printed book form.
- **Tutorial videos:** Teaching video of each lesson available on YouTube.
- **Confirmation Videos:** A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
- **A flipbook:** A flipbook edition is also accessible.
- **Helping material:** Helping material for the teachers like quizzes, question papers and images is available on website.

## Course Outline:

| Weeks | Lectures | Units | Lessons | Assignments/Home Task | |
|---|---|---|---|---|---|
| 1. | 1. | 6 | 6 | Understanding & Translation of Verses | Present Tense<br>صیغة جمع مذکر غائب مثل یعبدون |
| | 2. | 6 | 7-8 | Understanding & Translation of Verses | Present Tense<br>صیغة جمع مذکر غائب مثل یعبدون |
| 2. | 1. | 6 | 9-10 | Understanding & Translation of Verses | Present Tense<br>صیغة مفرد مذکر مخاطب (تعبد)<br>وجمع مذکر مخاطب ( تعبدون) |
| | 2. | 6 | 11-12 | Understanding & Translation of Verses | Present Tense<br>صیغة جمع مذکر مخاطب ( تعبدون) |



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| | | | | | صيغة المتكلم (أعبد) |
| 3. | 1. | 6 | 13 | Understanding & Translation of Verses | Present Tense<br>صيغة جمع المتكلم (نعبد) |
| | 2. | 6 | 14-15 | Understanding & Translation of Verses | Negative Imperative<br>صيغة المفرد وصيغة الجمع , لا تعبدْ، لا تعبدوا |
| 4. | 1. | 6 | 16-17 | Understanding & Translation of Verses | Conditional Sentences & masdar moawal<br>(مصدر موؤل) |
| | 2. | 6 | 18-19 | Understanding & Translation of Verses | Laam uttaleel<br>(لام التعليل) &<br>Laam ul jhood(لام الجحود) |
| 5. | 1. | 6 | 20-21 | Understanding & Translation of Verses | Present with object pronouns &<br>Passive Voice |
| | 2. | 6 | Revision (Unit 6) | Quiz | |
| 6. | 1. | Unit 7 | 1 (sec 1-3) | Understanding & Translation of Verses | Past Tense<br>صيغة المفرد الغائب |
| | 2. | 6 | 1 (Sec 4-5) | Understanding & Translation of Verses | Past Tense<br>صيغة المفرد للغائب |
| 7. | 1. | 6 | 1 (Sec 5-6) | Understanding & Translation of Verses | Past Tense<br>صيغة المفرد للغائب |
| | 2. | 6 | 1 (Sec 7-9) | Understanding & Translation of Verses | Past Tense<br>صيغة المفرد للغائب |
| 8. | 1. | 7 | Revision | Understanding & Translation of Verses<br>QUIZ | Past Tense<br>صيغة المفرد للغائب |
| | 2. | [redacted] | | | |
| 9. | 1. | 7 | 2 (sec 1-2) | Understanding & Translation of Verses | Past Tense<br>صيغة الجمع للغائب عبدوا |
| | 2. | 7 | 2 (sec 3) | Understanding & Translation of Verses | Past Tense<br>صيغة الجمع للغائب عبدوا |
| 10. | 1. | 7 | 2 (sec 4-5) | Understanding & Translation of Verses | Past Tense<br>صيغة الجمع للغائب عبدوا |
| | 2. | 7 | 2 (sec 6-7) | Understanding & Translation of Verses | Past Tense<br>صيغة الجمع للغائب عبدوا |
| 11. | 1. | 7 | 3 (sec 1-2) | Understanding & Translation of Verses | Past Tense<br>صيغة الجمع للمتكلم عبدنا |

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|---|---|---|---|---|---|
| | 2. | 7 | 3 (sec 2-3) | Understanding & Translation of Verses | Past Tense صيغة الجمع للمتكلم عبدنا |
| 12. | 1. | 7 | 3 (sec 3-4) | Understanding & Translation of Verses | Past Tense صيغة الجمع للمتكلم عبدنا |
| | 2. | 7 | 3 (sec 4-5) | Understanding & Translation of Verses | Past Tense صيغة الجمع للمتكلم عبدنا |
| 13. | 1. | 7 | 4 (sec 1-2-3) | Understanding & Translation of Verses | Past Tense صيغة الجمع للمخاطب عبدتم |
| | 2. | 7 | 4 (sec 4-5) | Understanding & Translation of Verses | Past Tense صيغة الجمع للمخاطب عبدتم |
| 14. | 1. | 7 | 5-6 | Understanding & Translation of Verses Quiz | Past Tense صيغة المتكلم والمخاطب عبدتُ ، عبدتَ |
| | 2. | 7 | 7 | Understanding & Translation of Verses | Past Tense صيغة المؤنث للغائب عبدَتْ |
| 15. | 1. | 7 | 8 | Understanding & Translation of Verses | Passive Voice (Past Tense) فعل مجهول للمفرد |
| | 2. | 7 | 9 | Understanding & Translation of Verses | Passive Voice (Past Tense) فعل مجهول الجمع |
| 16. | 1. | 8 | 1-4 | Understanding & Translation of Verses | Imperative Verb for singular فعل الأمر للمفرد |
| | 2. | 7 | 5-8 | Understanding & Translation of Verses | Imperative Verb for plural فعل الأمر للجمع |

## PAKISTAN STUDIES

### UGE POLICY V 1.1 : GENERAL EDUCATION COURSE

| | |
|---|---|
| **Credits:** | 02 |
| **Pre-Requisite:** | Nil |
| **Offering:** | Undergraduate Degrees |
| **Placement:** | 1 - 8 Semesters |
| **Type:** | General Education |
| **Fields:** | All |

### DESCRIPTION

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

### COURSE LEARNING OUTCOMES

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

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

### SYLLABUS

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

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

## SUGGESTED INSTRUCTIONAL / READING MATERIALS


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


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